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Symmetry Identified in 2-Dimensional Artwork Compositions  
using Visuospatial Ability

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A Dissertation

Presented to

the Faculty of the Morgridge College of Education

University of Denver

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In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

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by

Theresa Ferg

March 2018

Advisor: P. Bruce Uhrmacher

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Author: Theresa Ferg

Title: Symmetry Identified in 2-Dimensional Artwork Compositions using Visuospatial Ability

Advisor: P. Bruce Uhrmacher

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## ABSTRACT

At the John Langdon Down Foundation A.C. in the La Escuela Mexicana de Arte Down school in Mexico City D.F., Mexico, art students with Trisomy 21 display the use of a mathematical construct in the painting compositions of their artworks. The mathematical construct is a type of symmetry and it carries a positive affect. This is important because there have been no studies that have investigated the use of the symmetry in the artwork compositions of persons with Down syndrome.

The geometric construction of the artwork compositions follows the artistic principle of the Rule of Three and the division of extreme and mean ratio (DEMR). The two specific geometric patterns are known as harmonic ratios and referred to as the HR-RT symmetry (harmonic ratio with Rule of Three) in this research. Painting composition is a demonstration of the intentionality of the artist, which involves sensory and cognitive processes that engage both artist and viewer. This communication is via the motoric ability of proportional gauging. The action of proportional gauging is the manner in which both the artist and viewer perceive the geometrics and aesthetics of the composition. This process is a conjoined visuospatial and bodily kinetic cortical process. A group of seven representative Master artists' paintings from the Quattrocento was the standard of HR-RT with which to compare the use of the construct in the art students' painting compositions. The Master artists' employed HR-RT as a compositional element to direct the communication of a 3-dimensional spatial representation of an aesthetic

experience via a 2-dimensional venue. A novel 5-step measurement procedure identifies the mathematical construct using a geometric grid overlay on the student artworks. In 159 student artworks (out of 161), the variable use of HR-RT, similar to the Master artists, was revealed in five quantized levels. The art students demonstrated the use of the construct at a strong level 62 images (38.51%) and at the moderate level 65 images (40.37%). Twenty-five of the images were at a low level (13.04%), 7 images were an inconsistent representation (4.347%) and in 2 images the construct was not found (1.24%).

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## CHAPTER ONE

### **Introduction**

Individuals who have significant cognitive disabilities can nonetheless demonstrate artistic principles of symmetry in their artworks. Using a case study approach, this dissertation focuses on a special group of Down syndrome students from a school in Mexico City D.F. specifically looking at 161 of their artworks. These artworks display use of the artistic principle of symmetry known as the “Rule of Three” in their compositions. The artists themselves chose to use artistic principles of symmetry within their images. They were not taught them. This study is not about Down syndrome, per se, rather it is a study about the mathematics of symmetrical constructions in any works, but in particular, it investigates the role and function of symmetry in aesthetics. Because this study examines the works of Down syndrome artists, however, it nevertheless demonstrates that it is not necessary to be trained in principles of symmetry in order to demonstrate the artistic principle of symmetrical artwork composition. This supports existing research indicating that the use of symmetry in artworks may be an inherent component of aesthetic appeal.

## **Fresh Paradigms in Learning**

In the search for explanations of how best to assist a student's learning, the psychology of human behavior, in relation to the making of artworks, includes the perception of symmetry and the phenomenon of aesthetics. A leading American psychologist, Howard Gardner, has pioneered the understanding that cognitive abilities can be acknowledged as the integration of aptitudes. Aptitudes are the natural ability to do something and the having of multiples sources of intelligence is an essential life advantage.

The theory of multiple intelligences (MI) proposed by Howard Gardner (1983) consists of multiple aptitudes: logical, linguistic, visuospatial, bodily kinetic, musical, interpersonal, intrapersonal abilities (the list as of 1983), and naturalist added in 1997 (as cited in Armstrong, 2009). These aptitudes are “determined and differentiated by genetics and experiential explanations in relationship to the strengths and weaknesses of each individual” (Gardner, 2003, p. 1). One of his studies on patients who had suffered brain injury or defect connected specific biologically based processes to the structures of cognition in the human brain (Gardner, 1983). Gardner believed that his rigorous training as a pianist played an important role in figuring out this connection: “When I began to study developmental and cognitive psychology, I was struck by the virtual absence of the arts. An early professional goal was to find a place for the arts within academic psychology” (Gardner, 2003, p. 1). He maintained his enthusiasm for the arts while he continued to study developmental and cognitive psychology elucidating that “each intelligence can be aligned with aesthetics, which may or may not be expressed as an

artistic endeavor” (p. 3). Gardner stated that the psychological MI Theory “gives no direct educational implication but if people have multiple intelligences; it is best to acknowledge the information within the education realm” (p. 3).

Similarly, Thomas Armstrong (writer, educator, and proponent of the MI Theory) and Carol Ann Tomlinson (2014) (educator and advocate of differentiation lesson plan strategies for the classroom) provide a concise description of the current list of the characteristics of the Multiple Intelligences (MI) criteria. The definition of intelligence that Gardner (2003) used to create the criteria was the ability to solve a problem or create a product that is valued in a society.

**Linguistic:** The capacity to use words effectively and a sensitivity to the sounds, structures, meanings, and functions of words and language.

**Logical-mathematical:** The capacity to use numbers effectively and sensitivity to discern, logical or numerical patterns; the ability to handle long chains of reasoning.

**Spatial:** The ability to perceive the visual-spatial world accurately and to perform transformations on one’s initial perceptions.

**Bodily kinetic:** Expertise in using one’s whole body to express ideas and feelings; to control one’s body movements and to handle objects skillfully.

**Musical:** Capacity to perceive and produce rhythm, pitch, and timbre; appreciation of the forms of musical expressiveness.

**Interpersonal:** The ability to perceive and make distinctions the moods, temperaments, motivations, and desires of other people.

**Intrapersonal:** Access to one’s own “feeling” life and the ability to discriminate among one’s emotions; the self-knowledge of one’s own strengths and weaknesses.

**Naturalist:** Expertise in distinguishing among members of a species; recognizing the existence of other neighboring species; and charting out the

relations, formally or informally, among several species (as cited in Armstrong, 2009).

As Gardner continued his research of MI, he developed “Entry Points” (presented in 1991 and 1993) to assist teachers in understanding how they can differentiate their instruction to provide a maximum opportunity for the student to learn using their specific type of intelligence. There are five entry points:

1. Narrational Entry Point is presenting a story or narrative about the topic or concept in question.
2. Logical-Quantitative Entry Point is using numbers or deductive / scientific approaches to the topic or question.
3. Foundational Entry Point is examining the philosophy and vocabulary that under grid the topic of concept.
4. Aesthetic Entry Point is focusing on the sensory features of the topic or concept.
5. Experiential Entry Point is using a hands-on approach where the student deals directly with materials that represent the topic or concept. These materials also make links to the student’s personal experience (as cited in Tomlinson, 2014).

One example of MI curriculum, developed by Thomas Armstrong, identifies the five strategies for teaching and learning visuospatial intelligence as forming a mental image (i.e., *visualization*), categorization and organization using color (i.e., *color cues*), comparing one idea to another, seemingly unrelated idea (i.e., *picture metaphors*), visual thinking that involves drawing a central theme or core concept to articulate understanding of a subject (i.e., *idea sketching*), and visual methods such as a diagram, graph, or logo to communicate information (i.e., *graphic symbols*) (Armstrong, 2009, pp. 79–82).

From around the world, more scholarly articles on MI have increased at the academic research level. Peer-reviewed articles have been published in China (Furnham

& Wu, 2008), in Japan (Furnham & Fuhumoto, 2008), and in Singapore (Mohktar, Major, & Fu, 2007). A partial list of the institutions to include MI are the following: Middle East Technical University in Ankara, Turkey; University of Jordan in Amman, Jordan; Malawaram University in Samarinda, Indonesia; Ferhat Abbas University in Setif, Algeria. At the school and community level, the Dafoss University in Denmark has a theme park that allows participants to creatively test their Multiple Intelligences. The Multiple Intelligence Education Society in China promotes MI concepts through radio and television interviews (Armstrong, 2009). In Santiago, Chile, the Anancy Elementary School, La Florida, has a district-wide multiple intelligences theme week: Scientific Week, Arts Week, Sea Week, etc. In the Philippines, the MI International High School in Quezon City uses MI theory to promote student entrepreneurship (Armstrong, 2009).

A number of leading educators from different specialties have voiced varying levels of support for the MI Theory. Generally, American education theorists have been supportive of MI. For example, Carol Ann Tomlinson (1999) concluded that MI has made some major contributions to education, in particular, the development of the individual cognitive potential matches the knowledge that the individual is capable of learning with how he/she learns by utilizing multifaceted intelligences (see Tomlinson, 1999, 2014). Similarly, Sonia Nieto (1999), an educator known for her writing on multicultural education, discussed how MI challenges a unitary intelligence model and provides a framework for understanding the complexities of cultural diversity. Elliot Eisner (1998), an education theorist and author of the education connoisseurship and criticism theory, agreed with the aspect of the multiplicity of the intelligences of MI but

he did not explain fully the role of emotion in relationship to the intelligences. Eisner believed more work needed to be done to explore the idea of an open-state of cognition (1994, 2002).

Nel Noddings (2005), a philosopher, education theorist, and proponent of the necessity for caring in schools, described the need in teacher professional development for increased interpersonal skills based on improved teacher intrapersonal awareness. She stated that understanding a multiplicity of cognitive capacities should provide a way in which teachers can learn to be more self-reflective. Noddings does not think that there is a set number of cognitive intelligences but agrees that MI is moving in the right direction. Additionally, Judith Sowder (2007), a mathematics teaching and learning education theorist, believed that a new conceptual grounding for teachers of mathematics requires the knowledge of cognitive developmental characteristics in order to engage student interest and provide teachers a way in which to know their students. As well, theorist and founder of the Core Knowledge Foundation, E. D. Hirsch, Jr. (2006), an education traditionalist, stated that intelligence is more about broadening the knowledge base of students through the core subjects of literacy and mathematics.

Due to Gardner's research, MI today is an accomplishment that has facilitated an expanded human cognitive model. The recognition of MI continues to grow in the continental United States and in the international community. Since 1983, there have been many opportunities for researchers and educators to advance the implications of multiple intelligences.



## **National Assessments of Visuospatial Ability**

The visuospatial and bodily-kinetic categories of MI are recognized in the artistic and athletic realms. Accomplished artists, dancers, musicians, sport champions, and so on have been and are able to be held in high regard. Importantly, the simultaneous integration with sensory experiences to the MI aptitudes demonstrates an open-state nature of intelligence (Dewey, 1934; Gardner, 1983; James, 1890, 1907) because creativity is unlimited. A property of the open-state intelligence would then be incommensurable (having no end) (Eisner, 1998, 2002; Schiralli, 2006).

There have been great efforts to develop the linguistic and logical aspects of human intelligence and the resultant social value has validated the outcome. The progress of knowledge and learning can be seen in the advancements made in national assessment tools for measuring cognitive ability, such as, IQ, ACT, SAT, GRE, etc. (Thorndike, 2005). Adaptations to the traditional assessment design have been few in reference to the main construct of the “g” factor as the standard of measurement. Robert Thorndike has criticized Gardner’s MI proposal because the MI Theory is not about cognitive ability but about competencies and there has not been “substantive research” to support testable hypotheses to determine the relative importance and organization of the multiple competencies (Thorndike, 2005, p. 246).

Innovative abstract visual reasoning tests are now part of the subtests of the Stanford-Binet, Wechsler Scales, Woodcock-Johnson Psycho-Educational Battery, Raven Progressive Matrices, and the Universal Nonverbal Intelligence Test (UNIT; Thorndike, 2005, pp. 240–264). The UNIT test measures symbolic memory, cube design, spatial

memory, analogic reasoning, object memory, and mazes (Thorndike, 2005, p. 265). The Naglieri nonverbal test (NNAT) measures general ability using nonverbal questions (Naglieri, 2003). The Cognitive Abilities Test (COGAT) is another contemporary assessment of cognitive skills that uses a visuospatial design to test logical thinking (Lohman & Hagen, 2001).

Today national assessment authorities acknowledge visuospatial abstract reasoning abilities as an intelligence. This shift in the assessment policy has been guided by significant evidence from longitudinal studies on students gifted in verbal, mathematical, and visuospatial ability. Researchers have documented that it is the students with visuospatial aptitude that demonstrate advanced innovation and ideation across all subject areas (Kell & Lubinski, 2013).

### **Visuospatial Ability and Memory**

Since the early 1990s, David Lubinski of Vanderbilt University has researched the need for improved education assessments to identify students who have a high visuospatial ability. Lubinski stated that there is now overwhelming and conclusive evidence that visuospatial intelligence is an important cognitive ability. He proposed further research on finding out the components of visuospatial intelligence emphasizing the need to change the primary focus in cognitive psychology away from the segmented design of the national assessments to an integrated cognitive format (Kell & Lubinski, 2013). Additionally, he proposed two reasons for the inclusion of improved visuospatial ability evaluations in the national education battery of current assessments for students. First, visuospatial abilities are better predictors of success in the STEM fields than

linguistic or mathematical assessments. Second, “visuospatial ability contributes to the generation of new knowledge or creative expression” (Kell & Lubinski, 2013, p. 237; Kell, Lubinski, Benbow, & Stager, 2013; Lubinski, 1996, 2000, 2003, 2004, 2010; Park, Lubinski, & Benbow, 2007; Shea, Lubinski, & Benbow, 2001; Wai, Lubinski, & Benbow, 2005, 2009; Webb, Lubinski, & Benbow, 2007).

A current definition of visuospatial ability is the mental capacity for “manipulating visual patterns, as indicated by the level of difficulty and complexity in visual stimulus material that can be handled successfully” (Kell & Lubinski, 2013, p. 230). Visuospatial intelligence testing traditionally has been “2 and 3-dimensional spatial visualization, mechanical reasoning, and abstract reasoning” (Wai, Lubinski, & Benbow, 2009, p. 822). The diverse mental actions taken to complete the various tasks are rotation, reflection, folding, and unfolding, as well as the combination of these actions with additional stimuli in conjunction with spatial memory (Carroll, 1993; Kell & Lubinski, 2013; Lohman, 1996). There are four categories of spatial memory: (1) spatial sequential memory; (2) spatial simultaneous memory; (3) memory for location; and (4) spatial working memory. Of interest in this study is the relationship of visuospatial memory and experiential memory to the spatial sequential memory of the art students with Down syndrome. The spatial sequential memory of persons with Down syndrome is similar to the mental age (MA) of typically developing (TD) individuals as reported in a meta-analysis (Yang, Conners, & Merrill, 2014; Jarrold, Nadel, & Vicari, 2008). Visuospatial sequential memory is “the order of spatial information that has been presented in temporally sequential order” (Yang et al., 2014, p. 19).

Of crucial interest for educators are the following questions: do we really understand what might be the optimal cognitive capacity of visuospatial intelligence? Are the current nonverbal test questions and tasks still giving a variation of the “g” factor just in different formats? The reason to achieve clarity for this enquiry is because some students score high on visuospatial assessments, but what this result demonstrates is not apparent to their teachers. For example, the capacity for giftedness may not repeat in the other intelligence assessments for linguistic and mathematical content based on the “g” factor. Consequently, teachers do not have visuospatial curricular objectives that directly address visuospatial intelligence or how it may best connect to linguistic and mathematical subjects. This constitutes a gap in curricular knowledge.

### **This Study**

In 2003 at the University of Colorado Memorial Gallery in Boulder, Colorado, a group of art students with Down syndrome presented artworks that displayed the use of artistic principles in the making of these compositions. The artists seemed to be using artistic principles of geometric patterns, which organized their intentionality within the images. The relation of that experience to the previous research by the researcher of a preference for HR-RT was considered an opportunity, given the cognitive difficulties of the art students. This observation is not focused exclusively on Down syndrome instead it offers an example of the innate/inherent human expression of HR-RT symmetrical composition in artworks, just as the previous research suggested of a preference for dynamic symmetry (Ferg, Kaplan, Coussons-Read, & Briggs, 2011). These Down

syndrome students demonstrated an inherent expression for HR-RT symmetrical composition in 159 out of 161 of their artworks.

**Symmetry.** Symmetry is the property of remaining invariant under certain changes – as of orientation in space, of the sign of the electrical charge, of parity, or of the direction of time flow – used of physical phenomena and of equations describing them (Merriam-Webster.com, 2018).

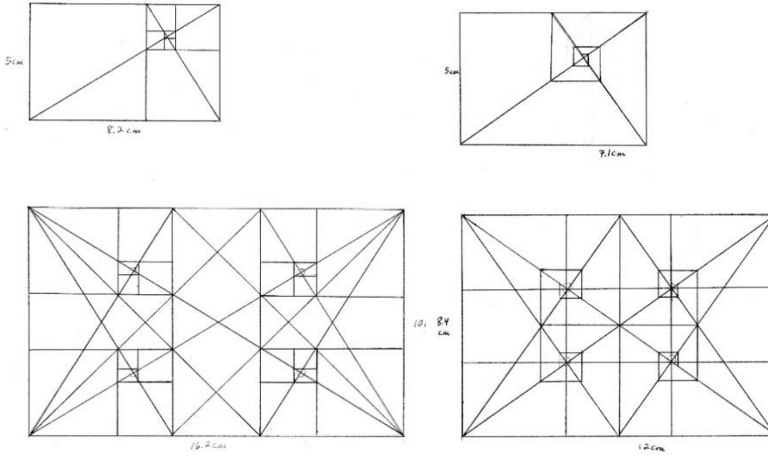
**Golden ratio.** The Golden ratio, the division of extreme and mean ratio (DEMR), is a mathematical process that begins with various shapes that can be divided into composite parts via a specific ratio, ( $\phi = (1 + \sqrt{5})/2 = 1.61803 \dots$  and  $\phi^{-1} = (1 - \sqrt{5})/2 = -0.61803 \dots$ ) (Fechner, 1865). The subdivisions of dynamic symmetry reduce to ratios from which emerges a spiral. “The spiral is without a terminal point: It may grow outwards (or inwards) indefinitely, but its shape remains unchanged” (Huntley, 1970, p. 102). The dynamic three-dimensional geometric image retains these proportional ratios whether it is reduced or enlarged (Huntley, 1970). The perception of the geometric patterning creates an aesthetic appeal (Baxandall, 1988; Bouleau, 1963; Colman, 2003; Devlin, 1994; Di Dio, Macaluso, & Rizzolatti, 2007; Di Dio, Canessa, Cappa, & Rizzolatti, 2011; Fechner, 1865; Ferg et al., 2011; Green, 1995; Hambridge, 1967; Huntley, 1970; Schiralli, 2006).

For distances along a line segment, “a harmonic range is a set of four collinear points, a, b, c, d, arranged such that  $ac/cb = ad/db$ . Then ab is said to be divided harmonically at c and d and the points a, c, b, d are said to form a harmonic range” (Durell, 1928, p. 65). This use of the term originates from the use of harmonics to refer to

the ratios of notes in small integers producing a pleasing sound, understood in music theory as harmony (Weisstein, 2016). This mathematical concept is from Euclid's Elements Book VI, Definition 3: a straight line is said to have been cut in extreme and mean ratio when, as the whole line is to the greater segment, so in the greater to the less (Euclid-Heath, 1926).

**HR-RT symmetry.** HR-RT symmetry is both harmonic ratios and Rule of Three or Thirds. Harmonic ratios are the whole number relationships of frequencies that are the geometric basis of the fundamental theory of music (Baxandall, 1988; Huntley, 1970). The development of a mathematical treatment of motion and change in order to describe infinite series that are the various patterns of the harmonic series, which cannot have a finite value (Devlin, 1994, pp. 76-79). The Rule of Three is the root 2 rectangle with a division of three.

One example of the use of harmonic ratios is in the making of artwork compositions. Underlying the harmonic ratio geometric concepts, as applied to artworks, is the mathematical ordered plurality pattern of DEMR. This geometric patterning is an artistic principle that gives a dynamically active symmetrical composition as opposed to one that is static. DEMR is similar to another dynamically active artistic design principle known as Rule of Three. These two geometric symmetry constructions are the basis of the visuospatial and bodily kinetic perceptual transference of symmetrical patterns and the emotion of pleasingness from artist to art viewer. This is a more explicit description of the known information on the artistic principle.



Division of extreme and mean ratio (DEMR)

Root 2 rectangle with a division of three, Rule of Three

Figure 1. Constructions of the division of extreme and mean ratio and the root 2 rectangle with a division of three.

The figures on the left are visual examples of the concept of DEMR. The smaller figure is represented in the larger figure four times and the larger is the same proportionality of 1: 1.61803 of the smaller rectangles (Fechner, 1865; Hambridge, 1920; Herter, 1966). The proportion and the perpendicular alignment of all the sides in two dimensions arrange the rectangles. This is a perception of the geometric idea and by abstract reasoning each of the four rectangles reduces and enlarges following the mathematical pattern to create implied vortex constructions.

The figures on the right are visual examples of the concept of the harmonic root 2 rectangle with a division of three i.e. Rule of Three (Hambridge, 1920; Herter, 1966). The smaller figure is represented in the larger figure four times and the larger is the same proportionality  $1: \sqrt{2}$  of the smaller rectangles. The proportion and the perpendicular alignment of all the sides in two dimensions arrange the rectangles. This is a perception of the geometric idea and by abstract reasoning each of the four rectangles reduces and

enlarges following the mathematical pattern to create an implied movement of the vortex constructions.

The four central points imply the multiple vortexes of the two geometric constructions aka harmonic ratio with Rule of Three (HR-RT). This artistic principle is in architecture, art, and photography. HR-RT is the primary compositional location within the 2-or 3-dimensional space of architecture or artwork design (Baxandall, 1972; Bouleau, 1963; Cennini, 1960; Hambridge, 1920; Herter, 1966; Huntley, 1970; Lanteri, 1965). A novel HR-RT heuristic was developed for this study as a technological tool to analyze the use of the HR-RT symmetry in artwork compositions (See Appendix A).

These two artistic principles, DEMR and Rule of Three, the root 2 rectangle with division of three, are fundamental harmonic frequency intervals, which relate to one another because of the perceptual action induced by the vortex patterns. The auditory and visual perception of these harmonics induces a pleasing response (Atalay, 2006; Baxandall, 1988; Bouleau, 1963; Canessa et al., 2011; Colman, 2003; Devlin, 1994; Di Dio et al., 2003, 2007; Fechner, 1865; Ferg et al., 2011; Green, 1995; Hambridge, 1967; Huntley, 1970; Schiralli, 2006).

**Ways to measure HR-RT symmetry.** HR-RT can be measured in the manner of the artists of the Quattrocento (during the 15th century, an early Renaissance period of Italian art and architecture (Baxandall, 1988). Master artists' paintings from the early Renaissance, were known to have used the HR-RT symmetry (Baxandall, 1988; Bouleau, 1963). Or, it is possible to eyeball the pattern according to the Rule of Thirds. The process requires the use of proportional gauging. One aspect of visuospatial and bodily-



kinetic intelligences is the concept of the action of proportional gauging, which is not explicitly demonstrated in the current epistemology of cognitive assessments.

Proportional gauging is a known visuospatial ability. In relationship to the making of artwork compositions, the behavior is a conjoined cognitive and physical action that is related to aesthetic appeal (a pleasing affect) of HR-RT for the artist, during the making of the artwork, and for the viewer upon seeing the artwork. The artist, by HR-RT and the action of proportional gauging, transfers their intentionality to the viewer. This is both a sensory and cognitive experience for the viewer of the artwork.

The word proportion comes from the Latin stem *prōportiō* [translation of Greek *analogia* (analogy)], from the phrase *prō portiōne*, “for (it’s or his) share),” (*American Heritage Dictionary*, 1973, p. 1049). There are many meanings of the word: a part considered in relation to the whole, a relationship between quantities, such that, if one varies, another varies in a manner dependent on the first; a ratio, a relation of equality between two ratios. Four quantities (a, b, c, d) are said to be in proportion if  $a/b = c/d$ , a harmonious relation; to balance; to form with symmetry (p. 1049). The noun proportion and the synonyms of harmony, symmetry, and balance are comparable as they apply to aesthetic pleasure derived from proper arrangement (p. 1049).

Proportional gauging has two components, physical and conceptual, and are engaged by the following:

Physical

- (1) Determine the measurements of the frame of the artwork.
- (2) Use the sense of sight to gauge the approximate locations of the thirds and or Golden Ratio (DEMR) lines within that frame of the artwork.

- (3) Repeatedly move through space closer and farther away to the frame of the work in order to check that that process is taking place to the artist's satisfaction.

#### Conceptual

- (1) This engages the spatial sequencing memory, which is the memory for the order of spatial information that has been presented in temporally sequential order (Wang et al., 2014, p. 19). An example is the Corsi block task (Corsi, 1972; Milner, 1971). That is, one must have an ability to remember the artistic plan one has simultaneously while one is creating one's artwork.

HR-RT is a dynamic, pleasing visual engagement (Atalay, 2006; Baxandall, 1988; Bouleau, 1963; Canessa et al., 2011; Colman, 2003; Devlin, 1994; Di Dio et al., 2003, 2007; Fechner, 1865; Ferg et al., 2011; Green, 1995; Hambridge, 1967; Huntley, 1970; Schiralli, 2006). Selected research investigations of HR-RT are listed in Appendix B.

**HR-RT symmetry prominently demonstrated.** Visuospatial and bodily kinetic sequential memory is integral to the action of proportional gauging and the making of the artwork. The word gauging, from the term proportional gauging, references the action of finding proportionality, which is forming a relationship with other parts or quantities being in proportion and having a constant ratio (*American Heritage Dictionary*, 1973, p. 1049). An example of the action of proportional gauging achieved by humans comes from a historical source known as mercantile geometry taught in secondary schools. During the fifteenth century early Renaissance in Florence (the Quattrocento, a specific historical period of approximately 100 years from 1400 to 1500). This system was a mathematics curriculum promoted by the merchants. Michael Baxandall, the author of the art history theoretical method, "The Period Eye" (Baxandall, 1988; Langdale, 1999), has explained about the gauging of the contents in a barrel from a mathematical handbook for merchants written by the Master artist, Piero della Francesca.

Many of their primers and handbooks survive and one can see very clearly what sort of thing this mathematics was; it was a commercial mathematics adapted to the merchant, and both of its principal skills are deeply involved in fifteenth century painting. One of these is gauging. It is an important fact in art history that commodities have come regularly in standard-sized containers only since the nineteenth century: previously a container – the barrel, sack or bale- was unique, and calculating its volume quickly and accurately was a condition of business. (Baxandall, 1988, p. 86)

Baxandall stated that the source of this mathematics was from India by way of Arabic arithmetic books. The mathematician, Leonardo Fibonacci of Pisa, brought some of these books to Italy from Islam in the early thirteenth century. The calculation used for the proportional gauging was the Merchant's Key or the Rule of Three (Baxandall, 1988, p. 95). Baxandall stated, "So fifteenth century people became adept through daily practice in reducing the most diverse sort of information to a form of geometric proportion: a stands to b as c stands to d" (p. 97). He further elucidated the phenomenon, the connections between the geometric constructs and the historical accounts of the ability of proportional gauging in the Quattrocento (Baxandall, 1988; Randolph, 2004).

The merchant's geometric proportion was a method of precise awareness of ratios. It was not a harmonic proportion, of any convention, but it was the means by which a convention of harmonic proportion must be handled. More than this, even, its compact suggestiveness carried within itself a tendency towards harmonic proportion. In plate 55 Leonardo [da Vinci] is using the Rule of Three for a problem about weights in a balance, and comes up with four terms 6 8 9 (12): it is a very simple sequence that any merchant would be used to. But it is also the sequence of the Pythagorean harmonic scale—tone, diatessaron, diapente, and diapason—as it was discussed in fifteenth- century musical and architectural theory. Take four pieces of string of equal consistency, 6, 8, 9, and 12 inches long, and vibrate them under equal tension. The interval between 6 and 12 is an octave; between 6 and 9 and between 8 and 12 a fifth; between 6 and 8 and between 9 and 12 a fourth; between 8 and 9 a major tone. This is the whole basis of Western harmony, and the Renaissance could note it is the form of the Rule of Three. (Baxandall, 1988, pp. 99-101)

The educated people of the Quattrocento developed a disposition to attend to structures as geometric objects and relate them as “intervals in a comprehensible series” (Baxandall, 1988, p. 101). They had a great deal of visual experience in understanding the volume vs. surface level of the perception of items as forms. There was in the society a continuum between the arithmetic skills of the vendors and the talents used by the painter “to produce the pictorial proportionality and lucid solidity” that is still held in such high regard (Baxandall, 1988, pp. 101–102). Baxandall’s historical analysis demonstrated that to understand art history, one must realize that humans process visual data in different ways that includes innate skills and skills based on experience “by which Baxandall means the social acts and cultural practices that shape attention to visual form within a given culture” (Lovell & Honig, 2009, p. 1). This is an example of the ability of perception using HR-RT; it is a demonstration of the enhanced emotional experience of a viewer, who understands the semantics used in the artwork and perceives the spatial sequential memory of the geometric patterns demonstrated by the artist.

For this dissertation, the artwork compositions of a group of seven of the paintings created by Master artists from the Quattrocento were used as representations of the HR-RT geometric patterns (Atalay, 2006; Baxandall, 1988; Bouleau, 1963; Cennini, 1960; Devlin, 1994; Huntley, 1970; Stewart, 2007). The artists were Masaccio, Fra Angelico, Benozzo Gozzoli, Piero della Francesca, Botticelli, Leonardo da Vinci, and Raphael. The paintings are in international art historical publications as a standard for artwork compositions of HR-RT known to be harmonically pleasing to the viewer (Atalay, 2006; Baxandall, 1988; Bouleau, 1963; Helmholtz, 1863; Huntley, 1970;

Stewart, 2007). At times the HR-RT and linear perspective (projective geometry) (See Appendix C) were the same measurement in the artwork composition (Atalay, 2006; Baxandall, 1988; Bouleau, 1963; Stewart, 2007).

Each of the chosen Masters' paintings has a composition that demonstrates a variation of the HR-RT proportionality (Baxandall, 1988; Bouleau, 1963). Each artist demonstrated the action of proportional gauging in the making of the painting composition (Baxandall, 1988; Bouleau, 1963). A caveat to this investigative approach is that the Master artists' paintings were a normative example of a complex historical situation. In other words, in the examples, the chosen paintings of the Master artist's group exemplify the consistent, mature work of each of the Master artists and does not necessarily constitute an exception. The artists were using HR-RT as a basis of the artwork compositions. They were experts at it; this represents an extreme case of the use. HR-RT is a central feature of their artistic works. Their use of that symmetry is an example of their artistry. HR-RT, in general, is a feature of artistry and creative artworks (Atalay, 2006; Baxandall, 1988; Bouleau, 1963; Canessa et al., 2011; Colman, 2003; Devlin, 1994; Di Dio et al., 2003, 2007; Fechner, 1865; Ferg et al., 2011; Green, 1995; Hambridge, 1967; Huntley, 1970; Schiralli, 2006).

Artists today continue to practice the action of proportional gauging by standing back away from the artwork up to approximately 12 feet and walking around it to use the proportional gauging ability to create a composition that is harmonically pleasing and based on the artistic principle HR-RT (Baxandall, 1988; Bouleau, 1963; Cennini, 1960,

Eisner, 1994, 2002; Lanteri, 1965). Thus in response to this, this dissertation responds to the question: how does HR-RT guide the intention of artistic compositions?

### **Investigation at the Mexican School**

The artworks created by the Mexican adult art students are also an example of a sociological case study (E. King, personal communication, February 23, 2017). They are the student artists at the John Langdon Down Foundation (JLDF) A.C., a school in Mexico City D.F., Mexico. Professor Sylvia García Escamilla founded the school in 1972. The school exclusively provides educational services for students with Down syndrome (See Appendix D). The students receive a comprehensive curriculum that includes swimming and dance, as well as the arts to focus on the improvement of gross and fine motor skills. Some of the students were brought to the school as infants by their parents in order for their parents to receive training in motor skills and massage to assist the infants and toddlers in their development prior to attending the school. Not all of the students have received this preliminary therapy. The children start school at five years of age and continue to the eighth grade. At that point, the students can choose to stay at JLDF or complete a certification in the culinary arts or the fine arts.

The school initiated programs for medical exams, language therapists, psychologists, and special education teachers. Community awareness of the school began to impact local then regional groups who were organized to disseminate the wealth of information coming from the school. Prof. García Escamilla was invited to attend and then organize numerous conferences and groups, the National Down Syndrome Congress (NDSC) in 1972, the American Association on Intellectual and Developmental

Disabilities (AAIDD) in 1972 and the First National Conference on Down Syndrome in México in 1973 (Foundation John Langdon Down A.C., 2010).

In 1994, after moving the original school to a new location a portion of the new building became an art school. Initially, the arts were lessons with a craftwork orientation; however, the students' artworks demonstrated promise so Professor García Escamilla expanded the original idea to a fine arts program (Foundation John Langdon Down A.C., 2010). Many students over the last 24 years have participated in the art school; currently, there are 35 art students.

Overtime the students' artwork have become renowned throughout the world for their color, composition, and ideation. Since 1994, various shows of the students' artwork have been presented in over 60 countries in the world and the school has received many national and international awards (Foundation John Langdon Down A.C., 2010). Art critics and art educators recognize these student artists because they demonstrate the human ability for creative expression, which involves the use of line, shape, color, and composition (Tischler, 1999). A visual comparison of the Master artists' group paintings and the art students' artworks on the use of HR-RT in the artwork compositions provides a method to identify the consistent visual quantitative parameter, which is an empirical methodology (Tufte, 1997).

**The art students.** The art students in this study have Trisomy 21 (for more on the student demographics, please see Chapter 4). This type of Down syndrome leads to physical and cognitive disabilities. Phenotypical characteristics of the Down syndrome population are slow mental and physical development that reaches a plateau in the late

teens (Dierssen, 2012). The range of intellectual ability as measured by the intelligence quotient (IQ) is from 40 to 70. It is thought that the observation of improved performance with age in cognitive ability indicates a slower than typical brain maturation. After reaching adolescence, the IQ of people with Down syndrome plateaus and may even decrease. Down syndrome is a neurodegenerative disorder. Physical characteristics are upward slanting eyes, flattened facial profile and nose, small ears, hands and feet, low muscle tone and loose joints, and a short neck (Dierssen, 2012). Physical disabilities include heart defects and ophthalmological disorders, such as, myopia, astigmatism, dry eye, strabismus, and keratoconus. Cognitive disabilities exist in speech, language, and reading (Lesin, 2003). Individuals with Down syndrome demonstrate impairment of gross and fine motoric abilities reported by Ulrich, Lloyd, Tiernan, Looper, and Angulo-Barroso (2008), such as, a deficit in the walking development of toddlers. The delay in overall movement and the impairment of sensory messaging functions for motor coordination and tasks is documented by a number of researchers (Firth & Firth, 1974; Henderson, Illingworth, & Allen, 1991; Kerr, 1985; Hodges, Cunningham, Lyons, Kerr, & Elliott, 1995; Chiarenza & Stagi, 2000). Due to these limitations, the consensus is that individuals with Down syndrome are less likely to accomplish recognition in traditional work-related endeavors, including the artistic realms.

**The art classes and training.** Of interest in this study are the art classes and training the students received at John Langdon Down Foundation A.C. The focus of the school is a fine arts program that emphasizes the visuospatial and bodily kinetic abilities of the art students. They attend art classes that are conducted in two large art studio



spaces with state of the art materials and equipment. A linotype-printing machine is in one of the studios. There are two art teachers, Daniel and Alan, who have been at the art school since the start of the program. They are professional artists and teachers who were trained at the Esmeralda Institute in Mexico City. In the 24 years of the art classes, they have developed a novel visuospatial and bodily kinetic curriculum. They demonstrated some of the methods and this information has been recorded on video.

The art students are taught how to use the materials and tools of the art processes, such as, painting, print making, and sculpture. The 161 artworks that are analyzed in this research are primarily oil paintings, mixed media paintings, and linotype prints. The image sizes vary from a standard size of linotype print, approximately, 17cm by 24cm to a variety of canvas sizes for the paintings.

### **Research Objectives**

The research objectives were to observe the students while they made their artworks, to interview the two art teachers, and to get permission to analyze as many of the artwork compositions as possible. During the week of research, Prof. García Escamilla, who has legal authority of guardianship for the art students gave the consent for participation of the art students in the study and to receive their demographics information (See Appendices E & F).

The purpose of interviewing the art teachers was to ascertain whether they had taught the art students the use of the HR-RT symmetry. They stated in a video recording that they attempted to teach the students the artistic principles; however, the students were unable to understand even the simplest concepts. So their teaching did not work in

respect to the HR-RT symmetry. Despite the fact that the art students did not learn the HR-RT symmetry, or proportional gauging, the students with Down syndrome in this study demonstrated an inherent expression for the HR-RT symmetrical composition in their artworks.

Each component of the making of the painting compositions is a demonstration of fine motor control and use of the proprioceptive sense. Proprioceptive sense is the unconscious perception of movement and spatial orientation arising from stimuli within the body and conscious awareness of the position of one's body (Armstrong, 2009; Damasio, 2012). Fine motor control, proprioception, proportional gauging, and aesthetic perception are integral and aligned to visuospatial and bodily kinetic aptitudes.

There have not been any studies of students with Down syndrome documenting the action of proportional gauging in the making of artwork. This research adds to the understanding of the degree that artistic principles relate to human behavior. HR-RT is a building block for the documentation and study of preferential psychology (Ferg et al., 2011). HR-RT is appealing, and it is an inherent part of human expression. By mathematically analyzing the artwork compositions of art students, who are cognitively challenged, this study provides evidence that Master artists and the art students are both using, in a similar manner, the HR-RT symmetry, the action of proportional gauging, spatial sequencing memory, and aesthetic appeal perception to make their artwork compositions.

If the same neurological procedure is demonstrable in both groups, one at a conscious level and one at the unconscious level, then, the findings would support the

hypothesis that HR-RT is an inherent human expression. The alternative hypothesis would be that there is a difference in the use of the mathematical construct between the two groups. The following are the research questions investigated of the student's artworks.

### **Research Questions**

1. Did the art students demonstrate HR-RT in the compositions of their artworks?
2. Is there evidence that the art students used HR-RT similar to the Master artists of the Quattrocento?
3. Did the art students demonstrate proportional gauging in the making of their artworks?

### **Rationale and Significance**

Current visuospatial tests assess cognitive ability to manipulate shapes, whether strict geometric or free form. These manipulations are (1) perspective, the reduction of 3-dimensional shape to 2 dimensional planar form or vice versa, (2) estimation, the task for finding proportion, such as, an object twice as large or one third the size of the original object, (3) rotation, a task that requires the viewer to mentally rotate an object into an alternate position, which may also describe a different perspective alignment, and (4) visuospatial and sequencing memory.

One method to expand traditional assessments for the combined visuospatial and bodily-kinetic aptitudes is to include the action of proportional gauging ability and the use of HR-RT construct for aesthetic appeal. One example of this kind of assessment was

undertaken in a study in 2005. The participants were asked to view images at a distance of 12 feet in a deliberately dimmed environment and to identify symmetry from among three different versions of the same image where only one of the three exhibited HR-RT symmetry (Ferg et al., 2005, 2011). A task of asking a study participant to replace a part of an image that is missing a portion of the HR-RT patterning could be another possible assessment.

Fundamentally, human vision is a 2-dimensional perception. Using stereopsis (i.e., binocular vision), it is a visuospatial and bodily kinetic process that involves multiple methods to compensate for visual confusion (Fein & Szuts, 1982). The action of proportional gauging from a distance of up to 12 feet demonstrates that there is a change in visual perception in the photoreceptors of the eyes (that is, the photopic, mesopic and scotopic human visual systems) used to perceive information (Fein & Szuts, 1982). This is one of the reasons that artists back away from the artwork to judge the proportionality of the image. For example, art viewers at the museum move closer to and then farther back away from artworks.

This study not only reveals important information about the role and functioning of symmetry in aesthetic appeal, but it also presents a novel assessment of combined visuospatial and bodily kinetic aptitudes. This may aid a better understanding of cognitive functioning and its relationship to multiple intelligences.

### **HR-RT and Incommensurability**

There have been numerous studies of HR-RT, the golden section, since 1865 when Gustav Fechner, the founder of psychophysics, investigated a positive emotional

response to the mathematical construct known by many names (Fechner, 1865). Previous studies have documented that this construct is part of a multitude of mathematics and science processes as a fundamental feature of pleasingness (Baxandall, 1988; Bouleau, 1963; Colman, 2003; Devlin, 1994; Di Dio et al., 2003, 2011; Fechner, 1865; Ferg et al., 2011; Green, 1995; Hambridge, 1967; Huntley, 1970; Schiralli, 2006).

HR-RT follows the continuum of incommensurability. This mathematical construct is simultaneously simple and complex. There are many parts and these parts have a relational order. The relationship of the parts to the whole is invariant and the biology of our sensory messaging is constructible on this framework. The origin and function of HR-RT in relationship to human perception is under investigation in the sciences. No studies have investigated the use of the HR-RT construct in artworks by art students with Down syndrome. No studies have analyzed the painting compositions of these two unique historical arts groups to compare them for the construct.

A property of HR-RT is the perception of a sense of order. This process originates from the earliest biological life systems such as the creation of the cell. Cellular biology began when there was a distinction made between the inside and outside of the cell (Oparin, 1938). Evolutionary design has continued the need for the arrangement and ordering of the parts and functions of the organism (Bateson, 1979; Oparin, 1938).

Martin Schiralli (2006), an associate professor at Queen's University, investigated how the sense of connecting patterns relate to an even deeper level of the human need for order. He proposed that inquiry into an "extrapolation of the realm of auditory phenomena" (p. 107) is nascent as the sense of order for "locating and exploiting

environmental regulations in the on-going business of living’’ (p. 107). Schiralli quoted Ernst Gombrich (1979) from the book *The Sense of Order*:

The “searchlight” metaphor comes in useful, for it reminds us of the activity that is inseparable from the most primitive model of perception. The organism must probe the environment and must, as it were, plot the message it receives against that elementary expectation of regularity, which underlies what I call the sense of order. (p. 3)

Schiralli (2006) proposed that the propensity to discern and create patterns was an offshoot of this ability to sense order. He contended that there was high value in understanding the integration of sensory input. An aesthetic basis of art, poetry, and music, in relationship to the perception of pattern from the sense of order, may give a common ground to understanding the aesthetic between art, literature, nature, and science.

Schiralli presented the examples of Bateson (1979), empirically centered, and Gombrich (1979), aesthetically centered, to demonstrate that the perception of patterns understood are not in a fixed discernible pattern but an indeterminate “dance of interacting parts” and “follow like characteristics across perceptual concepts in all disciplines” (p. 106). Schiralli further stated that when the commonality between the arts and mathematics is viewed at the fundamental level “first-order connections” (what can be stated as the origin of a systematic demonstration) a sense of order prevails through traditional and modern thought (p. 105).

Schiralli (2006) proposed that to understand this fundamental agreement between the arts and sciences, it was necessary to revisit the Pythagorean source on the “interconnectedness of the mathematical and aesthetic– through the mediating force of

patterns” (p. 112). In looking at the original numbers used by the early Greeks, the unique conception of number as an “ordered plurality” can be revealed (Becker, 1957, pp. 21-22). Schiralli cited numerous sources of this idea including Karl Menniger’s *Number Words and Number Symbols* (pp. 271–272) and Walter Burkert *Lore and Science in Ancient Pythagoreanism*. Burkert was explicit in his analysis:

*Arithmos* [the early Greek term used for number and not to be confused with modern concepts of number] is always a whole number, and tied up with the actual procedure of counting. Thus, it is closely connected with things, and in fact is itself a thing, or at least an ordering of things. *Arithmos* means a numerically arranged system or its parts. (p. 265)

Prior to Burkert, Oskar Becker (1957) transformed *arithmos* into the German term *geordnete Mannigfaltigkeit*, ordered plurality (pp. 21–22), and compared the concept to the modern use of couple, dozen, and score. Finally, Schiralli stated that David Fowler (1999), who wrote *The Mathematicians of Plato’s Academy: A New Reconstruction* claimed:

A much more faithful impression [than cardinal numbers] of the very concrete sense of the Greek *arithmoi* is given by the sequence: duet, trio, quartet, quintet . . . These numbers are ordered by size (“a quartet is bigger than a trio”), and can be added by concatenation (“a trio plus a quartet makes a septet”) and subtracted “less from the greater.” The *arithmoi* also appear in other forms, such as the adverbial sequence: once, twice, three-times, four-times. . . . I shall refer to them as “repetition numbers.” (pp. 13-14)

Fowler also gave the example of a *logos* (ratio) stating that the early Greeks did refer to *alogos* (without ratio) to indicate the discovery of irrational numbers, for example, the  $\sqrt{2}$ . The underlying concept revealed *arithmoi* (repetition numbers) that are the process of *anthyphaireis* (subtraction of the lesser from the greater). Schiralli demonstrated that this

is the meaning of a representation of a ratio between the side and diameter of the square, (i.e.  $\sqrt{2}$ ).

Additionally, the Pythagoreans discovered the process of *anthyphaireis* as it can be applied to the pentagon: the side and diagonal of the regular pentagon is incommensurable, specifically, the ratio  $\phi: 1$ , which shows the repeating pattern of *arithmoi*. Schiralli noted that incommensurability does not equate to indeterminacy in the sense that the Pythagoreans knew about the irrationality yet with the ordered plurality of their number concepts, they were able to continue to explain the arts, music, astronomy, and geometry as ordered patterns (Burkert, 1972; Fowler, 1999; Schiralli, 2006). Today, the phrase a sense of order or ordered patterns connotes a less than serious investigation in the discipline of mathematics. As Gombrich (1979) stated “Luckily, it is a mistake to think that what cannot be defined cannot be discussed. If that were so we could talk neither about life nor about art” (p. x).

Schiralli (2006) noted that a pattern could be identifiable across a number of different properties, for example, across time or within a given specific work of art.

Schiralli stated,

To say an arrangement is ordered is to claim that the relationships among the arranged phenomena are not arbitrary, that the arrangement may be at least partially described in terms of one or more relational principles or themes. (p. 119)

He then proposed that this idea of presenting themes or principles would help to provide meaningful and defining conditions that operationalize a method to study the concept of number without a fully determinate description. He theorized that it is precisely the return to an ordered plurality in mathematics study in education that proves to have great



significance today. The Pythagoreans had come to terms with the mathematical and aesthetic principles they were discovering in the ratios of harmonic intervals and geometric patterns. Philolaus of Cronton is attributed to stating, “And indeed all the things that are known have number. For it is not possible that anything whatsoever be understood or known without this” (as cited in Huffman, 1993, p. 172).

Schiralli (2006) noted that key to this fragment of thought is that Philolaus meant ordered plurality, “All things that are known have number”; that is, what is known is concatenated and has a sense of order. He stated that the important inference here is to realize it is the ability to distinguish between sets of phenomena (that have ordered plurality) in order to discover the underlying principles by which these sets may be designed.

Schiralli (2006) contended that it is a naturally evolved human perceptual ability to recognize the fundamental commonality between aesthetics and mathematics: “a cognitive infrastructure or scaffolding for knowing” (p. 124). He believed that there is a “special sub-pattern” (p. 124) to be discerned through visuospatial pattern recognition processes, such as, visuospatial sequencing and experiential memory in connecting mathematics and art.

### **Overview of Dissertation**

Chapter Two is a literature review of the field of neuroaesthetics. Neuroaesthetics is the study of psychological and neurophysiological processes fundamental to the origin of the creation and perception of art. Section one of Chapter Two focuses on the current research in the field that examines the neural relationships between the making of art and

specific cases of individuals who have been or are cortically impaired. The scientific approach of case study is the framework used for such investigations.

Additionally, psychophysical research methodology documents the behavioral processes of neuroaesthetics. The responses of participants to formal variables of symmetry, the semantics of artwork subjects, and the measurements of eye fixations using various stimuli are the subjects of the current research. The majority of the investigations record the detection and responses of the participants when viewing the various stimuli under varying environmental conditions. A review of a related psychophysics study by the researcher of this investigation sets the stage for the design of this study.

Section two of Chapter Two is a literature review of the empirical information on the action of proportional gauging. The lack of scientific documentation is discussed for this specific bodily kinetic ability. Elliot Eisner and Anjun Chatterjee offer observational evidence of the physical action of proportional gauging. Antonio Damasio (2012) research reviews the neural correlates of the development of emotional sensory messaging. As well, work by Waite and Oliver (2006) is included on the relationships of aesthetics and viewing distance for print and computer screens.

Section three of Chapter Two explores how prior research provides the context of the sensory and cortical processes that underlie the making of artwork compositions. The chart of information for the investigative design summarizes the current and past relevant research. A summary of the review concludes the chapter.

Chapter Three is the explanation of the case study of a convenience sample (the archival artworks) from a group of art students in an international research project in Mexico City D.F. The 21 participants are from the John Langdon Down Foundation A.C. (JLDF), a school in Mexico City D.F., Mexico. Section one of Chapter Three explains the objective to examine the art students' artwork records for the use of a mathematical construct. Documentation of the six sources of data collection reveal whether the persons with Trisomy 21 used the artistic principle of HR-RT, the action of proportional gauging, and spatial sequencing memory to create the artworks.

Section two of Chapter Three includes the design of Seven Master artists' painting compositions from the Quattrocento, an early Renaissance period of the fifteenth century. These paintings are a representation of HR-RT, and its use in an artwork composition. The documentation of the Master artists' group of seven paintings provides a standard by which to compare the art students' artwork. Section three of Chapter Three details how the mathematical component of HR-RT is a measurement that provides a visual record of the image analysis via a 5-step procedure to analyze the artworks. Section four of Chapter Three summarizes the international research investigation of the visuospatial and bodily kinetic abilities of the JLDF art students' group.

Chapter Four presents the data analysis from the weeklong research conducted at the school in Mexico City. Section one of Chapter Four is a brief review of the observations, interviews, and conversations with the art teachers, students, and the documentation of the unique creative environment at the school. Details of the art students' art curricular classroom design, their observed actions while making art, and an

example of the art teachers' visuospatial curriculum developed for the specific population of students with significant cognitive challenges provide the sources.

Section two of Chapter Four describes the extensive visual and textual review of the 161 pieces of art from the students. A five-step measurement procedure provides an accuracy score for the use of a specific mathematics in each art image of the art student group. Section three of Chapter Four reviews two independent inter-rater reliability (IRR) assessments that required ratings, first, a dichotomous assessment of the use of HR-RT in the images and, second, the determination of the artwork compositions following artistic principles and the use of the HR-RT construct. The IRR results provide validation of the use of HR-RT in the majority of the student artworks. The predictability of the use of artistic principles in identifying HR-RT in artwork compositions improves with the continuing development of the procedure. A summary of the research findings concludes the chapter.

Chapter Five discusses the findings of the study and the answers to the research questions. Discourse on the current educational model in populations with disabilities provides information on the expressive abilities for the art students through visuospatial and bodily kinetic aptitudes. Implications are given of an inherent expression for symmetry and the association to teaching strategies using visuospatial tools in the classroom.

### **Glossary of Terms**

*Aesthetic appeal*: A physiological phenomenon that facilitates sensory messaging;

systemic definition: a mathematical harmonic range perceived during the

action of proportional gauging that comprises conscious and unconscious states of comparative reasoning and biological value with the invariance of the interoceptive sense to set the limits of sensory messaging experiences (Baxandall, 1988; Damasio, 2012; Ferg et al., 2011; Helmholtz, 1985; Huntley, 1970).

*Aesthetic experiences:* Sensory-filled experiences in which one undergoes feelings of a heightened sense of perception, a concentrated focus on the moment, and liveliness (Uhrmacher, 2012).

*Analogy:* Correspondence in some respects, especially in function or position, between things otherwise dissimilar (*Merriam-Webster.com*).

*Art:* Human effort to imitate, supplement, alter, or counteract the work of nature; a specific skill in adept performance, conceived as requiring the exercise of intuitive faculties that cannot be learned solely by study (*Merriam-Webster.com*).

*Artist:* One who creates works of art, for example, a painter or a sculptor (*Merriam-Webster.com*).

*Artistic composition:* A putting together of parts to form a whole; an arrangement (Bouleau, 1963; Lanteri, 1985).

*Astigmatism:* a defect of an optical system (as a lens) causing rays from a point to fail to meet in a focal point resulting in a blurred and imperfect image; a defect of vision due to astigmatism of the refractive system of the eye and especially to corneal irregularity (*Merriam-Webster.com*).

*Biological value:* Any image processed by the brain is automatically appraised and marked with an emotional value in a process based on the brain's original dispositions (Damasio, 2012, pp. 49–53).

*Bodily-kinetic intelligence:* ability to control one's body movements and to handle objects skillfully (Gardner, 1983).

*Closure (spatial):* the ability to process information into larger wholes and deconstruct larger wholes into smaller parts; to interpret incomplete visuo-spatial information (Yang et al., 2014).

*Comparative reasoning:* Examination to note the similarities or differences of the basis or motive for an action or decision (*Merriam-Webster.com*).

*Concatenation:* To connect or link in a series or chain (*Merriam-Webster.com*).

*Conscious:* Having an awareness of one's own existence, sensations, and thoughts and of one's environment; intentionally conceived or done; deliberate (*Merriam-Webster.com*)

*Creativity:* To grow; the use of imagination or ideation (Dewey, 1934).

*DEMUR:* division of extreme and mean ratio; a straight line is said to have been cut in extreme and mean ratio when, as the whole line is to the greater segment, so is the greater to the less (Fechner, 1865).

*Down syndrome:* Down syndrome is a chromosomal condition that is associated with intellectual disability, a characteristic facial appearance, and weak muscle tone (hypotonia) in infancy. All affected individuals experience cognitive delays, but the intellectual disability is usually mild to moderate. People

with Down syndrome may have a variety of birth defects. About half of all affected children are born with a heart defect. Digestive abnormalities, such as a blockage of the intestine, are less common. Individuals with Down syndrome have an increased risk of developing several medical conditions. These include gastroesophageal reflux, which is a backflow of acidic stomach contents into the esophagus, and celiac disease, which is an intolerance of a wheat protein called gluten. About 15 percent of people with Down syndrome have an underactive thyroid gland (hypothyroidism). The thyroid gland is a butterfly-shaped organ in the lower neck that produces hormones. Individuals with Down syndrome also have an increased risk of hearing and vision problems. Additionally, a small percentage of children with Down syndrome develop cancer of blood-forming cells (leukemia). Delayed development and behavioral problems are often reported in children with Down syndrome. Affected individuals' speech and language develop later and more slowly than in children without Down syndrome, and affected individuals' speech may be more difficult to understand. Behavioral issues can include attention problems, obsessive/compulsive behavior, and stubbornness or tantrums. A small percentage of people with Down syndrome are also diagnosed with developmental conditions called autism spectrum disorders, which affect communication and social interaction. People with Down syndrome often experience a gradual decline in thinking ability (cognition) as they

age, usually starting around age 50. Down syndrome is also associated with an increased risk of developing Alzheimer disease, a brain disorder that results in a gradual loss of memory, judgment, and ability to function. Approximately half of adults with Down syndrome develop Alzheimer disease. Although Alzheimer disease is usually a disorder that occurs in older adults, people with Down syndrome usually develop this condition in their fifties or sixties (*NIH/Genetics Home Reference.com*).

*Emotion*: the affective aspect of consciousness; a state of feeling; a conscious mental reaction subjectively experienced as strong feeling usually directed toward a specific object and typically accompanied by physiological and behavioral changes in the body (*Merriam-Webster.com*).

*Experiential memory*: is episodic memory and represents the memory of experiences and specific events in time in a serial form, from which the actual events can be constructed from the place and time. This includes the memory of autobiographical events such as, times, places and associated emotions and other contextual knowledge (Sutton, 2016)

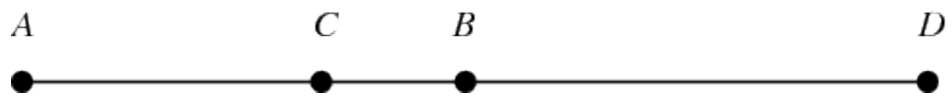
*Exteroception*: Sensing the exterior by way of smell, taste, touch, vibration, hearing, and seeing (Damasio, 2012, p. 54).

*Golden section*: Also known as the golden ratio, divine proportion, division of extreme mean and ratio (DEMUR), and dynamic symmetry; it is a mathematical process that begins with various shapes that can be divided into composite parts via a specific ratio, ( $\phi = (1 + \sqrt{5}) / 2 = 1.61803 \dots$  and  $\phi^{-1} = (1 - \sqrt{5}) / 2$ )



) / 2 = -0.61803 . . . ) (Fechner, 1865). The subdivisions of dynamic symmetry reduce to ratios from which emerges a spiral. “The spiral is without a terminal point: It may grow outwards (or inwards) indefinitely, but its shape remains unchanged” (Huntley, 1970, p. 102). The dynamic three-dimensional geometric image retains these proportional ratios whether it is reduced or enlarged. The perception of the geometric patterning creates an aesthetic appeal (Huntley, 1970).

*Harmonic range:* Let a straight line  $AB$  be divided internally at  $C$  and externally at  $D$  in the same ratio, so that



$$\frac{AC}{CB} = -\frac{AD}{DB}.$$

Then  $AB$  is said to be divided harmonically at  $C$  and  $D$  and the points  $A C B D$  are said to form a harmonic range (Durell 1928, p. 65).

If  $C$  and  $D$  divide  $AB$  harmonically, then  $A$  and  $B$  divide  $CD$  harmonically.

If  $O$  is the midpoint of  $AB$ , then

$$OB^2 = OC \times OD.$$

Hardy (1967) uses the term harmonic system of points to refer to a harmonic range (Weisstein, 2017).

*Harmonic ratio:* The sequence of the Pythagorean harmonic scale – tone, diatessaron, diapente, and diapason- as it was discussed in fifteenth- century musical and architectural theory. Take four pieces of string of equal consistency, 6,

8, 9, and 12 inches long, and vibrate them under equal tension. The interval between 6 and 12 is an octave; between 6 and 9 and between 8 and 12 a fifth; between 6 and 8 and between 9 and 12 a fourth; between 8 and 9 a major tone (Baxandall, 1988, pp. 99–101).

*HR-RT symmetry:* HR-RT symmetry is both harmonic ratios and Rule of Three or Thirds.

Harmonic ratios are the whole number relationships of frequencies that are the geometric basis of the fundamental theory of music (Baxandall, 1988; Huntley, 1970). The development of a mathematical treatment of motion and change in order to describe infinite series that are the various patterns of the harmonic series, which cannot have a finite value (Devlin, 1994, pp. 76-79). The Rule of Three is the root 2 rectangle with a division of three (Hambridge, 1920; Herter, 1966).

*Incommensurable:* Having no common measure; an open-state; not comparable (*Merriam-Webster.com*).

*Inherent human expression for HR-RT:* the ability to perceive artistic principles of HR-RT, which induces a positive response, in the making and viewing of artworks using proportional gauging (Baxandall, 1988).

*Insular cortex:* In each hemisphere of the mammalian brain, the insula is a portion of the cerebral cortex folded deep within the lateral sulcus between the temporal lobe and the frontal lobe. The insulae are believed to be involved in consciousness and play a role in diverse functions linked to emotions and regulation of body homeostasis. The functions include perception, motor

control, self-awareness, hedonic states, cognitive functioning, and interpersonal experience (Damasio, 2012, p. 202).

*Interoception*: The process by which crucial brain stem nuclei conduct homeostasis (life regulations); the mapping of the visceral and internal milieu; signals for physiological connections, such as hunger and thirst which materialize in the mind, for temperature and, that these signals participate in the making of hedonic states and the in-parallel feelings of pleasure i.e. biological value (Damasio, 2012, p. 202).

*Irrational number*: A member of the set of real numbers, which is not a member of the set of rational numbers (Weisstein, 2017).

*Keratoconus*: cone-shaped protrusion of the cornea; in its earliest stages, Keratoconus causes slight blurring and distortion of vision and increased sensitivity to light (*Merriam-Webster.com*).

*Keratoconjunctivitis sicca*: dry eye; a condition associated with inadequate tear production and marked by redness of the conjunctiva, by itching and burning of the eye, and usually by filaments of desquamated epithelial cells adhering to the cornea (*Merriam-Webster.com*).

*Linear one-point perspective*: A mathematical system for indicating spatial distance in 2-dimensional images where lines converge in a single vanishing point located on the horizon line as seen by a stationary viewer (Alberti, 2004).

*Ideation*: The formation of ideas or concepts: imagination; to think original thoughts (Lubinski, 2003).

*Mental rotation*: the ability to distinguish between a figure and its mirror image; to interchange an image using angles of rotation (Yang et al., 2014).

*Mercantile geometry*: also known as the Merchant's Key: a geometric proportion that was a method of the precise awareness of ratios for the measurement of any item (Baxandall, 1988, pp. 99–101).

*Mirror neurons*: Mirror neurons are a type of brain cell that respond equally when humans produce an action and when human watch someone else perform the same action (Chatterjee and Vartanian, 2014).

*Motoric ability*: the ability to perform complex muscle and nerve acts that produce movement: fine motor skills are small movements like using a pencil or paintbrush; gross motor skills are large movements like walking and dancing; the spatial content of perception is the production of sets of basic function values apt for constructing motor sequences (Briscoe & Grush, 2017).

*Multiple intelligences (MI) theory*: human beings possess not just a single intelligence (often called “g” for general intelligence). Rather, as a species we human beings are better described as having a set of relatively autonomous intelligences. Most writing about intelligences focuses on a combination of linguistic, logical, spatial, bodily-kinetic, musical, interpersonal, intrapersonal, and naturalistic intelligences. While we all have these intelligences, individuals differ for both genetic and experiential reasons in terms of their profile of intellectual strengths and weaknesses. No

intelligence is in and of itself artistic or non-artistic; rather several intelligences can be put to aesthetic ends, if individuals so desire. There can be no direct educational implications from this psychological theory; but if individuals differ in their intellectual profiles, it makes sense to take this fact into account in our educational system (Gardner, 1983).

*Myopia*: a condition in which the visual images come to a focus in front of the retina of the eye because of defects in the refractive media of the eye or of abnormal length of the eyeball resulting especially in defective vision of distant objects: nearsightedness (*Merriam-Webster.com*).

*Natural selection*: The principle that individuals possessing characteristics advantageous for survival in a specific environment constitute an increasing proportion of their species in that environment with each succeeding generation (Darwin, 1859).

*Nystagmus*: involuntary usually rapid movement of the eyeballs (as from side to side) occurring normally with dizziness during and after bodily rotation or abnormally following head injury or as a symptom of disease (*Merriam-Webster.com*).

*Ordered plurality*: A much more faithful impression (than cardinal numbers) of the very concrete sense of the Greek *arithmoi* is given by the sequence: duet, trio, quartet, quintet and so on. These numbers are ordered by size (a quartet is bigger than a trio), and can be added by concatenation (a trio plus a quartet makes a septet) and subtracted (less from the greater). The *arithmoi* also

appear in other forms, such as the adverbial sequence: once, twice, three-times, four-times, and so on. I refer to them as *repetition numbers* (Fowler, 1999, pp. 13–14).

*Perspicacity*: Acuteness of perception, discernment, or understanding; clear sightedness (*Merriam-Webster.com*).

*Platonic ideal*: a precise geometric measurement of image parameters; a quantitative measure of the content of information (*Merriam-Webster.com*).

*Practice of freedom*: A process of teaching in a liberatory manner one that is the active participation of the teacher and students who link their learning to the actual practice of engaging dialogue (hooks, 1994).

*Processing fluency*: The ease with which perceptual and conceptual information is processed in the mind (Reber et al., 2004).

*Projective geometry*: a branch of geometry that deals with the properties of configurations that are unaltered by projection, example: Renaissance painting compositions (Delvin, 1994).

*Proprioception*: Unconscious perception of movement and spatial orientation arising from stimuli within the body and conscious awareness of the position of one's body (Armstrong, 2009).

*Proportional gauging*: The act of perceiving both internally and externally, by the sensory messaging of movement through space, the relational aspects of objects, items, or sets of things (Baxandall, 1988; Bouleau, 1963).

*Psychophysics*: The psychological study of relationships between physical stimuli and

sensory response (*Merriam-Webster.com*).

*Quantum mechanics (QM)*: The quantum theory is a mathematical theory of dynamic systems in which dynamic variables are represented by abstract mathematical operators having properties that specify the behavior of the system (Witten, 1998).

*Quattrocento*: During the 15th century, an early Renaissance period of Italian art and architecture (Baxandall, 1988).

*Ratios of consonance*: Fundamental harmonic frequencies of the traditional painting compositions of the Quattrocento. The use of mathematical constructs as related to the Quattrocento cultural phenomenon of linear perspective, ratios of consonance and the rule of three in proportional gauging. Selective arrangement of elements in a painting to lead the eye into a painting to retain interest in the subject matter and to deploy all the painterly elements to work together (Bouleau, 1963).

*Relaxed selection process*: A natural selection process that occurs when selective processes are either eliminated or dramatically reduced (Chatterjee, 2014, p. 173).

*Rule of Three (Rule of Thirds)*: Principal of art; a compositional rule of thumb that states an image can be divided into nine equal parts; application of the rule is proposed to make the art composition more aesthetically pleasing (Baxandall, 1988, p. 86). An artistic element of balance and proportion

based on the subdivision of the root 2 rectangle in to multiples of three (Hambridge, 1967; Herter, 1966).

*Self-reflection*: Concentration of the mind on one's self (*Merriam-Webster.com*).

*Sense of order*: Intuitive or acquired perception or ability to estimate a sequence or arrangement of successive things; customary procedure (Gombrich, 1979).

*Sensory messaging*: Transmitting impulses from sense organs to nerve centers; afferent communication (Damasio, 2012).

*Somatosensory function*: Primary cortical processing mechanism for sensory information dedicated to exteroception and proprioception (Damasio, 2012).

*Spatial sequential memory*: is the memory for the order of spatial information that has been presented in temporally sequential order (Yang et al., 2014).

*Spatial object memory*: is where an object is in space (Yang et al., 2014).

*Spatial working memory*: the simultaneous generation of circuits and engram cells for both short and long time memory in the hippocampus and basolateral amygdala for the learning of spatial experiences (Kitamura et al., 2017).

*Stereopsis*: The perception of depth produced by the reception in the brain of visual stimuli from both eyes in combination; binocular vision (Fein & Szuts, 1982).

*Strabismus*: inability of one eye to attain binocular vision with the other because of imbalance of the muscles of the eyeball; squint (*Merriam-Webster.com*).



*Superior colliculus (SC)*: A seven layered multisensory cortical structure. The upper layers receive visual signals from the retina of the eye, and the lower layers process signals from multiple cortical areas (Damasio, 2012).

*Symmetry*: Symmetry is the property of remaining invariant under certain changes (as of orientation in space, of the sign of the electrical charge, of parity, or of the direction of time flow) – used of physical phenomena and of equations describing them <http://www.merriam-webster.com/dictionary/symmetry>.

*The Period Eye*: An analytical technique used by art historians to define the cultural environments from which the artworks were created and understood (Baxandall, 1988).

*Unconscious*: Without conscious awareness'; involuntary; the division of the psyche not subject to direct conscious observation but inferred from its effects on conscious processes and behavior (*Merriam-Webster.com*).

*Visual object memory*: the recognition of an object (Yang et al., 2014).

*Visuospatial intelligence*: Ability to perceive the visual-spatial world accurately and to perform transformations upon those perceptions. Sensitivity to color, line, shape, form, space and the relationships that exist between these elements. Includes the capacity to visualize, or graphically represent visual or spatial ideas, and to orient oneself appropriately in a spatial matrix (Armstrong, 2009).

*Visuospatial sequencing memory*: is the conjoined emotional response of an object moving in a spatial temporal pattern that can be recalled (Yang et al., 2014).

*Visualization*: Formation of mental images; the act or process of interpreting in visual terms or putting into visual form (*Merriam-Webster.com*).

## CHAPTER TWO

### **Review of the Literature**

#### **Introduction and Overview**

Neuroaesthetics research is the investigation of the science underlying the making of artwork compositions; the research follows numerous psychophysics theories. These theories include formal objective variables, subjective analyses of aesthetic properties, and roles of processing fluency in the viewing of artworks. The manner in which these affective variables are explored requires both quantitative and qualitative research methods. This literature review focuses on the psychology of perceptual systems that offer study designs that seek to find ways in which visuospatial and bodily kinetic aptitudes are connected in the making of artworks. The field of neuroscience is new; however, much has already been determined or observed through the investigations in the evaluation of the core subject of symmetry. This epistemology helped the researcher to create the current study design.

Some of the major findings include research by Elliot Eisner and Anjun Chatterjee. Specifically, Eisner (1994, 2002) studied the somatosensory connections of mind and body and the relationship of these to proportional gauging. While Anjun

Chatterjee (2006, 2014) reviewed the relationship of proportional gauging to the subject of natural selection. Scholars Jerry Waite and Garth Oliver (2006) found a lack of empirical research about proportional gauging explaining the viewing distance between observer and a printed screen, sign, or artwork. Research by Antonio Damasio (2012) provided physiological and behavioral indications for the significance of the human brain stem as a crucial component of the singular development of the self and the role of emotions in that process. A synthesis of current research on the neurological perception of artwork compositions assists in the understanding about the processes of the perception of symmetry.

### **Neuroaesthetics Research**

The subject of neuroaesthetics is interdisciplinary as it relates to art, aesthetics, psychology, and neuroscience. In the 1990s, Semir Zeki of the University College of London came up with the term neuroaesthetics based on qualitative observations and quantitative experimentation. Marcos Nadal, the editor-in-chief of the Empirical Studies of the Arts (ESA), a peer-reviewed journal of SAGE publications, has along with other researchers in the field, established ESA as a premier source of information on the new science. Nadal proposed that contributing researchers find a way to measure the artistic process. This challenge, to find a method of assessment for aesthetics, will further the science of neuroaesthetics. ESA has recently been included in the Thomson Reuter's Social Science Citation Indexes, which improves the merits of the field of research.

In 2015, Huston, Nadal, Mora, Agnati, and Cela-Conde authors of the book *Art, Aesthetics and the Brain* introduced pertinent research within the field, such as, "The

Neuropsychology of Visual Art” by Anjun Chatterjee. Chatterjee is a professor of Neurology at the University of Pennsylvania and on the editorial board of the *ESA* (as is Howard Gardner). He reported on situations where there has been brain damage to patients, which in some cases paradoxically facilitates an increase in art production even though this aptitude may not be present prior to the disability. He stated three observed neural changes.

- a. Individual produces unique visual vocabulary.
- b. Individual demonstrates an ability to render images.
- c. Individual’s expressive abilities are improved.

Chatterjee’s research also found the example of a non-professional artist who started making visual art only after the advent of brain damage. This *de novo* behavior is demonstrable within a small percentage of people with brain damage. Chatterjee believed this maybe an alternative to the loss of regular language communication capacities such as speaking or writing. Art is a communication system yet not as sensitive to brain damage as language. Information sent through different pathways engages the emotions. This is perhaps related to the fundamental ability of humans and animals to innovate in order to survive (Chatterjee, 2006).

Visual artists with Alzheimer’s disease or fronto-temporal dementia (FTD) and other degenerative brain issues seem to be able to continue artistic projects. It is only when hand movements are disabled that the artistic production ends. It is difficult to identify the specific areas attributed to artwork behavior (Miller et al., 1998). This information is supported by multiple sources of research such as *Indre Viskontas and*

*Suzee E. Lee* and “The Creation of Art in the Setting of Dementia” (2015). Similarly, in the book *Neuroscience of Creativity*, Vartanian, Bristol, and Kaufman (2013) found that increased artistic activity happens in spite of brain degeneration.

This research investigated case studies of people with neurological disorders furthering our understandings of the cognitive and neurophysiological bases of artistic production (Zaidel, 2014; Huston et al., 2015). Along with case study investigations, behavioral measurements from psychophysics research methods explained further information about artistic processes. For example, a theory of the neuroscientific perspective is that there are multistage integrations of the visual consciousness as the visual brain consists of a parallel integrative system with each pathway following a particular attribute such as color or motion (Cela-Conde et al., 2004) or form (Locher & Nodine, 1973). These systems link to the subjects of memory, spatial location, and attention (Zeki & Marini, 1998). Artists utilize these systems to produce aesthetic sensations (Bartels & Zeki, 2000; Cela-Conde et al., 2004). Artists use explicit laws of aesthetic expressions (Gage, 1999; Latto, 1995; Ramachandran & Hirstein, 1999; Zeki, 1999). Only humans produce art spontaneously using creativity as part of the process. Humans are more creative than animals so it is necessary to look for unique features in humans (Zaidel, 2014; Cela-Conde et al., 2004).

Spatial location involves visuospatial abilities: (a) the sequence in which processing steps are executed and (b) the precise steps taken. These components follow two strategies:

1. Constructivist approach: the mental construction of visual representatives of Objects, which requires transformations.
2. Analytic approach: employing a sequential feature by feature method of comparison and transformation. (Lajoie, 2003)

Looking at the psychology of form in reference to the construction of shape and placements on a plane, the parameter of symmetry is an aspect of the informational content of the form (Locher & Nodine, 1973, p.408). In a study measuring eye movements, a complexity task examines subject observation visual stimuli. The time involved and the number of fixations increased as the complexity of the shapes increased. Locher and Nodine found that for symmetrical shapes only one-half of the object information was needed to determine the entire shape. Whereas for the asymmetrical shapes, the subjects needed to view all of the shape. The authors suggested that the participants used an “organizing code” (p. 408) in addition to the feature code “in characterizing a given shape” (p. 408). The authors also suggested that their research provides confirmation of “the importance of peripheral viewing during the processing of visual information” (p. 412).

In 1989, Locher and Nodine determined that the presence of symmetry, a pattern within an image composition, for example, bilateral or vertical symmetry, was perceived more quickly than others types of patterns. The authors stated:

Art historians have noted the perceptual salience of symmetry in the visual arts and architecture. In fact, based on his extensive examination of the composition and design of works of art, Bouleau concluded that it is the symmetry contained in a composition, no matter how “hidden”, which draws the viewer into that world of secret geometry which has governed the arts of design from classical antiquity. (Locher & Nodine, 1989, p. 475)

Locher and Nodine used Daniel Berlyne's theory of psychophysics (1973) as a framework for understanding how symmetry as a visual stimulus was part of an "orientation reaction" to the stimulus pattern. This is a visual exploration using basic perceptual and cognitive strategies of "attention, detection, discrimination, and identification" (p. 475). Locher and Nodine made the distinction between "static symmetry, a fundamental aesthetic stimulus that does not hold perceptual attention" and "dynamic symmetry (asymmetry) that does enhance attention" (p. 477). The researchers found that the two types of symmetrical patterns are detected at 100ms 93% of the time. Mirror symmetry was perceived at horizontal, vertical, and oblique axes. If a midline is placed to the right or left side, then there was a demonstrated tolerance for the imperfect symmetry patterns (p. 476). This misalignment was observed equally for vertical and horizontal orientations. The results given by the participants were accurate 91-99% of the time (p. 476). Additionally, the participants observed the symmetry relationships "globally and for different types of symmetry at 50ms of stimulus presentation" (p. 478). In summary, the researchers stated that the observation of static symmetry is possibly a "fundamental unlearned response" (p. 483). The use of the axis of symmetry is considered an "anchoring point" of the eye-brain system (p. 483). Further "exploration is guided not only by the structural content of pictures but also by their emotional impact. This exploration leads to physiological changes in arousal that are closely tied to aesthetic responses" (p. 483).

This pleasingness response is autonomous and is located in the general reward cortical systems (Kuhn & Gall, 2012). Specifically "the orbito and medial frontal cortex,



ventral striatum, anterior cingulate and insulae respond to aesthetic visual images and the medial orbitofrontal cortex and adjacent cingulate cortex respond to different sources of aesthetics including music” (Chatterjee & Vartanian, 2014, p. 370).

Following the research focus of Locher and Nodine for the perception of form as balanced, symmetrical, or asymmetrical, Hasse and Weber (2012) investigated eye movements when the subject perceived architectural facades. The authors questioned the cortical process of how the fluency of perceptual processing (Reber, Schwartz, & Winkelman, 2004) affects the determination of whether shapes are in a balanced, symmetrical, or asymmetrical proportion. Hasse and Weber found that the eye movements of the participants when viewing the compositional elements were notable only when the manipulation of balance was also a manipulation of symmetry. They found that when symmetry was not balanced, it was the crucial factor in influencing the perception of the image. The orientation of the gaze was toward the vertical axis of symmetrical compositions. Their research supports Locher and Nodine findings that symmetry is a fundamental visual factor in an image perception.

Chatterjee and Vartanian (2014) investigated how the components of an aesthetic experience are interactive. They referred to these components as sensory-motor, emotion-valuation, meaning-semantic knowledge, and neural systems (p. 370). The authors stated that when viewers look at paintings with images of actions, this then engages the critical processes of the motor system. This system is the mirror neuron system. The neurons respond to both the execution and perception of actions (Chatterjee & Vartanian, 2014). The authors stated that “This system resonates when people infer the intent of artistic

gestures or observe the consequences of actions shown in the artworks” (p. 370).

Chatterjee and Vartanian (2014, p. 372) contended that current research findings are

Consistent with the notion that aesthetic experiences include an important internally oriented component, subjects focusing on the feelings that artworks evoke exhibit bilateral activation of the insulae (Cupchik et al., 2009), regions strongly implicated in regulating our autonomic nervous system and the visceral experience of emotions. (Critchley et al., 2005)

Andreja Bubic, Ana Susae, and Marijan Palmovic (2016) used eye-tracking methods to investigate participants’ responses to figurative and abstract artworks. They report that the participants preferred the figurative artworks. The parameter of interest in their study was whether the participants connected a short title of brief information to a preference of the artwork. They did not make a distinction between naïve or mature (persons with prior art knowledge) participants. A current trend in the understanding of aesthetics is to focus on semantics, which is another aspect of the appeal of artworks. Kathleen Moore and Alan West (2012) investigated the role of semantic meanings of artworks. They chose to juxtapose the various artistic styles into two main groups, Impressionism and Renaissance and the realist representational venue versus abstract and cubist styles of Dada and Outsider. Their findings demonstrated that the semantic meanings seemed to indicate an increased liking for the representational artworks versus the abstract works. In their further investigations, the rapid perception of the “global” image features revealed composition elements at a low spatial frequency. High spatial frequency information is a detailed rendition of the scene. Moore and West stated that natural scenes and representational artworks must share common perceptual characteristics. This “scale invariance” helps to zoom in and out of the image to retain the

same spatial frequency (p. 26). Moore, West, and Martindale (2006) tested whether meaning predicted preferences for representational paintings at a rapid 10msec viewing time. The authors referenced Reber, Schwartz, and Winkelman (2004) as having

identified several variables that enhance the ease of perceptual processing, including semantic priming and prototypicality. The authors stated that perceptual fluency is hedonically marked: the more easily a stimulus is processed, the more positive the aesthetic response. (p. 26)

In fact, the theory of processing fluency involves both perceptual fluency (the ease of identifying physical characteristics of the stimulus) and conceptual fluency (the ease of mental operations concerned with stimulus meaning and the relation to semantic knowledge structures) (Reber et al., 2004).

Reber et al. also stated that there four components that facilitate fluency: (1) that symmetry is a formal variable; (2) that processing fluency is itself hedonically marked; (3) that high fluency is subjectively experienced as positive; and, (4) that fluency relates to judgments of aesthetic appreciation because subjective experiences are used in the evaluation (Reber et al., 2004). Likewise, Moore and West (2012) found that “the summative activation of sensory, perceptual, and semantic nodes rises rapidly to a high level, enhancing liking” (p. 26). They hypothesized

meaning would be the best predictor of preference and over shadows formal variables even with only global or coarse information available. Furthermore, because meaning can be processed so rapidly or with only coarse information, representational paintings would continue to yield the strongest preferences even under degraded, i.e., low spatial frequency only conditions. (p. 27)

The researchers used two sets of artworks, Romantic and Impressionistic (artworks considered of the realist genre) and Cubist and Abstract Expressionism (artworks considered of the abstract genre), to test the preference judgments of the participants.

“The artistically naïve college sophomore participants found Romantic and Impressionistic paintings to be more meaningful and orderly, and liked them better, than cubist or Abstract Expressionist paintings” (p. 35). This research of how semantics relate to the making of artworks concluded that representational painting activates preexisting cognitive nodes facilitating the pleasingness response.

Wang, Can, and Cupchik (2016) studied how artwork viewers are seeking the experiences of aesthetics appeal. They referred to this phenomenon as the principle of affective covariation that the person “seeks out experiences, aesthetic or otherwise, that modulate transitory feelings typically associated with valence” (p. 195). They reported that the elementary stimulus features occur first before the viewer makes “affective judgements or search for semantic content” (p. 193). Cupchik et al. continue to explore the relational aspects of a neural model of aesthetic versus cognitive processing in particular the “understanding of the relationship between the perceptual encoding of various elementary features and memory retrieval” (p. 217).

In 2011, Ferg et al. conducted a psychophysics study of a forced choice preference for the mathematical construct DEMR. Nine novel images with varying percentages of horizontal and vertical distortions were presented along with the DEMR image. The study found that the 139 participants preferred the DEMR images (DEMR is a type of symmetry). The Chi square statistical measure was significant  $p < 0.0001$ . This was a casual study of a random sample population and the results can be generalized to the larger community. It was the core feature tested in relationship to a pleasing response. This current research investigates further the relationship of symmetry and a pleasing

response by reviewing the use of HR-RT in the artworks of persons with known cognitive disabilities.

Related to the perception of symmetry, Chatterjee and Vartanian (2014) reported that when a viewer observes an artwork with an image, there is a neural correlation of the implied movement or action either as an execution of action or as a cortical perception or both of the movements can induce a reciprocal response in the brain. Looking at the research of Locher and Nodine (1973, 1989), they stated that symmetry (static and dynamic) is possibly an internal cognitive code. Future investigations of the implied movement of the HR-RT geometric vortexes and the possible use mirror neurons activated by action suggests further neuroaesthetics research is needed in particular to investigate the possible perception of action when viewing the vortex constructions of HR-RT.

In sum, all of these studies helped pave the way for this dissertation as it attempts to fill in some of the gaps. The artwork of the art students with cognitive challenges is anecdotal evidence, as the art was an archival data source; however, the use of the HR-RT construct is of interest. The Master artist's paintings are a historical representational art genre. Analysis of their artworks provides further information on HR-RT as an innate positive emotional response. The Masters' paintings show a more sophisticated conscious use of the construct.

### **Bodily-Kinetic Intelligence**

Bodily kinetic intelligence has not been researched as extensively as the linguistic, logical, and visuospatial categories in relation to the making of artworks. The

bodily kinetic ability is associated with the control of one's bodily movements and the handling of objects (Armstrong, 2009; Gardner, 1983). This ability is related to the proprioceptive and exteroceptive sensing of the exterior body movement through the somatosensory cortices (SI, SII) and the interoceptive sensing of the interior of the body functions (Damasio, 2012).

The curriculum education theorist, Elliot Eisner (2002), addressed both the visuospatial and the bodily kinetic intelligence aptitudes in his book, *The Arts and Creation of Mind*, as the opportunity for humans to use a “new vision” that is aligned to our somatosensory biological systems (Eisner, 2002, p. 76). Eisner discussed the importance of mind and body connections and how the study and practice of the arts develops this natural perspicacity. He theorized that until the bodily kinetic somatosensory connections are understood, the full potentiality of human consciousness will not be achieved, a consciousness he proposed as incommensurable (Eisner, 1998). Following the American pragmatic theorists William James (1890) and John Dewey (1934), Eisner believed that knowing how the body and the mind function together can be achieved by obtaining empirical evidence of the experiential connections of sensory messaging.

Eisner (1994, 2002) discussed an example of the association of visuospatial and bodily kinetic intelligence. He was a connoisseur of the arts and how artistic experiences relate to emotions. He believed that the optimal manner in which one comprehended experiences and learning was when the individual was fully aware of the simultaneous use of both visuospatial and bodily kinetic aptitudes. Eisner connected the making of art

and the perception of these experiences through bodily kinetic movement as the action of proportional gauging. Eisner described the process of artistic gauging to create expressive and ordered relationships of the elements of a composition. He referred to this ability as using a form of vision focused on qualitative matters. Eisner related an example of proportional gauging of artwork perception:

One of the techniques people use to heighten awareness of these relationships can be seen in an art museum as people move close to a painting and then step back several feet. Move up, and then step back. What is happening here is a kind of visual analysis—synthesis relationship. (Eisner, 2002, pp. 75–77)

He proposed that understanding artistic experiences can be achievable by proportional gauging capacities dependent upon characteristics of the physical body. Eisner also connected this awareness to the somatosensory systems:

In the kind of perception, I am describing, sight alone will not be adequate for resolving problems of fit. Problems of fit must be addressed not only through sight but also, as I indicated in Chapter 1, through *somatic knowledge*, through being tuned in to the work and being able to make adjustments to the image on the basis of what is felt emotionally. Body knowledge comes into being as the individual learns how to use sight to inform feeling. (Eisner, 2002, pp. 75–77)

Eisner (2002) referenced the idea of somatic knowledge and that the artist and observer of the art are “tuned” in to an awareness actively informing the individual of the emotional experience (p. 76). Gardner (1983) also related the idea of bodily kinetic intelligence to the somatosensory via the proprioceptive sense, “the conscious and unconscious perception of movement and spatial orientation of the position of one’s body arising from stimuli within the body” (as cited in Armstrong, 2009, p. 7).

Eisner’s research found that the connections of visuospatial and bodily kinetic intelligence demonstrates the basic tenant of a cognitive psychology theory in a reference

to the embodied mind (Eisner, 2002, p. 76). Similarly, Mark Johnson and George Latkoff (1980) proposed the theory of embodied mind in *Metaphors We Live By*. Johnson subsequently published a monograph in 2007, *The Meaning of Body: Aesthetics of Human Understanding*, to propose his concept of “the body as fundamentally the source of meaning, thought, images and language” (as cited by Damasio, 2012, p. 348). This happens because the human is fundamentally aesthetic, which is the source of meaning making (Johnson, 2007).

Johnson (2007) along with Eisner (2002) connected ideation with aesthetics. Aesthetics is definable in various ways, from Greek *aisthētikos*, pertaining to sense perception; *aisthēta*, perceptible things; *aisthemasthai*, to perceive (*American Heritage Dictionary*, 1973, p. 21). “Aesthetic experiences are defined as sensory-filled experiences in which one undergoes feelings of a heightened sense of perception, a concentrated focus on the moment, and liveliness” (P. B. Uhrmacher, personal communication, November 15, 2012). Similarly, Anjun Chatterjee (2004) wrote that the investigative focus of the new field of neuroaesthetics is on the biological-basis of the understanding of aesthetics. He has primarily focused his research on the relationship of aesthetics and artistic variation in natural selection and adaptive processes. Chatterjee has proposed an evolutionary theory of the development of human aesthetics (2004, 2014).

In the book *Aesthetic Brain*, Chatterjee (2014) documented the perceptual action of proportional gauging in his descriptions of natural selection adaptations. He described this as the natural human conscious and unconscious calculation of spatial relationships used to assist in the making of preferential judgments. These preferential judgments



facilitate processing fluency (Reber et al., 2004). Chatterjee evaluated prior research showing the brain stem region is involved in the maintenance of the homeostasis of life processes including core emotional centers (Chatterjee, 2014; Damasio, 2012; Winkelman, Schwarz, Fazendiero, & Reber, 2003) and that HR-RT seems to be the “arrangements [of patterns] and spirals that minimize energy in a system” (Chatterjee, 2014. p. 58). Chatterjee (2014) projected that humans use the proportional gauging of symmetry relationships to determine behavior. This ability is an action and as such involves movement; it relates to proprioception (as cited in Armstrong, 2009).

Chatterjee discussed the importance of this ability in the natural selection process of evolution. He stated that men prefer women who have a ratio relationship of waist to hips of 0.70 and that this factor remains constant for all cultures and that this preference is related to the fertility of women. Most fertile women have a waist-to-hip ratio of between 0.67 and 0.80 (Singh, 1993). Chatterjee also gave the example of a preferred average proportional symmetry of the human body (Chatterjee, 2014) and cited the use of “proper proportions” (p. 17) by the artists during the Renaissance. He also used the artist Albrecht Dürer who used the HR-RT and linear perspective constructs in the composition of his paintings and drawings (Bouleau, 1963).

Another notable example observed by Chatterjee (2014) is that along with natural selection and sexual selection, there are processes of aesthetic symmetrical preferences for choices in relationship to faces and bodies (pp. 12–13). In addition, Chatterjee stated that humans may have a partially hardwired preference for landscapes that may have

improved the chances of Pleistocene ancestors. He wrote “But the evidence suggests that our visual brain not only classifies things, it also evaluates them (Chatterjee, 2014, p. 52). Chatterjee reasoned that the evaluations (proportional gauging decisions) are preferentially based and can be associated with visuospatial analyses within the cortical regions of the brain stem that monitor biological value. He explained that there is evidence that can be classified as “fitness indicators” (p. 57) in landscape preferences such as places with habitat that exhibit improved survivability. Chatterjee proposed that there might be a preference for number sense and that this may be a human adaptation to natural selection:

Why would numbers be adaptive? The reasons I offer are at best speculative. In the Pleistocene era, humans must have been able to quantify things and predict quantities of future things. For areas with wild game, knowing how much meat might be available relative to the number in a group would have been critical to deciding whether to stay or press on. Predicting areas of good foraging based on the growth of edible plants would have been an important survival skill. People who enjoyed quantiles, probabilities, and correlations would have had an evolutionary advantage in meeting their needs to assess immediate and future sources of nourishment and shelter. (Chatterjee, 2014, p. 63)

In this scenario, Chatterjee described the ability of proportional gauging. First, the amount of meat available in proportion in the relative size of a group of animals and how long the acquired meat would last over time for the humans. Second, the assessment of the proportional amount of edible plants in a given area, and third, what would be the proportional likelihood of survival given the various factors of the fitness indicators such as the number and size of the surrounding trees for shelter and proximity of water. He also described ways in which humans used comparative reasoning and the action of

proportional gauging as an adaptive strategy in natural, sexual, and aesthetic selection and that these strategies provide a successful design for survival.

Components of an aesthetic evolutionary paradigm may be a combination of an adaptation of proportional gauging action guided by the interoceptive sense of emotional sensory messaging from the master cortical structure system, the insula (Damasio, 2012). The insula provides the fundamental frequency ordered patterning of the cortical framework for the biological values of pleasingness and the somatosensory connections that facilitate our motoric ability (Damasio, 2012).

### **Source of Meaning Making**

Antonio Damasio (2012), citing the work of William James (1890) and Mark Johnson (1980), believed that the body and brain have the same purposefulness. Damasio, however, spent 30 years in a clinical environment studying the human brain of patients using the fMRI imaging technologies. For this reason, Damasio proposed that the broad view of an embodied mind has merit but the mega-complex structure and design of the intricate mechanisms of the interactions of the cortical structures and sensory messaging must be known in a more thorough and precise manner to provide rigor to that understanding. Damasio discovered an evolutionary perceptive:

In effect, I am now convinced that talking merely about the body to brain communication misses the point. Although part of the signaling from body to brain results in a straight forward mapping (for example, the mapping of the position of a limb in space) a substantial part of the signaling is first *treated* by subcortical nuclei, within the spinal cord and especially in the brain stem which should not be conceived of as a way station for body signals enroute to the cerebral cortex. (Damasio, 2012, p. 99)

He developed a superior explanation of the differences between exteroception and proprioception on the mapping of touch, pressure, and skeletal movement, and interoception “the mapping of the visceral and internal milieu” (Damasio, 2012, p. 346). Interoception is the process by which crucial brain stem nuclei conduct homeostasis (life regulations). The brain stem should not be considered as a channel by which signals are processed from body to brain or inversely. Damasio claimed that it is the cortical structures within the brain stem such as the nucleus tractus solitarius (NTS) and the parabrachial nucleus (PBN) that are nuclei that correspond to the topographic arrangement of the cerebral cortex and they respond to body signals. Damasio also claimed that in the process of life regulation these networks of nuclei give rise to neural states of feelings. A few prominent scientists have studied the involvement of the superior colliculi (SC) implicated in visuospatial behavior in the development of consciousness (Damasio, 2012; Merker, 2007; Panksepp, 1998; Strehler, 1991).

The assembly of the SC is in seven layers. The first three are the superficial layers and have to do with vision as from a retinotopic map of the contralateral visual field (coordinated with the opposite side, a stereopsis 3-dimensional perception). The deeper layers of the SC contain the visual map (as ipsilateral field coordinated with the same side, a planar 2-dimensional perception), topographical maps of auditory, and somatic information (Brecht et al., 1999, 2001; Damasio, 2012). Damasio elucidated the relationships further by noting that the visual, auditory, and somatic maps are in spatial register. He identified that there is no other area in the brain where information is so highly integrated and efficient. This arrangement is further significant because it has

access to the motor system. The strong connections from the colliculi to the regions that control movement guides the effective action. Damasio proposed that the superior colliculi generate images that are the beginnings of mind and self (Damasio, 2012).

I must add one last fact to the evidence in favor of promoting the superior colliculi to mind-contributing status. The superior colliculus produces electrical oscillations in the gamma range, a phenomenon that has been linked to synchronic activation of neurons and that has been proposed by the neurophysiologist Wolf Singer to be a correlate of coherent perception, possibly even of consciousness. To date, the superior colliculus is the only brain region outside the cerebral cortex known to exhibit gamma-range oscillations. (Damasio, 2012, p. 91)

Of crucial interest to this study is the analysis given by Damasio (2012) of the necessity of invariance (remaining unchanged regardless of changes in the conditions of measurement) of this interoceptive brain stem system. He stated that the interoception signals indicate the need for physiological connections, such as hunger and thirst, which materializes in the mind for temperature and a “host of parameters that coordinate in the internal milieu,” as well these signals participate in the making of hedonic states and the in-parallel feelings of pleasure (i.e., biological value) (p. 202).

Additionally, Damasio (2012) referred to a subset of these signals that are assembled and altered in the brain stem nuclei as the source of the generation of primordial feelings. He concluded that the brain stem is a “decision station” (p. 202) and that the primordial feelings are a byproduct of how the brain stem nuclei arrange with “an unbreakable connection with the body” (p. 203). Damasio furthered

The primordial feelings precede all other feelings. They refer specially and uniquely to the living body that is interconnected with its specific brain stem. ... The importance of the interoceptive system for the understanding of the conscious mind cannot be emphasized enough. (Damasio, 2012, p. 203)

He claimed that it is of utmost importance to establish the relative invariance of the interoceptive system because “the self is a singular process and we must identify a plausible biological means to ground the singularity” (p. 205). Damasio also said that this singularity would align with the area of the body that changes the least or not at all over time.

Moreover, Damasio claimed that from multiple entry points, neural, and chemical signals on numerous levels from the spinal cord, the trigeminal nucleus in the brain stem, and the special collections of neurons near the margins of the ventricles that the signals relay to the integrative nuclei in the brain stem. The signals are complete with the attached primordial feelings and relay to the insular cortex (Augustine, 1996; Dupont et al., 2003; Critchley, Wiens, Rotshtein, Ohman, & Dolan, 2004; Mesulam & Mufson, 1982, 1985). The insular cortex is the “foundation for the development of the self-process” (Damasio, 2012, p. 207).

Further evidence from numerous neuroaesthetics studies of brain network activation using fMRI imaging indicated a positive emotional response from the insular cortex (Craig, 2009; Critchley, 2005, 2009; Di Dio et al., 2007). The results of the research documented that the response was most noticeable when participants were spontaneously observing the images (Di Dio et al., 2011). In 2009, Cupchik, Vartanian, Crawley, and Mikulis researched fMRI imaging techniques where participants observed numerous categories of paintings under the “esthetic vs. baseline condition (viewing the paintings accompanied by no explicit task-related instructions) and elicited bilateral activation of the insular, suggesting this area is crucially implicated in the hedonic feeling

associated with aesthetic experience” (Cupchik et al., 2009, p. 2). The parameter used in these studies in reference to the visual stimuli were canonical known to follow the proportionality of HR-RT. Additional research on the DEMR concept is an ongoing interest in the sciences.

Jerry Waite and Garth Oliver (2006) published the article “Viewing Distance as a Variable in Discerning Grayscale Halftone Dots at Varying Screen Frequencies” in the *Journal of Industrial Technology*. The researchers found that “although decisions about most of these variables are mathematically based, some depend upon the end-use of the product and/or aesthetic considerations. One end-use concern is the distance between viewer and printed product” (p. 2). They further stated, “Although the printing industry has traditionally employed rules-of thumb regarding this variable [the viewing distance], no empirically based study to relate viewing distance to halftone screen frequency (LPI) was found” (p. 2). The authors proposed a more conservative approach to the midrange distances. Their observations of the viewing distance and image reproduction procedures included the following:

1. LPI is complex and based on multiple aesthetic and mathematical considerations.
2. Viewing distance has traditionally been a seldom-considered end-use requirement.
3. Screen frequency decreases as viewing distance increases and conversely it increases as viewing distance decreases.
4. Only two factors affecting the choice of LPI are not predetermined. Those are aesthetics and viewing distance.

Further research is suggested by the authors on the phenomenon of the relationship of aesthetics and viewing distance to end-user perception (Waite & Oliver, 2006).

A chart organizing the various research designs on the factors of symmetry as a formal variable, sensory motor execution and perception, semantics, proportional gauging, and emotion (as a biological value) reveal a major distinction in the investigative approaches. There is a fundamental difference in research designs that test for the numerous factors involved in neuroaesthetics aspects in the making of artworks. That difference is whether the relationship, intended by the artist as a communication with the viewer, is accounted for in the research design.

To answer how the perception of artwork occurs via neural correlates, it is crucial to recognize that there is a sensory and cortical connection between artist and viewer on a range of factors. If, the research analysis is set up to account for just the viewer's response to the factors, then only a portion of the associations involved in the participants' responses can be known. Also, prior research results in neuroaesthetics have shown that naïve participants prefer images based on the HR-RT construct (Ferg et al., 2011; Hekkert, Peper & van Wieringen, 1994). Therefore, there is a strong possibility that HR-RT is a confounding factor in the current studies that are using representational artworks without accounting for the underlying symmetry and asymmetry core features in the compositional intent of the artists. No studies of the related research have analyzed only the artists' responses to the test parameters.

<u>Neuroaesthetics research designs: Biological properties and</u>	<u>Researchers</u>	<u>Description of psychophysics factors</u>	<u>Experienced by</u>



<u>behavioral investigative differences</u>			
Sensory motor- perception of artwork image	Chatterjee & Vartanian, 2014	Perceiving image information about inferred action, which activates mirror neurons in the viewer. Focus on the perception of the image in artwork not the execution of the action.	Artist and viewer, however, the perception of the viewer may be different than what the artist intended.
Sensory motor – action and distance viewing	Bouleau, 1963  Baxandall, 1972  Eisner, 2002  Waite & Oliver, 2006	Action of proportional gauging is a conjoined experience between artist and viewer. The perception of HR-RT is received as a pleasing emotion because the artist and viewer used the same process.  Viewing distance of image involves end- user.	Artist and viewer use same process to receive intended messaging. Information is transmitted as the artist intended.  No known standards for aesthetic judgments.
Emotion- internal component	Locher & Nodine, 1973, 1989  Chatterjee & Vartanian, 2014  Cupchik, 1995 Cupchik et al., 2009	Part of visual exploration (Locher & Nodine); part of our rewards system as shown by nMRI and MEG studies (Chatterjee & Vartanian); An internally oriented component; Affective covariance and emotional elaboration	Viewer participates alone in the visual exploration.  How the artist intended the perception of the art is not considered.
Emotion- biological value, proportional gauging, semantics and HR-RT integral in artwork compositions	Bouleau, 1963  Baxandall, 1972  Damasio, 2012	The artist uses HR-RT with the action of proportional gauging and aesthetic appeal perception in the artwork composition to transmit their experience to the viewer. This is an inherent human expression.  Neural correlate, the insula, is proposed as the location of the master interoceptive invariant process that includes emotions and	Artist and viewer participate in the same emotional experience of the artwork.  Thus, ideation initially occurs to the singular self. This expression carries a pleasingsness affect.

		sets up the singularity of the consciousness.	
<p>Meaning-knowledge of neural correlates, memory retrieval</p> <p>Semantics preference of artwork genre</p>	<p>Chatterjee, 2014</p> <p>Cupchik, 1995</p> <p>Wang, Cant, &amp; Cupchik, 2016</p> <p>Moore &amp; West, 2012</p>	<p>The insula is involved in the autonomic nervous system and experience of emotions. Two neural models: one for aesthetics and one for cognitive processing. No evidence found for a relationship of elementary visual features and memory retrieval.</p> <p>Two classes of artistic genre are used to determine viewer preference. No consideration of the artists' compositional intention, such as, HR-RT geometric design.</p>	<p>Viewer demonstrates affective responses to fundamental visual features but no correlation to memory retrieval of objects shown in artworks.</p> <p>Viewers shown representational artworks for preference judgment yet there is no connection to actual intention of artist in the making of the specific artworks.</p>
<p>Comparative reasoning-spatial sequential memory</p>	<p>Gardner, 1983</p> <p>Baxandall, 1972</p> <p>Damasio, 2012</p>	<p>Visuospatial and bodily kinetic aptitudes provide experiential memory of comparative actions.</p> <p>The making of artwork compositions involves the foundational visual features that elicit a pleasing response that is experienced by both the artist and viewer.</p> <p>Increased sensory messaging controlled by the insula facilitates the conjoined aesthetics and cognitive processing, such as, the occurrence to the self of ideas.</p> <p>The processing of sensory information in the superior and inferior colliculi assist in a somatosensory cognition of the spatial location of images portrayed in artworks.</p>	<p>Artist and viewer experience the artwork in the same manner because of the use of HR-RT with the action of proportional gauging. The viewer executes their spatial sequencing memory aligned to their own bodily kinetic actions to process the artists' intentionality of how the artwork image is composed. In addition, the viewer perceives the semantics and uses the perception of their episodic memory to connect to the image.</p>

Symmetry as a core feature;	Locher & Nodine, 1973  Hasse & Weber, 2012	Vertical and horizontal axes; static and dynamic symmetry; represents an organizing code	Experienced by both artist and viewer and can be assessed separately but is the same construct experienced by both artists and viewer.
HR-RT is a type of symmetry	Ferg et al., 2011	The perception and use of HR-RT is a core symmetry feature and a function of an aesthetic art principle.	Experienced by both artist and viewer and can be assessed separately but is the same construct experienced by both artists and viewer.

*Table 1.* Overview of selected research designs in neuroaesthetics

The seven Master artists’ representational paintings from the Quattrocento (the early Renaissance period) are of the realist art genre and the compositions are precisely the HR-RT construct (Baxandall, 1972; Bouleau, 1963). Based on the premise from Marcos Nadal that “though at present we can only assume that neural networks related with object recognition contribute differently to the aesthetic appreciation of abstract and representational visual stimuli” (Nadal et al., 2007, p. 387) further clarification is needed in understanding the use of the genre of representational artworks for aesthetics research.

During the Quattrocento, it was the commercial, educated, and noble classes of people in the state of Florence that had influenced the creation of the artworks and the use of the Merchants’ Rule of Three including the proportional gauging ability using the HR-RT concept in the harmonic ratio geometric patterns (Baxandall, 1988). There was a strong aesthetic and cognitive connection between the artists and the viewers because of the HR-RT construct (Baxandall, 1988). The citizens of Florence engaged with the artists to create the type of the art they wanted to see (Baxandall, 1988).

The seven Master artists consciously used the concept of a complex matrix of geometric patterns known as ratios of consonance in other words harmonic ratios (Bouleau, 1963) to create and ensure the acceptance of the art by their art patrons. This venue of artistic work was a unique phenomenon of the Quattrocento as the art patrons themselves were adept at the motoric action of proportional gauging (the physical process related to the proprioceptive sense) and aesthetic appeal perception. In the making of the paintings, the Master artists used these abilities to gauge the relative positions of the objects, the respective positions of the viewers, and the meanings of the artwork compositions to create a recognizable experience for the art patrons. This aesthetic process transfers experientially via visuospatial and bodily kinetic aptitudes, from artist to viewer.

## **Summary of Chapter Two**

The goal of this chapter was to find the manner in which the laws of aesthetics, art principles, and fundamental features of symmetry perception aligned with artists' processes in the making of painting compositions and conjoin with viewers' experiences. To help provide context for the research in this dissertation, these studies suggest further research is required in the field of neuroaesthetics. Thus, what this dissertation offers is of possible significance to this field through the analysis of the archival artworks by the JLDF art students in Mexico City D.F., Mexico.

The study of the JLDF art students' artworks is similar to other case studies that have observed the artistic actions of persons with Alzheimer's, FTD, or brain damage (Chatterjee, 2014; Viskontas & Lee, 2015; Viskontas & Miller, 2013). Interpretations can

be made of the JLDF art students' use of unique visual language, their ability to render, and their expressive intent in the artworks (Chatterjee, 2014; Chatterjee & Vartanian, 2014). Proposed criteria for analyzing the artworks is to assess the use of symmetry and whether the forms are static or dynamic. Also, the use of vertical, horizontal, and oblique axes with a midline to the left or right of the center (Locher & Nodine, 1973, 1989).

Observations were made of the spatial location of the objects in the images questioning if the rendering is indicative of a constructivist or analytic approach (Lajoie, 2003). Investigation of the motor sensory execution and perception occurred by watching the students make the artwork. Whether the art students used proportional gauging in the making of the art was observed during the research. The art students' artworks can be analyzed for the use of HR-RT proportionality (Ferg et al., 2011) as well as questioning whether the perception of the elementary core features is possibly connected to the use of mirror neurons (Chatterjee & Vartanian, 2014) to further develop a sensory and cognitive model (Wang, Cant, & Cupchik, 2016). Discussion on the subjects of affective covariance (Wang et al., 2016) provides possible support for the purpose of determining if the insula is the origin of the self-process (Damasio, 2012) for the manifestation of ideation. The effectiveness of the artists in transferring their intentionality of the artwork to the viewer for a conjoined emotional and physical experience provides evidence of proportional gauging and bodily kinetic abilities (Baxandall, 1988; Bouleau, 1963; Gardner, 1983).

## CHAPTER THREE

### **Methodology**

#### **Introduction and Overview**

This dissertation research is the social science methodology of a descriptive case study. The case study included a collection of archival artworks created by adult art students (a convenience sample), who are persons with Down syndrome. This was a quantitative and qualitative investigation of a psychophysics phenomenon of preference related to a type of symmetry. The unit of analysis for this investigation was HR-RT. There are six sources for the data collection.

The history of JLDF introduces the context within which the art students created their artworks. The demographics from the student profiles provide additional information on the multiple factors of the environmental and artistic procedures in other words where the art students made their artworks. Some of the artworks made by the participants for the study are from the book *Mexican School of Down Art* (2010) and others are from the art show catalogs from JLDF records.

Dr. Karen Riley, Dean of the Morgridge School of Education and associate professor at the University of Denver, with a dual faculty appointment in the Child,

Family, and School Psychology program and the department of Teaching and Learning, established three criteria for the art student participants who were then included in the study. A second group of seven paintings created by seven Master artists from the historical context of the Quattrocento (c. 1400-1500) and the city-state of Florence demonstrate the use of HR-RT in painting compositions. The art patrons in Florence were responsible for the making of the paintings. The Master artists followed the requests of their patrons to use the religious iconography and the underlying geometric construct of HR-RT in the painting compositions.

The HR-RT symmetry is a series of geometric concatenations based on the division of extreme and mean ratio (DEMR) and the root 2 rectangle with the division of three. These mathematical constructs are attributed to a pleasing affect and demonstrate an incommensurable property (Baxandall, 1988; Bouleau, 1963; Colman, 2003; Devlin, 1994; Di Dio et al., 2003, 2007; Fechner, 1865; Ferg et al., 2011; Green, 1995; Hambridge, 1967; Huntley, 1970; Schiralli, 2006).

### **Qualitative Research Strategy**

The aim of an exploratory and descriptive case study is to document a phenomenon within its context, to use a diverse set of data, to include detailed documentation, to examine archival records, to conduct interviews, to do direct and participant observation, and to collect physical artifacts. The information in this chapter reviews the participation of the art students, who have certain characteristics and direct experience relevant to the phenomenon of interest, which provides the opportunity to observe the properties of HR-RT that influence their behavior.

Social processes and behavioral phenomenon are complex and qualitative research allows a focus on the context and details of the unit of analysis to elucidate a unique description of the phenomenon. Qualitative research aligns toward discovery of the phenomenon (Creswell, 2013; Wolcott, 2009). The qualitative research design is not specified prior to the fieldwork. The process of the multiple source collection of data brings forth the understandings of the phenomenon. A detailed description of the two artist groups is crucial in setting the context of who the artists are, what they chose to create, and how they demonstrated ideation in the artworks. A description of the weeklong investigative research at the JLDF School gives the supplementary dimension of the art students' context of activities, which relates to artistic processes (See Appendix D). The accumulation of the large amount of information (data) is a requisite of the case study design and this was possible because of the research in Mexico.

This strategy allowed the researcher to induce meaning from the data and evolve the understandings to support known and novel findings of HR-RT construct such as the use of the independent IRR ratings and the computer coding of the construct for statistical analysis. The investigation of HR-RT via the making of artwork compositions, a visuospatial and bodily kinetic aptitude, is one possible process in the description of the behavioral phenomenon. The questions of “what” and “how” are addressed in the following manner: What is the HR-RT construct? How is HR-RT used in artwork composition?

Qualitative research requires fieldwork, which was the direct personal contact with the art students of JLDF, the participants who demonstrated the HR-RT symmetry



within the context of their natural setting. In qualitative research, the researcher controls and moderates the collection of the data. In this study, the researcher collected data from the school archival records, interviewed the art teachers, observed the art students in the process of making their artworks, held conversations with students, applied IRR ratings and examined the physical artifacts, including the artworks in visual, textual and computer formats.

The measurement of the use of the HR-RT construct in the artwork compositions is a way of understanding the processing used in sensory messaging systems. It is necessary to identify themes or patterns that come from an interpretation of the multiple data. Qualitative analysis provides for the variable interpretations that are required to describe the unit of analysis.

The qualitative research approach is inductive. The focus of this work is on exploration and discovery. There is no assumption of generalizability of the findings from the small number of participants. There is no predictive power of the conceptual model. There was no treatment given to the artist groups. The artworks analyzed had already happened and are observational artifacts. The intentionality of the researcher in this investigation was to design an inductive analysis with a geometric measurement to assess the use of the HR-RT artistic principle in the artwork compositions of the two artist groups. The art students used proportional gauging in the making of their artwork. The researcher observed this by direct observation of the art students in their environment. This investigation documents the relationship of visuospatial and bodily kinetic aptitudes to the HR-RT construct for support of the MI Theory.

## **A Case Study**

The development of the evidence of a construct is the qualitative methodological design using a revelatory case study (Yin, 1984). The case study approach “as an empirical inquiry that investigates a contemporary construct within its real-life context; when the boundaries between the phenomenon and context are not clearly evident and in which multiple sources of evidence are used” (p. 23). Yin further proposed that a case study provides a unique manner of describing a natural phenomenon revealed via data analysis. The purpose is to investigate at a micro level a small geographical area or a small number of subjects in detail. This approach gives validity to the empirical understanding of the action of participant activities, the selections made for the artwork compositional arrangements and the ideas generated by the integrated processes (Yin, 2014).

There are three types of case studies as defined by Stake (1994). They are the intrinsic, the instrumental, and the collective (Stake, 1994, p. 237). This study is intrinsic: the research goal is to explore and describe a collection of archival artworks for the use of a specific mathematics construct, HR-RT, to gain a better understanding of it. The study is also instrumental in that the procedure for measuring the HR-RT construct may be useful for researchers in the field of neuroaesthetics. The comparative analysis of the two groups, using a quantized measurement, provides additional knowledge with which to study the relationship of the explicit use of HR-RT within the Master artists’ works, and the implicit use of the HR-RT principle within the artworks by the art students.

The reliability of the image measurements was a corroboration of the existing historical descriptions of the Master artist compositions (how they did it) and the three independent ratings of the images from the researcher and both IRR raters. In addition, the analysis using the Python package, Pandas, to assess the quantized levels of HR-RT used by the art students in their images gives further insight into the significance of similarities or differences of these artworks on the use of the construct.

### **Independent Inter-rater Reliability (IRR) Assessments**

There are limitations to the approach of a case study in terms of the generalizability of any statistical analysis. The IRR procedure is an appropriate analysis to counter balance researcher interpretation and provide increased validity of the measurement for identifying the HR-RT art principle within the painting compositions. The goal is to draw conclusions for the single unit of analysis, HR-RT, even though this study is one instance of a description. This is because the conclusions can be developed using other related sources such as the use of computer algorithms to establish from a large database of responses more consistency of the HR-RT parameter in the process to identify artwork compositions. The independent inter-rater reliability (IRR) ratings of the images on the HR-RT principle of the unit of analysis can reduce the uncertainty of researcher selection and increase the reliability of the study findings. The results of the two independent IRR assessments are in Chapter 4.

### **Unit of Analysis HR-RT**

In Chapter One, the initial stages of the research introduced a theoretical framework of the MI aptitudes, visuospatial, and bodily kinetic. A case study must have

established boundaries or what is part of the case. Stake (1994) claimed that to bound the case means to conceptualize the object of the study. In this investigation, HR-RT is the object of study under the MI Theory.

This MI framework reflects the researcher's previous experiences, teaching, and publications in the arts, mathematics, and the sciences. The prior work of creating new mathematics and further describing HR-RT orients the researcher to be "sensitized" (Patton, 1990, p. 216) toward a continuing framework of discovery. In the beginning of this investigation, there was no setting of limits or exclusions on the findings from the data collection and subsequently the data analysis.

The evolution of the understanding of the HR-RT concept is an attempt to represent the unit of analysis within the framework of MI Theory. This gives descriptive power to the MI model. This study represents preliminary groundwork for future research on visuospatial abilities and spatial sequencing memory involving HR-RT and the making of two-dimensional artworks.

### **The Study Design**

This investigation is the analysis of the collection of archival artworks to interpret the connections of visuospatial and bodily kinetic aptitudes in the making of art. The researcher of this study designed a method for the observation of the expression of HR-RT by way of an in-depth description of the unit of analysis. The use of the HR-RT art principle through the action of proportional gauging and spatial sequencing memory revealed the inherent human expression for the symmetry in the making of artwork compositions.

In this study, there are three phases of the case study of a convenience sample, (a) document the archival information about the two artist groups, (b) document the action of proportional gauging by the art students in the making of their artworks, and (c) report the findings of the comparisons to current and existing research of the two artist groups on the HR-RT construct. The study design is a systemic research investigation that aligns the study's goals, objectives and questions. The timeline of the study design is the chronological flow of the activities that initiated the study and the preliminary unit of analysis concept building through to the data collection of multiple sources and subsequent analysis.

**Preliminary activities.**

- A. Conducted extensive literature review of the concept of the use of HR-RT in artwork compositions.
- B. Reviewed research on the reports of key conclusions derived within the context of the MI theoretical model and neuroaesthetics.
- C. Developed a preliminary conceptual model from existing neuroaesthetics research and the use of the HR-RT measurement technique to identify the parameter of interest.
- D. Reviewed various methods of data collection for multiple source evidence in order to conduct data collection and analysis.
- E. Designed a consistent quantitative parameter for the visual image presentation and the application of the inter-rater reliability (IRR) assessment for the reliability of data.

F. Designed computer code of the data to set up data sets of the image analyses for future research.

### **Sources and Collection of Data**

The multiple techniques are listed in chronological order:

- Demographics of the participants to create a profile from the archival records.
- Published information on JLDF and the art show catalogs.
- Interviews conducted with the participants in the art studio.
- Interviews conducted with the art teachers in the art studio.
- Observations of the art students and teachers working in the classrooms.
- Acquisition of the physical artifacts, the authority to photocopy the 161 images made by the 21 student participants.

The researcher anticipated the excessive amount of data collected as this has both qualitative and quantitative aspects that are revelatory to the understanding of the phenomenon. “Every case should serve a specific purpose within the overall scope of inquiry. Here, a major insight is to consider multiple cases as one would consider multiple experiments—that is, to follow a ‘replication’ logic” (Yin, 1994, p. 45).

There were 161 art images and seven Master artists’ images. The analysis of each art image required a visual representation and geometric assessment in 2-dimensions, the length and height of the picture frame, for the use of HR-RT in the composition following the measurement key. These examinations exemplify the concept of replication logic.

## **Preparation for an International Study**

The research was an internationally approved investigation of the visuospatial ability of the art students at JLDF. The researcher took 33 Collaborative Institutional Training Initiative (CITI) assessments for Human Subjects Research, international research protocols and research involving persons with disabilities required by the University of Denver (DU) Internal Review Board (IRB) in order to conduct the research in Mexico City D.F. Mexico. Due to the extended wait for the official authorization to conduct the research, the researcher took Spanish language classes at DU and a course in Latin American cultural and history. In addition, the researcher took a course on the art history of the Quattrocento.

In 2010, the JLDF organization had published the historical record of the school in the book *Mexican School of Down Art*. The researcher had studied a copy of the book extensively prior to the visit to the school. All of these preparatory activities were invaluable to the researcher once arriving in Mexico. The research occurred from June 1, 2015 through June 5, 2015.

## **Mexican Art School**

An art school in Coyoacán, Mexico City D.F., Mexico called the Mexican School of Down Art is the primary source of the archival data. The art school is within the larger JLDF School. The Mexican School of Down Art is a talented group of adult student artists who have created artworks that today are well known throughout the world's communities. The success of the art students is noteworthy because this school is exclusively for students with Down syndrome. These student artwork compositions have

the HR-RT construct. A comparison with the master artists' artworks is important to order to find out if the use is similar for both groups, which would help to explain why the art students' works are so remarkable. The focus of this investigation is on the subject of the substantial cognitive disability of the JLDF art students and their use of the HR-RT symmetry and not primarily the condition of Down syndrome. The opportunity to analyze the artworks of the JLDF art students is unique, as these images have not been released for prior study. This is the first investigation of the artwork compositions of persons with Down syndrome for the use of the HR-RT artistic principle.

### **Criteria of Art Student Participation**

There have been numerous art students since 1994 who have taken the art classes at JLDF. There were three criteria used to determine which of the art students would be included in the study. The faculty advisor of the international research determined these conditions. The three criteria for determining the art student group of participants were the type of Down syndrome, the existence of medical and personal records, and the artworks published in the book *Mexican School of Down Art* (2010) or in the school's art show catalogs.

<u>Inclusionary Criteria</u>	<u>Exclusionary Criteria</u>
Trisomy 21 DS	Mosaic status; translocation status
Complete medical records	Lack of records
Artwork contained in book or art catalogs	Work not contained in book or art catalogs

*Table 2.* Criteria for Study Participants

The art students that the JLDF staff documented, which students were persons with Trisomy 21 (triplication of the 21<sup>st</sup> chromosome) they are the participants (see



Appendix D). Students with mosaicism (a combination of cells; some are typical and others have Trisomy 21) and translocation (partial trisomy cases, two chromosomes, the 14<sup>th</sup> and 21<sup>st</sup> chromosomes are rearranged so that some of the 14<sup>th</sup> chromosome is replaced by an extra 21<sup>st</sup> chromosome) or had no record of the type of Down syndrome were not accepted to reduce any bias of the condition in the study design. Twenty-one art students fit the criteria from the list of possible art students. Whether or not the 21 participants had visual issues was not a criterion because the researcher does not have a background in medical ophthalmology. The school staff generated profiles from archival records and provided student demographics and medical records of the visual history of the art students (see Appendix E).

The artworks of the art student participants were included in the study if the images had been published in the book about the school *Mexican School of Down Art* (2010) or in the art catalogs printed about the JLDF art shows. These publications are the only professional photographic records of the artworks. The art teachers and Professor García Escamilla made the decisions of which artworks would be included in the book and art catalogs. This selection made of artworks for the JLDF publication was in 2010. This book was one of the sources of the artworks by the art students. The images in the book about the Mexican art school were from the first group of art students at the JLDF art school. These artworks were examples of the most professional art demonstrations from the art students at the time. This is the established method for the publication of a historical artistic record (Bouleau, 1963).

Traditionally for the organization of artworks for art shows the overarching factor is the environment where art is displayed, as there are circumstances of size restrictions to be considered as well as the expense of shipping the artworks a long distance. The artworks, included in the art shows, are most likely the best examples of the work from each artist at the time.

### **Guided Interviews with Art Teachers**

Interviews conducted with the two JLDF art teachers provide further insight to the art students' education. The teachers have been the only art teachers since the start of the art school. There is a circumstance of teacher prior knowledge of the HR-RT artistic principle in terms of the instruction given to the students using the principle for compositional design. This is because both art teachers were trained at the "La Esmeralda" in Mexico City D.F., Mexico, which espouses this approach. This institution is considered the best school for artists in all of Mexico (Foundation John Langdon Down A.C., 2010). At the institute, the art teachers, Daniel and Alan, were taught the Quattrocento Master artists' use of the mathematical construct HR-RT (D. Perez & A. Planells, personal communication, June 4, 2015).

The three one-hour interviews with the art teachers were conducted after the end of the school day at 2:30 in the afternoon. The art teachers requested that they give the interviews together as they have spent 24 years co-teaching and developing the novel curriculum for the art students. The interviews were a general guided interview format. The researcher had prepared an outline of issues and questions that was loosely followed during the interviews. This structure allowed for flexible and unexpected discovery

during the interviews (Patton, 1990, 2015). The researcher followed the four intentions Patton advises when conducting case study interviews:

1. Acquire then and now information of the phenomenon.
2. Build the evidence of a previous event.
3. Estimation of future events.
4. Validate and coordinate the data from other sources (triangulation).

The goal of systemic research design is to avoid researcher selection bias in interpreting data. The interviews with the art teachers gathered information from the individuals directly involved and in their own work environment. The teachers' responses to the questions were recorded on video. During the interviews, which were recorded on video, Daniel and Alan explicitly stated that the art students were not mentally capable of understanding the artistic principles that included the HR-RT symmetry.

### **Observations of the JLDF Art Students and the Action of Proportional Gauging**

The researcher had direct experience with the JLDF art students in June of 2015 for one week during the regular school day from 8:00am - 2:30 pm. Observation was one of the techniques used for data collection. It was the active engagement with the art students in their natural setting at the art studio at JLDF. Of the 21 art students whose artworks were analyzed for the HR-RT construct, ten of the art students were not at the school during the week of research but eleven of the study participants were in the classroom at different times during the week. The researcher did not know the week spent at the school which of the art students and their artworks would be used in the analysis. This art school is the primary location where all the study participants made the artworks

that are the physical artifacts of the study. The technique of observation involves multiple dynamics for achieving effective use of the data collection:

- The researcher assesses the environment and culture directly.
- The researcher can observe the participant actions in their own environment.
- The process of induction is in the evolution of understanding the process of observation. (Creswell, 2007, 2013)

### **Informal Conversations with the Art Students**

Informal conversations conducted with the art students in the art classrooms were spontaneous. There were four videos of the conversations. They were primarily video recorded to observe the actions of the students while making their artworks. The purpose of this data collection source was for answering Research Question Three, which directs attention to the use or not of the action of proportional gauging. The video recordings were of the art students actively making their artworks. There were no direct questions during the impromptu conversations of the art students who were in the art studio during the two days of filming.

There was video of six of the art students whose artworks were included in the study. During the videos, some of the students did speak about the making of art. There was no preplanning of whom to film and when the opportunity presented itself, the art students would begin the impromptu conversations. The researcher was flexible in allowing the students to speak impulsively. Some of the art students spoke a little English. Most of the art students spoke Spanish with the translator. All of the art students

had given IRB informed consent through Prof. García Escamilla, who has legal authority to give informed consent for the art students (see Appendix F).

### **Researcher as Observer**

The researcher is an accomplished portrait artist and teacher, and as such, is able to recognize the goings-on of the activities between artists and art teachers in the art studios (see Appendix G). The role of the researcher in observation is to observe the activities, the classroom events, and the actions of the art students' in relationship to the making of their artworks. Videos of the art students in the studio were made of the activities that related to proportional gauging and the making of artwork compositions. A record of the videos was archived on an external storage device. Field notes were made during the day of the studio activities. Yin states that a concern of observation is for the "potentiality of researcher bias" (1994, p. 89). The opportunity at JLDF was to be able to observe the art students and art teachers for a full five days. The observations had continued for an extended period of time, which reduced the occurrence of researcher bias. With consecutive days of observation, it is less likely that the behaviors, activities or responses by participants are observed only once.

### **Descriptions of the Master Artists' Paintings**

In Michael Baxandall's (1972) book, *Painting and Experience in Fifteenth Century*, he gives a theoretical argument for understanding that the style of the Quattrocento painters was a continuum of interwoven social and artistic histories that "gauged, preached, and danced the story" of the beginning of the Renaissance (Baxandall, 1988, p. 152). Each Master artist demonstrated the use of the HR-RT

principle using proportional gauging. The Master painting compositions are historical records of significant artifacts in relationship to a “period eye” theoretical analysis (Baxandall, 1988, p. 29). The period eye analytical technique can define the cultural environments from which the artworks evolved and were appreciated (Baxandall, 1988). There is significant historical evidence that the artists of the Quattrocento consistently used multiple-point linear perspective and HR-RT proportionality in their painting compositions to create art that communicated to the viewer multiple layers of religious life and Roman iconography (Baxandall, 1988; Bouleau, 1963; Cennini, 1960).

The artists in the masters’ group of painters are Masaccio, Fra Angelico, Benozzo Gozzoli, Piero della Francesca, Botticelli, Leonardo da Vinci, and Raphael. All of these artists trained in art guilds and workshops. They were maestros who worked with each other in some cases as collaborator, student, apprentice, or teacher. These seven artists consistently employed the HR-RT artistic principle for their painting compositions (Baxandall, 1988; Bouleau, 1963). The seven paintings chosen for the Master artists’ group demonstrate four of the harmonic ratio examples: each painting demonstrates a specific variation of the proportionality construct (see Appendix H). Each of these artworks are different yet exemplify the mature works of the Master paintings created in the Quattrocento. In all of the paintings, the linear perspective and HR-RT tend to overlap one another in the composition, which increased the artists’ intentionality to emphasize pleasingness and direct the viewers’ attention. This procedure enhanced the viewer’s experience of the preferred and expected geometric arrangement of pictorial elements (Baxandall, 1988; Bouleau, 1963).

The artists' actions were a deliberate orchestration of the composition to control the emotional space between the painting and the viewer. The process utilized the viewers' visuospatial sequencing memory because the viewer understood the artwork just as the artist intended based on their conjoined experiences.

A research method identified and measured the HR-RT mathematical construct. This procedure reduced the possibility of researcher selection bias in the analysis of the artwork compositions by following the implementation of the artistic principle, HR-RT. Artistic principles are the analysis of artwork compositions (Alberti, 2004; Baxandall, 1972; Bouleau, 1963; Cennini, 1960; Colman, 2003; Hambridge, 1920, Lanteri, 1985; Zöllner, 2011). This comparison is necessary to also determine the level at which HR-RT is demonstrated in the artwork compositions of the art students' artworks.

### **Development of a 5-step HR-RT Measurement**

Each Master artist painting demonstrates a variation of HR-RT, the ratios of consonance in the composition. The evidence of this phenomenon is part of the historical record and it is the reason the Master artists' paintings are included to verify the mathematical construct (Baxandall, 1972; Bouleau, 1963). The specific types are in Latin terms from the Quattrocento and the harmonic names. The types were the diapason, the octave, (ratio 1/2), diapente, the fifth, (ratio 2/3); diatessaron, the fourth from the octave and a fifth, (ratio 3/4); double diatessaron, from the fifth and the fourth (one example is a sesquiterce double with caesarus 9) (ratio, 9/12/16). There are two variations of the demonstrated harmonic ratios: double diapente, the double fifth, (ratio 4/6/9); the sesquiterce double, the sixth from the fourth (ratio 3/5). The Rule of Three (aka

Merchant's Key) concept (Baxandall, 1988) is designated as the 3/3 ratio (Alberti, 1435; Baxandall, 1988; Bouleau, 1963; Herter, 1966).

<u>Artist Name</u>	<u>Painting Title</u>	<u>Name of Harmonic ratio with Rule of Three (HR-RT)</u>	<u>Orientation of artwork (Vertical or horizontal)</u>	<u>Dimensions of the artwork (length and height) and ratio</u>
Masaccio	The Trinity	Diapente, 2/3, the fifth	Vertical	667cm / 317 = 0.475
Fra Angelico	The Annunciation	Diapason double, 1/2 harmonic subdivision of square root of 2 rectangle	Horizontal	230cm/ 321cm = 0.7165
Benozzo Gozzoli	Procession of the Magi: The Youngest King, on the east wall	2/3/4 harmonic division of octave 1/2, into the fifth 2/3 and the fourth 3/4, diatessaron	Horizontal Implied movement	405cm/ 516cm = 0.7848
Piero della Francesca	Madonna and Child with Saints	Diapente 2/3 divided horizontally and vertically, progression of triangles	Vertical Outward gaze of angles	248cm/ 150cm = 0.6048
Botticelli	Birth of Venus	9/12/16 diatessaron double	Horizontal Implied movement	172.5/ 278.5 = 0.619
Leonardo da Vinci	Last Supper	Diapason 1/2, double square into progression of squares	Horizontal	460cm/880cm = 0.522



Raphael	Lady Viceroy of Naples	9/12/16 sloping axis of figure is the caesarus 9	Vertical	120cm/ 95cm = 0.791
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*Table 3.* Master artists' paintings with HR-RT descriptions, names, orientation and dimensions of the artworks (Baxandall, 1972; Bouleau, 1963).

An examination of the participants' painting compositions using a visually comparative process translates and compares the geometric information between the two artists' groups. One constant in the process was that every picture frame represented a quadrangle (a four-sided plane figure, a square or rectangle) (Tufte, 1997). The quadrangle shape was either in a horizontal or vertical orientation for the seven Master artists' works and for the 161 participants' artworks.

This novel research analysis of the Master artists' paintings and the art students' artworks is the restriction of the size of the art to the shape of quadrangles (specifically a rectangle or square) with two dimensions, the vertical and horizontal. Within the space of the frame of the rectangle or square, the description of the main subject matter, whether by spacing, alignment or ideation of the composition identified and measured the 5-step procedure and a unique accuracy score assessed each image, which determined five quantized levels. This measurement procedure was consistent for the seven Master artists' paintings and the 161 art students' artworks. The visual comparison between the two groups was the unique record per image of compositional lines.

A 5-step procedure documents the artwork compositions whether by line, spacing or ideation. The researcher followed traditional artistic principles for art composition (see Appendix G) to identify the lines of the composition. The goal of the 5-step measurement

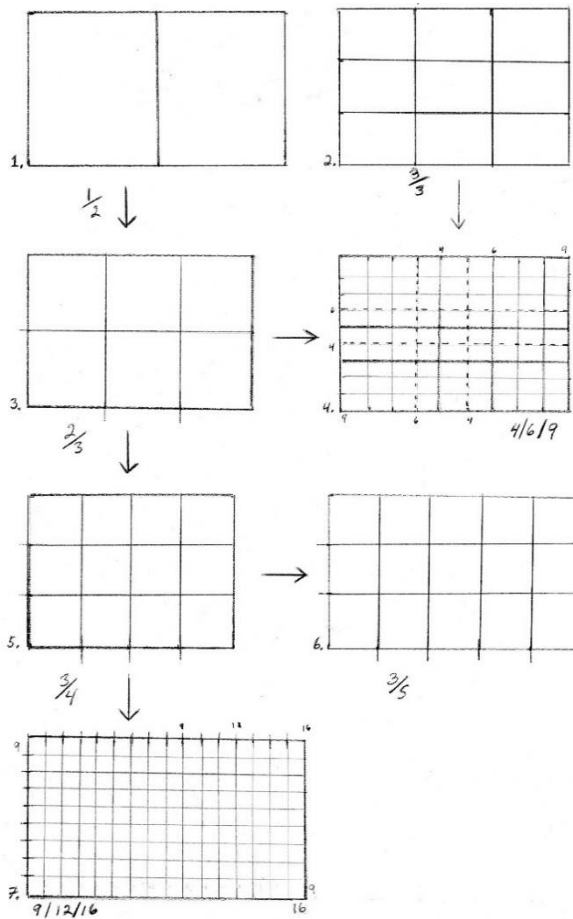
procedure is to translate the artistic compositional elements of the 2 and 3-dimensional artwork compositions into a quantized numeric value. Each of the artworks of the Master artists and the 21 art student participants is a unique composition. The resulting description of a horizontal and vertical geometric grid of lines is specific to each artwork.

The space within the quadrangle shape divides into specific geometric measurements for a harmonic ratio. The  $1/2$ , the octave interval, divides the space into two equal shapes and the two shapes are square or rectangular within the picture frame dimensions (horizontal or vertical). The  $3/3$  is an example of the Rule of Three. The concept divides the space into three equal shapes and the three shapes are square or rectangular within the picture frame dimensions (horizontal or vertical). The  $2/3$ , the fifth interval, divides the space from the two frame dimensions in half in one direction and in thirds for the other direction. The  $3/4$  ratio interval, the fourth, is the combination of the octave and the fifth and the space is divided by thirds in one direction of the frame dimensions and by fourths in the other (Baxandall, 1988; Bouleau, 1963).

There are seven examples of HR-RT identified for the analysis. Four of the examples #1, #3, #5, and #7 are fundamental harmonic ratios demonstrated in the Master artist paintings. Example #4 is the  $4/6/9$  ratio. The  $4/6/9$  consonant is a variation of the  $2/3$  ratio. The  $4/6/9$  ratio, the double fifth interval, is the  $2/3$  ratio doubled and extended in both directions of 9 spaces. When the major composition elements align to the 4<sup>th</sup> and 6<sup>th</sup> lines in both dimensions, this spatial patterning results in a specific alignment of the  $4/6/9$  spacing. The  $3/3$  art principle, Rule of Three, can, therefore, be found imbedded

within the 4/6/9 ratio. The 3<sup>rd</sup> and 6<sup>th</sup> divisions both vertically and horizontally are the same lines as the 3/3 ratio (Baxandall, 1988; Bouleau, 1963).

Example #6 is the 3/5 ratio and is a variation of the #5 consonant, the 3/4 ratio. The 3/5 ratio is the sixth interval, an extended fourth interval with a division of the frame dimensions in thirds in one direction and in fifths in the other direction. The 9/12/16 ratio is the combination of the fifth and the fourth (Baxandall, 1988; Bouleau, 1963). The horizontal and vertical frame dimensions divide by 9, 12 or 16 spaces in one direction and 9, 12, 16 spaces in the other direction. The caesarus 9 is a specific geometric alignment for the composition of the portrait (Bouleau, 1963). For example, at the top of the picture frame at space 9 with 12 spaces across the top and bottom of the picture frame is the position of the center of the face of the portrait. The 16 spaces are on the left and right sides of the picture frame.



*Figure 2.* Harmonic ratio examples and Rule of Three, HR-RT, principle 1. The  $1/2$ , the octave (diapason); 2. The  $3/3$ , Rule of Three; 3. The  $2/3$ , the fifth (diapente); 4. The  $4/6/9$ , the double fifth (double diapente); 5. The  $3/4$ , the fourth from the octave and the fifth (diatessarou); 6. The  $3/5$ , the sixth (from the fourth); 7. The  $9/12/16$ , from the fifth and the fourth (a double diatessarou) (Baxandall, 1988; Bouleau, 1963).

Each of the art students' artworks is a unique composition. The same procedure for each image examines where the artist placed and related the subject matter of the artwork. This same process determines the geometric compositions of the Masters' paintings. The underlying geometric compositions describe the main subject matter whether by spacing,

alignment or ideation based on the fundamentals of the elements and principles of art. This process produces a geometric grid of lines that delineates the underlying composition. Consequently, the grid of lines is unique per each image, and the arrangement of the lines in the space of the picture frame of the artwork follows the artist's intentional ideation.

A key for a geometric grid overlay of the use of the HR-RT construct translates the spatial location of each composition line into a numeric value of the ratio relationship. The vertical or horizontal orientation and geometric division of this location of the line within the space of the picture frame describes the key designation. The various geometric divisions of the key are a color-coded set of lines per each image, which facilitate the overall image composition description. The accuracy of the set of lines per each image provides a relative distance from the lines of the HR-RT construct examples (Baxandall, 1988; Bouleau, 1963). A quantized value provides each image with a strong, moderate, low, inconsistent and not found categorization of the use of HR-RT.

There are five steps for the measurement procedure. The HR-RT construct aligns to each image per the dimensions of the picture plane. The geometric lines generated from steps 2 to 5 are color-coded to distinguish the delineations.

1. Measure the horizontal and vertical dimensions of the picture frame and the ratio relationship.
2. Measure the two dimensions for the half, quarters, eighths, twelfths or sixteenths divisions within the space of the picture frame if the lines describe the main

subject matter whether by spacing, alignment or ideation. The lines are color coded black.

3. Measure the two dimensions for the thirds, sixths or ninths divisions within the space of the picture frame if the lines describe the main subject matter whether by spacing, alignment or ideation. The lines are color coded yellow.
4. Measure the two dimensions for the fifths divisions within the space of the picture frame if the lines describe the main subject matter whether by spacing, alignment or ideation. The lines are color coded red.
5. Measure the two dimensions for the precise DEMR divisions (this is the frame ratio, FR, measuring the length and height times the numeric value 0.6183 (resulting in two values per dimension) within the space of the picture frame if the lines describe the main subject matter whether by spacing, alignment or ideation (Baxandall, 1988; Bouleau, 1963). The lines are color coded green.

The 5-step measurement procedure examines the composition of the participants' artworks. If the line measurement describes the subject matter whether by spacing, alignment or ideation, then it is a delineation of the composition. If the line does not describe the subject matter by spacing, alignment or ideation, then it is not a delineation of the composition. Artistic principles of design determine the composition (Baxandall, 1988; Bouleau, 1963).

The researcher followed the established artistic principles (Alberti, 2004; Baxandall, 1988; Bouleau, 1963; Cennini, 1960; Coleman, 2003; Hambridge, 1967; Herter, 1966; Huntley, 1970, Lanteri, 1985; Zöllner, 2011) to determine if an element of

the image by spacing, alignment or ideation was an indicated compositional line (see Appendix I). This measurement procedure allowed for a comparison to the existing historical information on the seven Master artists' paintings compositions and it shows a precise alignment of the 5-step procedure to existing assessments for the Master artist paintings. It is the same information but a different methodology.

The Photo Shop Creative Suite 6 application process documented a visual record of each Master artist and art student composition. The visual information was stored in multiple layers for the descriptive geometric grid lines. The resulting unique set of lines of the composition indicates the intention with which the artist had composed the artwork. The distinct HR-RT relationships are fundamentally a geometric measurement. The explanation of the set of lines that perceptually reads the composition of the artwork is in the measurement key.

Three questions guided the rationale for the development of the examination and the levels of accuracy of strong, moderate, low, inconsistent, and not found of the images for the compositional assessment. First, did the geometric grid delineate the key HR-RT compositional elements? Second, are there multiple examples of HR-RT described in the image that reinforce the composition, and is the use of the frame ratio, FR, supportive of the harmonic ratio(s)? Third, how accurately are the compositional lines relating to the 5-step measurement grid lines? The lines of the artwork compositions measure to the standardizing procedure to assess the accuracy of the spacing, alignment or ideation of the image.

A strong representation was the distance of within 0-3 millimeters (this is a score between and included the values of 2.1-3) of the grid lines that indicated the spacing, alignment or ideation of the image. A moderate representation was the distance of within 3.1-5 millimeters (this is a score between and included the values of a score of 1.1-2) of the grid lines that indicated the spacing, alignment or ideation of the image. A low representation was the distance of greater than 5.1 millimeters off the linear placement (this is a score between and included the values of a score of 1 or less) of the grid lines that indicated the spacing, alignment or ideation of the image. A rating of inconsistent was a compositional arrangement with grid lines that were inconsistent in the overall description of HR-RT. The not found (NF) category describes artwork that has no HR-RT relationship in the composition of the artwork. A key identifies the necessary geometric measurements of the vertical, horizontal and diagonal lines that describe the composition of the artwork (see Appendix J).

### **Summary of Data Collection**

The multiple data collection techniques provide sources of information and balance one another to achieve a greater validity of the findings of the study. The depth and breadth of the data collection develops a repository with which to answer the research questions. The data from Table 4 gives an account of the sources of the data and the use of each category of data. Initially the researcher started the data collection by reading documentary information on JLDF and the art students. The opportunity to spend a week on site at the school and personally meet the art students allowed the researcher to gain a deeper understanding of the participants, the teachers, and art studio environment.



For example, the researcher came away from the experience with a greater understanding of the art students' artistic capacities.

<u>Data Source</u>	<u>Category of the Data</u>	<u>Function of the Data</u>	<u>Resolution of the Data</u>
1. Preliminary sources	Historical records of Quattrocento artists, publication of the JLDF history, Latin American culture and knowledge of the HR-RT construct	This information provided the researcher with sufficient background in the multiple facets of the study to proceed with the research.	Knowledge of the preliminary sources was instrumental in assisting the researcher to discover the connections between the MI aptitudes.
2. Documentary sources	Art students profiles, publication of the art student artworks in the JLDF book and art show catalogs.	This archival source was the information needed for the background of the art student participants' artifacts.	The three criteria of art student participants was verified by this source.
3. Guided Interviews of the art teachers	Video and textual data of the guided interviews on the confounding factor of teacher instruction of HR-RT record of novel curriculum	This information provided the direct art teacher interpretation and understanding of the issue of the HR-RT construct. The demonstration of the visuospatial curriculum.	This data source assisted in the processes of the identification of the components of the unit of analysis HR-RT.
4. Direct and Participant observations of the activities and lessons at the art school.  5. Impromptu conversations with art students	Video and textual data of the researchers' field notes, and the observations of the actions of the art students while making their art.  The interactions with the art students, with the art teachers, the other art students and with the researcher.	This information provided the researcher the direct interpretation and understanding of the issues of the environment of the art students' studio, the manner of the presentation of the curriculum of the teachers and the observations of the occurrence of proportional gauging in the	These data sources assisted in the development of the identification of the unit of analysis HR-RT and the connections to the MI theoretical model of visuospatial and bodily kinetic aptitudes.

		making of the artworks.	
6. Physical artifacts – the artworks	The record of the art made by the 21 art student participants from the JLDF publications of the <i>Mexican School of Down Art</i> and the art show catalogs.	This data source was the previously created 161 artworks of the 21 art student participants for the compositional analysis.	The compositional analysis of the participants' artworks assisted in collecting detailed descriptions of the use of the HR-RT construct for evidence of aesthetic appeal response.

Table 4. Data sources and the category, function and resolution of the use.

### Data Management and Strategies

A crucial theoretical construct of qualitative research is to focus on the evolving data collection. Casual experimental design is a control of preexisting variables and hypotheses. However, qualitative induction is to include a method to understand what has been determined by process. In this study, the answers to the research questions were the triangulation of the six sources of the data collection. The overarching conceptual model of MI Theory provides a “sensitizing framework” (Patton, 1990, p. 216) for the rationale of the data collection and review. MI Theory introduced the unit of analysis, HR-RT.

Patton explained that “... induction application of sensitizing concepts ... to examine how a particular concept is manifest in a particular setting and among a particular group of people” (1990, p. 390). In this case study, both the art students and the Master artists' groups required this process to ascertain if the mathematical patterns of HR-RT are in the artwork compositions. Additionally, the inquiry of Question 3 is whether the art students used the action of proportional gauging in the making of their artworks, which was something ascertained at the art school.

Knowledge of these occurrences is crucial for answering the research questions 1, 2, and 3. Once compiled, the record of the data collection is therefore the documentation of the information. This is a database of 322 pages in Photoshop Creative Suite 6 of a visual record of the artworks and 243 pages of textual descriptions of the artworks. The documentary sources of the book *Mexican School of Down Art*, 12 art show catalogs of the JLDF art student events, 126 pages of art student profile information obtained from the questionnaires, and 45 pages of Master artist painting descriptions both visual and textual. There were 20 hours of video recordings of the teachers, art students, and observations of the classroom activities during the week of the research and 150 pages of notes, guided questions, and artistic documentation from the videos. The research method of a case study induces the exploration and description of the unit of analysis, HR-RT, as it emerges from the MI Theoretical model.

### **Reliability of the Data Sources**

The case study method is vulnerable to criticism for the lack of rigor and the occurrences of researcher bias on the interpretation of the data. Yin (1984, 2014) found three types of arguments against case study research.

1. Case studies lack rigorous work as the data is not managed or organized systematically.
2. The researcher is biased in the interpretation of the data.
3. There can be no generalizability due to the small number of cases.

In order to address each of these criticisms, the researcher took appropriate steps to ensure the trustworthiness of the data. First, the database in this qualitative study is the

extensive systemic record of the images for both artists' groups. The Master artists' seven paintings were from multiple historical sources for the traditionally accepted analysis of the painting compositions to give validity to the novel 5-step measurement procedure. Each of the seven paintings has a visual representation and the textual description of the historical account of each Master artist and the specific painting composition (Baxandall, 1969; Bouleau, 1988). The seven Master artist paintings and the 161 art student artworks were visually recorded with the most current Photoshop Creative Suite 6 program.

A professional Photoshop artist worked with the researcher for five months to document the geometric examinations of all of the artwork images with the 5-step quantization procedure. The visual record is of a professional quality and is available for future research and analyses. This was the first time the artwork images were released by JLDF for a research project. Each of the Master artist paintings and the art student artworks has a textual description. This is a thorough and detailed record for a supplemental data source with the visual Photoshop record. There are 234 pages of textual documentation of the images. A detailed explanation of how this record was prepared is given in Chapter Four.

Reliability of the researcher's interpretation of the data examination is crucial in this case study. To decrease the likelihood of researcher selection bias in interpreting the painting compositions, the two procedures strengthened the reliability of the image analysis procedure. In essence, the study design was set up a priori to reduce researcher selection bias in assessing the artwork artifacts by employing a consistent quantitative parameter (Tufte, 1997) a rectangular or square to allow for the simplification of the

comparison of the visual information between the two groups. In addition, the 5-step measurement applies to the Master artists' paintings and the resulting scrutiny of the painting compositions accurately follows the accepted art historical analyses used for painting compositions.

Another strategy to decrease the occurrence of bias in interpreting the data for the study was to get two independent assessments on all of the 161 art student artworks. This procedure is the inter-rater reliability (IRR) for observational data. The appropriate statistic used in the analysis is Cohen's kappa to account for chance agreement (McHugh, 2012). The IRR demonstrates consistency between the researcher and an independent rater to provide a quantification of the degree of the agreement between the raters, "Well-designed research studies must therefore include procedures that measure agreement among the various data collectors" (McHugh, 2012, p. 277). The first independent rater provided a dichotomous response of yes or no (the answer to research question one) of whether or not the HR-RT art principle was the underlying structure of the painting compositions of the art students' artworks. The administrator of the assessment was Dr. Jill Fulkerson and the rater was Dr. Jen Lin Yin. Dr. Yin is a high school mathematics teacher at the Cherry Creek School District in Colorado. The HR-RT examples are simplistic and observable by a non-professional artist, and such as, Dr. Jen Lin Yin, the IRR rater. The second independent IRR rating was to address possible bias of the researcher in determining the lines of composition of the art student artworks. The administrator of the second assessment was Dr. Jill Fulkerson and the rater was Dawn McFadden (MA). Ms. McFadden is a professional illustrator, artist, and art teacher at

Metro State University and Community College of Denver. She analyzed what were the compositions of each artwork, whether HR-RT was used and at what level of accuracy.

Additionally, the large amount of data from the mathematical analysis of all of the lines of the images from both groups is in a Python package, Pandas, computer program using novel code to address the HR-RT construct. A novel heuristic of the artistic principle, HR-RT, of the platonic ideal (exact geometric measurement of each image horizontal and vertical parameter) assessed the lines of the artwork compositions of both the art students and Master artists. The results of these assessments are in Chapter Four.

## CHAPTER FOUR

### **Presentation of the Findings**

#### **Introduction and Overview**

The choice of the John Langdon Down Foundation A.C. (JLDF) School in Mexico for the study location is because it has an art school. The Mexican School of Down Art is the name of the art school. This artistic school is a unique circumstance and provided the researcher an opportunity to look at the artworks that had been made over a 24 year span of time. The school, exclusive for Down syndrome students, represents a group of students who are cognitively challenged and, therefore, are an extreme case of individuals who make art. Being in the art studio environment allowed the researcher to gain interviews with the teachers, staff and students during the weeklong research at the school, which provided further insight to the art students' visuospatial sequencing and experiential abilities.

The data sources reveal how the findings support or not past and current neuroaesthetics research. The items considered are symmetry as a formal variable, aesthetic perceptions and cognitive evaluations.

An explanation of the measurement key provides for the quantification of the compositional lines of the art students and Master artworks; it shows the utility of the

measurement in analyzing the images. Examination of the use of HR-RT per participant and per image is given on the factors of years at the JLDF art school and time span of the artwork creation.

There is a record of the various artistic techniques used by the participants and the use of 2 or 3- dimensional rendering of the image, such as, the artist techniques of the perception of depth and the multiple venues of artistic media used in the making of the artwork. Predominantly, the participants demonstrated a 2-dimensional visual description in the artworks. There is a record of the visual impairments of the art students.

The information on the Interrater Reliability Assessments (IRR) offers support to reduce the occurrence of researcher bias in the determination of the student artwork compositions. The development of a database of the image line measurements provides additional validity of the use of HR-RT and the quantized level assessments of the artwork compositions.

### **Weeklong Research Opportunity at the Mexican Art School**

The opportunity to study the artworks and the art students was exclusive to this particular school as there is no counterpart. This school is unique because of the founder's focus on a high standard of educational, health, and scientific objectives for the advancement of the population of persons with Down syndrome during the last 46 years. There are excellent records of curriculum development, teacher history, and student medical history at the school.

The art students' developmental records along with demographic information about their participation in the art program, such as, the specific characteristics of the



student's syndrome type, and the visual challenges of each student artist were a comprehensive database of information. The administrative staff worked throughout the week in the making of the student profiles for the information requested for this research in the questionnaires.

The artifact collection of the artwork images is in excellent condition. The museum quality, professional care, and treatment of the artworks provides a superior source of archival information for this investigation. There are three reasons for this assessment of the effectiveness of the artifacts as a data source:

1. The artworks of various mediums are a consistent quantitative size.
2. There has been a professional conservation of the original artworks for a future museum.
3. This collection of artworks is a longitudinal record of the making of artwork compositions "over a sustained period of time" necessary criteria for case study data. (Creswell, 2013, p. 14; Stake, 1994; Yin, 2014)

The history of the creation of JLDF and the art school demonstrates the purpose and motivation of the school. Within that organizational design, the circumstances surrounding the establishment of the art school and subsequent events that led up to the success of the art school are an example of an arts curriculum that fundamentally has used visuospatial and bodily kinetic aptitudes. This is the first study to investigate the visuospatial and bodily kinetic aptitudes and the use of HR-RT by persons with Down syndrome in their artwork compositions. This work adds to existing neuroscience on the perception of artwork compositions and the art of persons with Down syndrome.

Various terms describe the factors of HR-RT. The perception of HR-RT and the action of proportional gauging, which are artistic terms (Baxandall, 1988; Bouleau, 1963) are not the same descriptors used to identify Down syndrome behavioral phenotypes, which may relate to the construct. HR-RT, dynamic symmetry and aesthetic appeal are mathematical and psychophysics terms (Baxandall, 1988; Ferg et al., 2011; Huntley, 1972; Locher & Nodine, 1973, 1989; Schiralli, 2006). Somatosensory, interoception, and proprioception are concepts from cognitive psychology (Damasio, 2012; Gardner, 2011). For persons with Down syndrome, these concepts are implicitly represented between and within the general behavioral phenotypes that are traditionally referred to as cognition, social and emotional functioning, and motoric development in general terms (Fidler, Most, & Philofsky, 2009).

Research on the memory, the visuospatial capacity, and the motoric abilities of persons with Down syndrome aligns to terms from behavioral psychology. Visual object memory is the recognition of an object. Spatial object memory is where an object is in space. Emotional memory is the expression of feelings from prior experiences. Spatial sequencing memory aligns with emotion as a spatial temporal pattern that can be recalled. Visuospatial sequencing memory conjoins to emotion, as an object is moving in a spatial temporal pattern that can be recalled. The integration of the multiple characteristics of visuospatial and bodily kinetics is the accumulation of experiential memory (Fidler et al., 2009; Jarrold, Nadel, & Vicari, 2008; Yang, Conners, & Merrill, 2014).

Whereas, there are categories of visuospatial memory assessment in the battery of standardized tests, there are aspects of visuospatial and bodily kinetic abilities that are not

acknowledged in those assessments, such as HR-RT, the action of proportional gauging and the coordinated execution of the spatial sequential memory. An expanded description of the term visuospatial sequential memory includes the making, execution, and perception of artworks that reveal observations and additional sources of data collected at the Mexican art school.

### **The Art Teachers' Unique Visuospatial and Bodily Kinetic Curriculum**

The ideation that the art students created for the subjects of their artworks was a range from a simplistic one-subject image to multiple images set in a complex scene. The students used subject matter that is traditionally appealing to artists and there was a consistent use of the same subjects, such as, animals. The subjects of the artworks had been in some cases introduced by the art teachers (D. Perez & A. Planells, personal communication, June 4, 2015).

The art teachers at JLDF, Daniel and Alan, took time during the weekly class schedule to demonstrate the unique curricular design they have created in the past 24 years. They explained that in the beginning of the art school they had just graduated from the Esmeralda Institute as trained artists and teachers but that they did not have experience with persons with Down syndrome. They had begun a traditional fine arts program to encourage and develop the artistic ability of the students in 1994.

However, they realized they were not able to communicate even the most basic art concepts to the students, such as, horizontal or vertical alignment. The students did not comprehend any of the artistic information. After this disappointing start, the two art teachers enlisted the assistance of Prof. García Escamilla and members of the JLDF staff

to create a curricular innovation in the way in which they were teaching art to the students. The main resolution was to let go of the traditional methods of teaching art and work with the observed visuospatial sequencing and experiential memory abilities that the art students were displaying in their behavior. Due to the curricular change, a breakthrough occurred in the way in which Daniel and Alan could communicate with their students. The art teachers contend that they are able to teach the students when the method of content delivery is a visuospatial emotional sequence experience that involves bodily movement.

They demonstrated this method by dividing the class of students into two teams. Each group had the name of a famous artist. Previously, the art teachers had dressed up in costume and acted out the personas of various artists with whom the students had become familiar. The art lesson was set up as a competition. The art teachers blindfolded one of students from each team and then had the student reach into a box to feel the object inside. As each student reached into the box with both hands, they and the other students became very animated and emotional. De Santana, de Souza, & Feitosa (2014) investigated the emotional and visual perception of persons with Down syndrome. The authors stated, “For example, visual cortical responses that reflect an item’s significance result from simultaneous top-down modulation by frontoparietal attentional regions and emotional modulation in the amygdala. Therefore, the item’s impact is both cognitive and emotional” (De Santana et al., 2014, p. 2).

After a few minutes, the blindfolds were taken off and the two students went to the drawing boards to draw what they thought the object was inside the box. The art

teachers asked the class if the drawing looked like the object, which they had previously shown to the class. There was discussion on why or why not the drawings were similar to the object. This procedure was repeated three times with different students and objects or materials. If the object was an animal, then one student from each team was chosen to act out the actions of the animal to their respective group. After each set of drawings, the teachers and students celebrated the accomplishments with ten minutes of music and dancing.

The art teachers explained that they had realized that the art students were able to follow their modelling of the actions of the visuospatial sequencing of the experiential aesthetic activities. The students would then remember what the lesson was. Daniel and Alan stated that sometimes the students have trouble distinguishing between what they mentally visualize and what is actually occurring in the room with them. That is why, they stated, the students at times become so emotional. For example, when the students were to act out the movements of a snake, one of the young men got up on a chair as he was frightened by the other student's acting like a snake.

The motoric ability of individuals with Down syndrome has been extensively studied. These individuals demonstrate impairment in both gross and fine motor skills. This assessment supports studies from Ulrich, Lloyd, Tiernan, Looper, and Angulo-Barroso (2008) on the evidence of a motor sensory deficit in the walking development of toddlers with Down syndrome. An inferior level of ability for learning sequential motor coordination is reported by (Firth & Firth, 1974; Henderson, Illingworth, & Allen, 1991; Kerr, 1985), delayed overall movement times were observed by (Hodges, Cunningham,

Lyons, Kerr, & Elliott, 1995), and specific impairments of somatosensory function related to motoric ability was reported by (Chiarenza & Stagi, 2000).

According to Virji-Babul, Loyd, and Van Gyn (2003), the majority of traditional studies have looked at motor coordination and attempted to evaluate isolated single-movement tasks. Virji-Babul et al. (2003) reported that the movements of individuals with Down syndrome showed improvements over time in two visual conditions of multiple sequencing tasks. The authors also found that the participants with Down syndrome were not dependent on the moving limb for visual feedback during coordinated movements. This result is interesting because research Question 3 of this investigation is specific to proportional gauging (i.e., the ability to hold a pencil or pen and make a painting composition without looking at one's hand while one draws, which is related to proprioception) (Armstrong, 2009). The fine motor movement of proportional gauging is demonstrated when an artist decides where to place a daub of paint on a canvas without looking at the brush or to gauge how much pressure is necessary to push a carving tool to remove a precise amount of material for the print design.

As a professional artist and teacher, it was possible to observe the actions of the art students for a week in the art studios while they were making their paintings and linotype prints. They move slowly when they are concentrating. They need at times to be within an inch or two of the artwork to make a specific addition. The students step back or sit back at other times to look at the whole work whether a painting or print. They are using their peripheral vision. They are clearly demonstrating the actions of proportional gauging when they do not look at the brush or print making tools to make the art; they

look at the artwork. They carefully keep track of their materials and place a favorite color or tool in a place in their art toolbox where it can be accessed more easily. All of these actions demonstrated proportional gauging and spatial sequencing memory.

Additionally, the art students keep a sketchbook of ideas for future artworks. The sketches are smaller versions of the actual artwork which were adjusted proportionally to make the larger size of the original artwork. They enjoy showing their art to others, and they talk to one another and the teachers about a difficulty they might be having while making the art. These students are artists in their own right and they happen to be persons with Down syndrome.

A summary of the proportional gauging, fine motor movements, and spatial sequencing memory observed as performed by the art students in making their artworks during the weeklong investigation.

- Physically moving around the objects to view them at varying distances in the environment of the art classroom.
- Standing and painting with a brush or print tool in hand, making numerous sequential movements.
- Sketching or drawing by sitting and using a pencil, charcoal, or pastels from a smaller version of the image.
- Erasing to change and replace the lines that were drawn.
- Preparing the canvas with gesso.
- Preparing the materials for engravings.

- Using an etching tool to cut the lines of an attached sketch to the linotype, which is drawn as a reverse image.
- Performing movements required to make changes in the various colors used from a box of pastel colors.
- Standing back from an easel to observe the painting or standing back from an image put on the wall to observe the artwork.
- Securing the artwork to allow the materials to dry.
- The multiple uses involved in mastering art tools and careful arrangement in the student's artist material box of the various items used in making the art.
- Coordination of bodily limb movements to accomplish multiple artistic tasks.

The information in Table 5 is a demonstration of the similarity of the behavioral phenotype characteristics of the art students in relationship to an inherent symmetrical expression.

<u>Behavioral Phenotype Characteristics</u>	<u>Current research</u>	<u>Source of findings from the research at JDLF</u>	<u>Observation of art students' abilities and examples</u>
Fine motor control	Ulrich et al., 2008 Virji-Babul et al., 2003	Interviews with art teachers and researcher observations; video and picture records	Consciously and unconsciously demonstrate the proprioceptive use of artistic tools
Proportional gauging	Not available	Researcher observations; video and picture records	Consciously and unconsciously make the actions of moving toward and then away from artwork to view the artistic composition, gauging while using



			artistic tools and changing artwork proportional size.
HR-RT	Not available	Interviews with art teachers; analysis of the art student artworks	Unconscious use of HR-RT in 159 of the student artworks in five quantized levels
Visuospatial sequencing and experiential memory	Fidler et al., 2009 Jarrod et al., 2008 De Santana et al., 2014 Yang et al., 2014	Interviews with art teachers; Researcher observations; video and picture records	Conscious and learned behavior of the placement of art materials in their art box in the sequence and preference of the use of the tools

*Table 5.* Comparison of Multiple Terms for Similar Behavioral Characteristics of JLDF Art Students in Relation to the Making of Art.

### **Daily Schedule at the JLDF School**

Infants with Down syndrome begin an education at the school as early as possible. The babies are given a physical exam and receive the medical attention they may require. They and their parents or guardians receive teaching and training for all of the appropriate areas of assessment, such as, motor skills. The educational project coordinator, Begoña Ortega, has been at the school for most of the 46-year history. She and her staff are responsible for the faculty professional development, curriculum, and student assessments. The students begin school when they are five years old and placed into cohorts designed as a program for individualized development. The administration of IQ tests is not given and the reason is because, the founder, Prof. García Escamilla and her staff have designed a battery of tests, since the start of the school, which they say is a more comprehensive analysis of the student's abilities in relationship to the unique learning styles of students with Down syndrome.

The areas of development included in the school's assessment program are cognitive, motor, and language skills, independence, socially adaptive and observational (B. Ortega, personal communication, June 4, 2015). Innovative programs add to the curriculum such as the Numicon Mathematics Learning program for visuospatial learners. Ms. Ortega stated that the results of using Numicon have been encouraging in the learning of mathematics for the students. Numicon is a visuospatial and bodily kinetic approach to the teaching and learning of fundamental mathematics (Wing & Tacon, 2007).

In reference to the learning of mathematics for children with Down syndrome, Tony Wing and Romey Tacon (2007) stated, "...children learn to relate their physical handling of patterns to their visual impressions, and incorporate both into their growing mental understanding of what number words and figures actually mean" (p. 22). The authors also state, "Children are also encouraged to consciously visualize the shapes in their mind's eye, preparing for the time when they will cease to rely on actual Numicon shapes because they have a clear mental picture of number that they can use in mental math" (p. 22). Wing and Tacon's found that mathematics teaching and learning is parallel to the United Kingdom (UK) Primary National Numeracy Strategy for all children because the curricular emphasis is based on building mental imagery, which requires visuospatial and bodily-kinetic aptitudes and this builds the student's sense of number (Wing & Tacon, 2007).

The JLDF students are in a specific curricular cohort following the results of the extensive analysis and evaluations during the year. Each cohort of about five students

experiences the various activities and class time at the school together. All of the students come for the day for school. The students have a curriculum of classes in the core subjects up to Grade 8. This schedule of classes also includes dance, swimming, visual and culinary arts, theater and music.

After the 8<sup>th</sup> grade, the students can leave the school or choose to attend either the culinary arts classes or the visual arts classes (B. Ortega, personal communication, June 4, 2015). If they choose the culinary arts, they train to work in the kitchen or the Tres 21 Cafés that are located on the school campus and in Mexico City. Alternatively, as a student artist they can participate in the art shows and gallery events that have become a significant part of the school's success. Thus, JLDF has developed a sustainable business model of two venues. Only prints made of some of the student artworks are offered for sale, which help to offset the cost of the school. The JLDF is keeping the original paintings for a planned art museum in Mexico exclusive for artworks of persons with Down syndrome.

The JLDF school in Mexico has operated with a conceptual approach to teaching and learning for the students since the school began in 1972. The environment at the school is an all-encompassing aesthetic experience at every level of engagement. It is no surprise of the success of the unique visuospatial and bodily kinetic curriculum of the art school developed under this classic aesthetic umbrella of the collectivist culture (Hofstede, 2001). The exceptional demonstration of the effects of the nurturing JLDF environment is itself an example of the biological design of a relaxed natural selection adaptation (Chatterjee, 2014).

## Demographics of the Participants

All the participants in this study were or are art students at JLDF. The staff at the school prepared a profile of each of the participants' demographics. A sequence number identified each participant. The participants had to meet three criteria to participate in the study a) identified as having Trisomy 21, b) the demographics for the art student were available, and c) publication of the artwork in the book or art show catalogs. The following list is a summary of the demographics information.

<u>Gender female</u>	<u>Age range</u>	<u>Number of years at JDLF</u>	<u>Number of years at art school</u>	<u>Range of number of artworks per student</u>	<u>Number of students with visual impairments</u>
7	28- 47	7- 44	7-23	1-14	4

Table 6. Demographics of the Female Participants

<u>Gender male</u>	<u>Age range</u>	<u>Number of years at JDLF</u>	<u>Number of years at art school</u>	<u>Range of Number of artworks per student</u>	<u>Number of students with visual impairments</u>
14	25- 46	4- 37	4-23	1-20	11

Table 7. Demographics of the Male Participants \*One student does not have a visual history record

<u>Very low</u>	<u>Low</u>	<u>Low to medium</u>	<u>Medium</u>	<u>Medium to high</u>	<u>High</u>	<u>Living at home</u>	<u>Living in-dependently</u>
3	3	3	8	2	2	21	0

Table 8. Participant Family Socioeconomic Status

<u>Types of art media</u>	<u>Number of artworks</u>
oil paintings on canvas	32
oil on cardboard	1
oil on wood	1
media paintings on canvas	42
linotype prints	57
lithograph prints	3
aquatint prints	2

acrylic prints	1
burnt wood prints	5
mixed media on wood	5
mixed media on paper	4
pen on paper	1
watercolor	3
acrylic paintings on canvas	1
pastel on paper	3

*Table 9.* Types of art media used in the artworks and number of artworks analyzed for the total number of images 161. Source for demographic information: JLDF Student Profiles

### **Geometric Grid Examination per Image by Master Artists and Art Students**

There were 161 artwork images made by the 21 art students, who fit the criteria to be included in the study. An examination of each image utilized the artistic principle of HR-RT. The shapes, lines, arrangement and placement of the major objects in the image determined the lines of the composition. A detailed textual review provides an explanation of each image (see Appendix K).

A composition assessment of the image alignment to the grid measurements is compared to the six harmonic ratio examples for the use and identification of HR-RT. In many of the images, more than one HR-RT was identified. The most complex harmonic ratio was considered the most significant as it represented more detail and accuracy overall for the image. The accuracy of the line placements for the composition was determined for five levels. A score for line accuracy to the platonic ideal (a precise geometric measurement for the image parameters horizontal and vertical) gave a quantified level.

The Master artists used, at a high accuracy, the multiple lines and precise arrangement of multiple HR-RT ratios in their paintings. The description of the complex compositions of the Master artist group required all of the divisions of the measurement

key both horizontally and vertically. That is the fifths, the ninths, the twelfths, the sixteenths and the two frame ratio measurements. The grid of geometric lines overlaid on the painting compositions aligns to the historical geometric analyses of the Master artists' painting compositions. The grid of lines provides an optional manner that aligns with the traditional artwork analyses in order to observe the intentionality of the Master artists in the making of the art compositions.

### **Artwork Compositional Analysis**

The art students' images represented a distinct composition based on HR-RT. Sixty-two images (38.51% of all the images) were confirmed at a level of strong with multiple representations of HR-RT and an accuracy between 2.1- 3 (between 0-3 millimeters line distance from the descriptive grid to the item of the composition). In sixty-five images (40.37% of all the images), a confirmation at a level of moderate representation of HR-RT was an accuracy of 1.1-2 (between 3.1- 5 millimeters line distance from the descriptive grid to the item of the composition). The findings of the geometric analysis of the 161 artworks were that 78.87% of the images scored as strong or moderate.

There were 25 images (15.53% of all the images) that were confirmed at a level of low representation of HR-RT construct with an accuracy of 1 (greater than 5 millimeters line distance from the descriptive grid to the item of the composition). These images showed some evidence of HR-RT relationship but had an accuracy score of 1 or less. Seven images were given an overall score of inconsistent (4.35% of all the images) this finding indicated that the compositions showed an example of the harmonic ratio but had

an inconsistency in the geometric relationships to the descriptive grid overall. The inconsistent HR-RT relationships are in the textual record of the images.

The harmonic ratio category assessment of not found (NF) was assessed for two of the images (1.24% of all the images). The combined categories of low, inconsistent and NF of 34 images were 21.12% of the 161 images and did not show satisfactory accuracy, consistency or evidence of the mathematical construct similar to the Master artists' group. The data in Table 10 illustrates the findings of HR-RT analysis per participant

<u>Sequence number of participant</u>	<u>Level of representation Strong &amp; number of images</u>	<u>Level of representation Moderate &amp; number of images</u>	<u>Level of representation Low &amp; number of images</u>	<u>Level of representation Inconsistent &amp; number of images</u>	<u>Level of representation Not found &amp; number of images</u>
369	7	1	5	-	-
370	10	5	2	3	-
371	4	1	1	-	-
372	1	-	-	-	-
373	2	1	-	-	-
374	6	5	-	-	-
375	2	3	1	-	-
376	-	6	4	2	-
377	-	-	1	-	-
378	-	3	1	1	-
379	4	3	2	-	-
380	7	7	3	-	-
381	7	3	1	-	-
382	-	4	1	-	-
383	-	2	1	-	1
384	2	2	1	1	-
385	2	9	-	-	1
386	1	1	-	-	-
387	-	1	-	-	-
388	2	-	-	-	-
389	5	8	1	-	-

Table 10. Harmonic ratio with Rule of Three (HR-RT) Analysis per Participant

<u>Level of Harmonic ratio accuracy</u>	<u>Strong</u>	<u>Moderate</u>	<u>Low</u>	<u>Inconsistent</u>	<u>Total number of times a specific ratio was used *</u>
1/2 ratio	5	6	4	4	19
2/3 ratio	9	25	16	1	51
3/4 ratio	17	19	5	1	42
3/5 ratio	22	14	0	1	37
4/6/9 ratio	3	0	0	0	3
9/12/16 ratio	6	1	0	0	7

*Table 11.* Number of Uses of the Harmonic Ratios and the Level of Accuracy in the 161 Artwork Compositions \*Two images did not have a ratio relationship in the composition

There were 21 participants and they had a varying number of artworks. The range of the number of artworks per participant was from 1 to 20. Twenty participants created artwork compositions that had used HR-RT similar to the Master artists' group at the strong or moderate level. One participant did not demonstrate the use of HR-RT construct above a low level. The participant had only one image in the study. Two images did not show any use of HR-RT at any of the quantized levels. There are four types of HR-RT representing the Master artists' group: the 1/2, octave, the 2/3, fifth, the 3/4, the fourth, (from the octave and the fifth) and the 9/12/16, from the fifth and the fourth. The number of times the 1/2 ratio was used in the participant works was 19, which is 11.95%. The number of times the 2/3 ratio was used was 51, which is 32.01%. The 3/4 ratio was used 42 times, which is 26.42% and the 9/12/16 ratio was used 7 times, which is 4.40%.

The examination of the participant artwork compositions reveals, the 3/5, the sixth, (from the fourth) and the 4/6/9/, the double fifth. Both of these harmonic ratios are an extension of the fundamental harmonic ratios of the Master artists' works. The number



of times the sixth,  $3/5$ , ratio was used was 37, which is 23.27%. The number of times the double fifth,  $4/6/9$ , ratio was used was 3 by the participants, which is 1.87%. The factors of the participants' age, years at JLDF and years at the art school, visual impairment, and the range of time of image creation and the student profile information reveal additional information about the use of HR-RT by the JLDF art students.

A Python package, Pandas, inspired by the “R” statistical application for advanced visual data, was used for the setup of the database of the large number of geometric lines of the artwork compositions for both art groups. The novel programming by Cary Miller allowed for the statistical analysis of a heuristic of HR-RT (the specific geometric relationships) on the platonic ideal (geometric measurement of each image horizontal and vertical parameters). The results of the two sample t-tests are as follows:

$1/2$   
vertical  
(statistic=-0.70661723282852984, pvalue=0.48127184827134661)  
horizontal  
(statistic=-0.64789774484081042, pvalue=0.51850682994261599)

HR  $2/3$   
vertical  
 $1/2$  (statistic=-0.36610372192788637, pvalue=0.7159661059222846)  
 $1/3$  (statistic=-0.47358819473742825, pvalue=0.63830571339802056)  
 $2/3$  (statistic=-0.1020433812473147, pvalue=0.91919661959231225)

horizontal  
 $1/2$  (statistic=-0.19621763393050279, pvalue=0.8454333230036486)  
 $1/3$  (statistic=0.27596519229516459, pvalue=0.78419775637333933)  
 $2/3$  (statistic=-0.01465040168447623, pvalue=0.98839672141138502)

HR  $3/5$   
vertical  
 $1/3$  (statistic=-1.1039966261281613, pvalue=0.2954509532481896)  
 $2/3$  (statistic=0.43550355630934745, pvalue=0.67244695607177896)  
 $1/5$  (statistic=1.6803361008333431, pvalue=0.11871493008138972)

2/5 (statistic=-0.90718758922188647, pvalue=0.38216386803707092)  
3/5 (statistic=-1.1838582630567063, pvalue=0.25939004506671748)  
4/5 (statistic=1.9536182020453439, pvalue=0.074456677130206511)

horizontal

1/3 (statistic=-0.38810394402984644, pvalue=0.70534475030849642)  
2/3 (statistic=1.0258064165263232, pvalue=0.32701248196303379)  
1/5 (statistic=1.1357631270365407, pvalue=0.28019593127485992)  
2/5 (statistic=1.1059071496822372, pvalue=0.29236695899422055)  
3/5 (statistic=1.0823361393533664, pvalue=0.3022588935368834)  
4/5 (statistic=1.2228069171612501, pvalue=0.24695485504583306)

HR 3/4

vertical

1/3 (statistic=0.11708788258525532, pvalue=0.90824758569007547)  
2/3 (statistic=-0.30595036330845138, pvalue=0.76335740721498524)  
1/4 (statistic=-0.92772390984260544, pvalue=0.36318484452194644)  
2/4 == 1/2 (statistic=2.1787266287080076, pvalue=0.038253702022866591)  
3/4 (statistic=-2.1868053476804596, pvalue=0.038738471425237953)

horizontal

1/3 (statistic=0.33553826643755691, pvalue=0.74186608134457699)  
2/3 (statistic=0.25726834017140626, pvalue=0.80025092112877827)  
1/4 (statistic=-0.74414106749912878, pvalue=0.46828908847976258)  
2/4 == 1/2 (statistic=-0.15304535835491956, pvalue=0.87989608561371635)  
3/4 (statistic=-0.80634144004845498, pvalue=0.43186850813535327)

These ratios represent the majority of the images and the pvalues indicate that there was no difference in the use of the HR-RT construct between the Master artists and the art students. There is an indication of a stronger difference for the 3/4 HR-RT for the vertical 2/4 and 3/4 lines. The 2/4 is the vertical 1/2 and there may be some additional factors affecting that t-test result, such as, the known use of the 1/2 bilateral line for visual orientation (Locher & Nodine, 1973, 1989; Hasse & Weber, 2012).

### **Comparative Analysis per Participant on the Year the Artwork was Created**

Each artwork has the date created and the score given for the level of evidence of HR-RT, the measurement construct. Six participants had created artwork in a span of two or less years, which would not be applicable for assessing the possible influence of the art teachers in respect to HR-RT. The parameter of interest is whether the time in which the participants made the images indicated an improvement or variable pattern of the use of HR-RT. This information provides further clarification for how the art students are using the HR-RT construct.

Fifteen participants created artworks for three or more years. Looking at a chronological record per each of the 15 participants demonstrates that there were a variable use of HR-RT irrespective of the increase of experience of the art student at the school. There is no pattern between the factors of length of time spent at the art school and an increase or decrease in the use of HR-RT (see Appendix L).

### **Use of Artistic Techniques for Demonstrating Depth Perception**

Depth Perception is “the ability of an observer to judge the spatial relationships of objects, especially their relative distance from the observer and from one another” (Dictionary.com unabridged, 2016) and is related to the action of proportional gauging (Baxandall, 1972; Bouleau, 1096, Lanteri, 1965). In the making of the artworks, the participants demonstrated the following techniques for creating depth perception.

<u>Type of Artistic Technique per image</u>	<u>Number of Images</u>
Shape and line components	50
Shape, line and dot components	6*
Shape and line with chiaroscuro (light/dark shading)	41
Shape and line with fore, middle and background	43
Shape and line with slight use of linear perspective	18
Fore, middle and background and linear perspective	1
Shape and line using optical illusion	1
Shape and line with anti-symmetry	1

*Table 12.* Artistic Techniques for Demonstrating Depth Perception

\*Some of the print images made as linotypes or woodprints displayed sections of the images as a stereopsis illusion.

Twenty-eight of the participant images demonstrate an image in 3-dimensions. A 3-dimensional image is the use of multiple techniques of depth perception (i.e. images with shape/line and fore, middle and background and at least one other technique such as linear perspective, chiaroscuro (light and dark shading) or optical illusion). Twenty-one of the 3-dimensional images are strong representations of HR-RT and seven 3-dimensional images are representations at the moderate level. There are no 3-dimensional images at a low or inconsistent representation.

The majority of the study images demonstrate a 2-dimensional image. The use of shape and line with some indication of other techniques gives the image an overall 2-dimensional appearance. One of the techniques used by the participants was to use a heavy black outline of the shapes that describes the figures or objects in the artwork composition. The number of 2-dimensional images is 131. Of these, there are 41 images

at the strong harmonic ratio representation, 58 images at the moderate representation, 25 images at the low representation, and 7 images at the inconsistent representation.

Table 14 has the number of images per 2 or 3-dimensions listed and the information shows the relationship of the 161 images to the overall HR-RT variations. The participants demonstrated that 81.37% of the images were 2-dimensional images and 17.39% of the images were 3-dimensional.

<u>Image dimension s &amp; level of HR-RT</u>	<u>Strong 3D</u>	<u>Moderate 3D</u>	<u>Low 3D</u>	<u>Inconsistent 3D</u>	<u>Strong 2D</u>	<u>Moderate 2D</u>	<u>Low 2D</u>	<u>Inconsistent 2D</u>
Number of images	21	7	0	0	41	58	25	7

*Table 13. Image Depth Perception, HR-RT and the Number of Images \*Two images did not have a harmonic ratio relationship in the composition.*

### **Visual Impairments**

Four of the seven female participants have ophthalmological impairments. Three female participants have normal vision. Eleven of the 14 male participants have ophthalmological impairments. One male participant did not have a visual history record at the school. One male participant needed glasses but there was no description of the type of visual impairment. One male participant has normal vision. The following is a list of the categories of the visual history of the participants.

<u>Category of visual Impairments</u>	<u>Number of Participants</u>
Myopia	4
Astigmatism	2
Myopia and astigmatism	4
Dry eye	1
Strabismus	1
Myopia and nystagmus	1
Keratoconus	2

No ophthalmological disorders	4
Student requires glasses, the disorder Is unknown	1
Student has no visual history	1

*Table 14.* Categories of the Visual History of the Participants.

During the week at the school, the researcher was able to observe the participants working on their art in the studio space. As an experienced portrait artist in the making of 3-dimensional sculptures of people and animals, the researcher noticed the morphology of the art students' eyes. The structure of how the pupil aligns in the eyeball, how the eyeball aligns in the eye socket, and then, how the eye socket aligns to the brow ridge of the skull and the zygomatic bones (cheekbones) across the front of the face was unique for each person. The photos and videos the researcher took of the students did not show accurately the alignment of the multiple parts of the eye structure and placement of the eyes and pupils to the planes of the facial morphology. In particular, how the planes on which the brow ridge, eye socket, eyeballs, and pupils were relating to each other and the rest of the cranial structure.

The use of HR-RT by the participants was irrespective of the participants' visual history (i.e. whether the participant had an ophthalmological disorder or not). For example, there was no record of a participant making artworks with HR-RT consistently at a not found, inconsistent or low level. The physiological structure of the participant's eyes was unique yet there was no relationship found to the visual impairment history and the making of artwork compositions using HR-RT.

### **Inter-rater Reliability (IRR) Assessment**

Two independent ratings were conducted of the 161 art student images using the inter-rater reliability (IRR) assessment (See Appendix M). The question is whether there is a consistent agreement between raters on the use of the HR-RT construct. The IRR assessment provides some measure of establishing reliability for the researcher's HR-RT artwork compositions assessments. The IRR is calculated using the Cohen's kappa statistic, which takes into account the number of choices that may have been made by chance,  $\kappa = 0.65$  for the independent rating by Dr. Jen Lin Yin. This result indicates a reasonable agreement with the assessment by the researcher on the use of HR-RT.

Of the 54 images that the independent rater did not find HR-RT, 25 of those artworks have the highest accuracy assessments for the use of HR-RT. The independent rater stated that the images were too complex for her to determine the composition so she marked them as no. Therefore, with additional clarification to the independent rater the confusion for the interpretation of the more complex images may improve future ratings. Dr. Jen Lin Yin is a mathematics teacher at the Cherry Creek High School in Denver, Colorado. She was selected because she is a teacher and has a mathematics and theater background but she is not a visual artist.

A second inter-rater reliability (IRR) assessment was conducted to determine the agreement or disagreement of an independent rating of the analysis made by the researcher of the HR-RT ratios found in the composition of an artwork. First, in looking at the 161 images for the use of HR-RT, the rater found HR-RT in all but in eight of the artwork compositions. The IRR calculated, using the Cohen's kappa statistic, which takes

into account the number of choices that may have been made by chance, is  $\kappa = 0.9379$  for the independent rating. This result indicates a strong agreement with the assessment by the researcher.

This result is predictable because the second rater has 30 years of experience in the art field. The second rater was Dawn McFadden. McFadden is an illustrator with 25 years of experience at the Denver Post Newspaper as the senior artist. She is also an arts teacher and artist on the faculty at the Community College of Denver and Metro State University at the Auraria campus in Denver Colorado. She was selected because she has the appropriate professional background and experience to make the artwork composition assessment.

In looking at the agreement or disagreement of the determination of the artwork compositions, the second rater agreed with the researcher on 110 of the images and disagreed on 51 images. The IRR is calculated using the Cohen's kappa statistic, which takes into account the number of choices that may have been made by chance,  $\kappa = 0.67$  for this independent rating. Of the 51 images that the independent rater did not agree with the composition, 11 of those artworks were in close agreement in terms of an alignment of the low to non-existent use of HR-RT. They were close to agreement because the terms low, inconsistent and not found indicate that the artwork composition was lacking in strong or moderate evidence of HR-RT. Future clarification of the procedures and terms of the rating may alleviate the confusion.

This second rating indicates the need for future methodological research to determine the most consistent manner in which to determine an artwork composition and



use HR-RT as a standard to analyze the artist's intentions. There was overall a reasonable agreement with the second rater on the analysis of the compositions. The continuous development of the Pandas computer coding system for the HR-RT heuristic will possibly be a way to improve the systemic methodology.

### **Computer Analysis of Quantized Levels**

The goal of developing technological tools for the data analysis of the use of HR-RT is to identify algorithms that describe the process of the computation of the mathematical construct. This process has begun and the data from this research project DU IRB Protocol #: [547005-3] is the data set used for the input. The data set was verified and the initial objectives are to validate and graph the assessed quantized levels for the use of HR-RT. This data analysis can be used to corroborate the artwork compositions described by the researcher (following artistic principles) from both the independent rating assessments of the geometric measurements and use of HR-RT in the Master artist works.

### **Synopsis of Artists' Compositions**

A grid system of lines measured the placement of the geometric delineations of artwork compositions, following traditional artistic principles, and revealed the use of the mathematical construct within the space of the quadrangle of the art student artworks. The measurement of HR-RT in an artwork composition is a way to quantify the psychophysics perception of the HR-RT symmetry. Overall, there is a similarity in the use of the HR-RT mathematical construct between the two artist groups. In all of the 161 artworks except for two images, there is evidence of strong, moderate, low or inconsistent

use of HR-RT in the artwork compositions of the participants, which parallels the consistent use of HR-RT in the Master artists' works.

The participants consistently used the harmonic ratios of the octave 1/2, the fifth 2/3; the fourth 3/4, the 9/12/16 from the fifth and the fourth. The double fifth 4/6/9 and the sixth 3/5, these ratios are similar to the harmonic ratios used by the Master artists' group (See Table 4). The participants demonstrated a 78.87% consistent use of HR-RT at a strong and moderate level. The participants demonstrated 34 images at a low level (15.53%), inconsistent representation (4.35%) or not found (1.24%).

The participants created artwork that was 2 and 3-dimensional. There are 131 2-dimensional images and 28 3-dimensional images. Looking at the 2-dimensional images confirms that 41 (25.78%) images are at the strong representation, 58 (36.48%) images are at the moderate representation, 25 (15.72%) images are at a low representation, and 7 (4.4%) are an inconsistent use of HR-RT.

The total number of the strong and moderate levels of the images of a 2-dimensional representation is 62.26% images. The findings of the strong and moderate levels of 3-dimensional representations are that 21 (12.42%) images are at a strong representation and 7 (4.4%) images are a moderate representation. The total number of the strong and moderate levels of image of 3-dimensional representations is 17.61% images. There are no 3-dimensional images at a low or inconsistent level.

The majority of the images created are 2-dimensional renditions of the subject matter with a strong, moderate, low, or inconsistent representation of HR-RT. This finding indicates that the depth perception of the participants is primarily 2-dimensional

and this is consistent with empirical research on the subject of stereopsis vision in persons with Down syndrome (Krinsky-McHale, et al., 2014).

The image on the retina is a two-dimensional representation of a three-dimensional world. One of vision's major roles is to extract information about depth, the third dimension. Because the retinal image for each eye has a slightly different view of the world, the brain, then, must coordinate these views into a fused 3-dimensional percept of a single world. For most people, the fused images also provide depth information, or stereopsis. In individuals with Down syndrome, stereopsis was found to be very poor. A deficit in stereopsis is not due to retinal damage to receptors alone, but likely reflects cortical involvement. (Krinsky-McHale, et al., 2014)

The visual system of linear perspective is present in the 28 (17.62%) of the 3D images, which did not significantly confuse the perception of HR-RT. The confusion of linear perspective exists because there is a question of whether the students were perceptually using linear perspective or the HR-RT construct. Dependent on the artwork compositions, there are occurrences where linear perspective and HR-RT are the exact same geometric measurement. The finding was that the participants primarily composed 2-dimensional artworks 131 (82.38%) and of these 99 (62.26%) of the artworks used HR-RT, without stereopsis, at a strong or moderate level.

The art teachers, Daniel and Alan, stated that they did not teach the art principle of HR-RT to the students because the students were not able to comprehend the fundamental art principle. Looking at the comparison of the level of representation over the span of years from 3 to 19 years (three or more artworks), 15 participants had made artworks demonstrating the variable use of HR-RT over time. There is a varying use of the construct whether the artwork was made earlier or later during the time the participant created the artworks at the art school. Overall, the number of years that the participants

had been at the art school and at the JLDF does not show a pattern of an increase or decrease in the use of the mathematical construct. These findings lend further support to the conclusion that the art teachers did not influence the use of the mathematical construct in the artwork compositions.

The record of the archival data of the images reveals that HR-RT is in the artwork compositions by the participants, demographically from a very low to high spectrum of socioeconomic status in Mexico City. The participants used the HR-RT construct in a variable manner regardless of the level of their socioeconomic circumstance.

Additionally, the use of the HR-RT construct is variable in the review of the 15 different types of materials that the participants used for the making of the artworks. Multiple materials were employed to make the artwork compositions and the three most were common materials were oil on canvas (32 images), mixed media paintings on canvas (42 images), and linotype prints (57 images).

The art students used nine other types of media for the remaining 30 images. Of the 7 inconsistent image composition assessments participant #370 had three inconsistent images, two of mixed media on canvas paints and one of oil paints; #376 had one image made of oil paints; #378 had one of watercolor on paper, and; #384 had a linotype print image. The two not found (NF) images were participant #383 with one image of not found using of mixed media on canvas and #385 had one image of mixed media on wood. There are no associations to the types of materials that the participants used to make the artworks and the use of the HR-RT mathematical construct.

## **Symmetry and Asymmetrical Patterns of the Artists' Compositions**

There are notable symmetry and asymmetrical patterns of the artwork compositions that are similar for both groups. Four images from the MA group of artworks have a symmetrical arrangement MA-1, MA-2, MA-4, MA-6 in respect to the HR-RT construct with the vertical centerline as a reflection line. Master artists' painting compositions MA-3, MA-5 and MA-7 are asymmetrical in respect to the HR-RT compositional arrangement to the left or the right of the vertical centerline. The participant group of artworks also showed this same demonstration of the symmetrical and asymmetrical patterns. Of the 161 images, 82 artworks were a symmetrical arrangement with the vertical centerline as a reflection line. Seventy-nine artworks were an asymmetrical arrangement of the HR-RT alignment to the left or right of the vertical centerline. Further examination of the 161 images using technology will provide more details on the possible multiple analyses of the data for questions about the use of symmetry in the making of artworks. This information is in agreement with the findings of Locher and Nodine, 1973, 1989.

There are examples of an alignment of a HR-RT geometric division within the harmonic ratio composition that is a significant compositional line aligned to the HR-RT artistic principle. It is designated in the image record as a blue dotted line. There are four Master artists' examples of this special case of a geometric line alignment to a HR-RT measurement. The MA-1 horizontal alignment that sets up a HR-RT rectangle relationship within the HR-RT of the composition. The MA-5 vertical alignment of the distance of the 5<sup>th</sup> 1/16 to the 8<sup>th</sup> 1/12 that is cut in DEMR. The MA-6 vertical alignment

is the DEMR cut between the lines of the 5<sup>th</sup> 1/16 to the 8<sup>th</sup> 1/12. The MA-7 has relationship of the 6<sup>th</sup> 1/16, from the top of the picture frame to the 7<sup>th</sup> 1/12. This is a DEMR measurement and from the line of the top of the head, the 3<sup>rd</sup> 1/16 to the line of the chin, the 6<sup>th</sup> 1/16 is exactly 1/2 the distance. In addition, the placement of the eyes of the Lady Viceroy are at the DEMR location in relationship to the length of the face.

There are six examples of the use of the blue dotted line DEMR construction in the participants' artworks. For the example of the image, #369-1, the horizontal alignment sets up a DEMR rectangle relationship within the HR of the composition between the H 1<sup>st</sup> 1/5 and the H 2<sup>nd</sup> 1/5. For the example of image, #374-8, the horizontal alignment sets up a DEMR rectangle relationship within the HR of the composition between the H 3<sup>rd</sup> 1/9 and the 6<sup>th</sup> /19; #374-9. The horizontal and vertical alignment sets up a DEMR relationship within the HR of the composition at the H upper FR. For the example of the image, #376-3, the horizontal alignment that sets up a DEMR cut of the rectangle relationship within the HR of the composition from the H 1<sup>st</sup> 1/5 to the H lower 1/8; #380-3. The vertical alignment sets up a DEMR rectangle relationship within the HR-RT of the composition. For the example of image, # 388-2, the vertical alignment sets up a DEMR cut of the rectangle relationship within the HR of the composition between the VL1/3 and the VR1/3.

In summary, the art students used the same preferred geometric alignments of the thirds, the 2<sup>nd</sup> and 3<sup>rd</sup> fifths, the 4<sup>th</sup> twelfth and 8<sup>th</sup> twelfth, 5<sup>th</sup> sixteenth and 10<sup>th</sup> sixteenth, and the frame ratios for the placement of the most significant objects or elements within the image space similar to the Master artists. There is evidence in six of the participant

images (five of the 21 participants) that the same manner of a specific alignment (blue dotted line) of a DEMR rectangle within the composition is used to describe a major compositional line.

The students demonstrated the three aspects of how cognitive disability can produce unique visual images, improve ability to render images and increase the ability to have creative expression (Vartanian & Chatterjee, 2014). Symmetry was a crucial aspect of the student artworks, more than balance and the artwork meaning. The students demonstrated examples of both the constructivist and analytical approaches (Lajoie, 2003). However, in observing the making of the paintings, drawings and prints, the students tended more to construct with various shapes, line and arrangements of the artwork images.

There were many examples of the use of the vertical 1/2 bilateral line to orient the artwork composition, which would follow the static symmetry found by Locher and Nodine (1973). There were also number of compositional examples that were offset of the center vertical line to the left or right slightly. Some of these examples were based on the use of the HR-RT's 3/5, 4/6/9 and 9/12/16 ratios. This is because the HR-RT symmetry aligns geometrically within the picture frame parameters precisely in that composition. In others, it was because the student was not accurate in the placement. As Locher and Nodine recorded, the effects of this in general alignment still rendered the pleasingness affect.

## CHAPTER FIVE

### **Conclusion**

The answers to Research Questions One, Two and Three provide the findings of the study. This study adds to the body of literature in the field of neuroaesthetics that suggests the human preference for HR-RT symmetry is inherent. This includes a recommendation for the expansion of visuospatial knowledge for all students to include the HR-RT symmetry perceptual ability with the proportional gauging and spatial sequencing memory properties of the construct. A discussion is offered about the implications of what this study reveals of HR-RT symmetry and the relationship of this cognitive phenomenon to teaching. Suggestions for future research projects align how these investigations can advance assessment in education of the visuospatial and bodily kinetic aptitudes.

### **Answers to the Research Questions**

Question One: Did the art students demonstrate the use of HR-RT in the compositions of their artworks? A 5-step procedure developed by the author, which has not been validated, identifies the use of HR-RT within the description of a geometric grid of the participant artwork compositions. The lines of the composition delineated the



ideation depicted within the artwork, but only if the lines described the main subject matter whether by spacing, alignment, or ideation. The accuracy of the lines determined by the 5-step measurement follows the artistic principle of HR-RT using established artistic procedures for identifying artwork compositions. Three questions guided the rationale for the development of the analysis and accuracy at strong, moderate, low, inconsistent and not found levels of the image for the composition assessment.

The answer to Question One divides into three segments. First, did the geometric grid delineate the key HR-RT compositional elements? Second, are there multiple examples of HR-RT described in the image that reinforce the composition, and is the use of the frame ratio, FR, supportive of the harmonic ratio(s)? Third, how accurately do the compositional lines relate to the platonic ideal (the exact geometric lines) of the specific picture frame? The use of HR-RT found in 159 out of 161 images indicates a significant use of HR-RT in the compositions of the art students' artworks:

- a. 62 of 161 images (38.51%) were scored at a strong accuracy.
- b. 65 of 161 images (40.37%) were scored at a moderate accuracy.
- c. 25 of 161 images (15.53%) were scored at a low accuracy.
- d. 7 of 161 images (4.35%) were scored at an inconsistent accuracy.
- e. 2 of 161 images (1.24%) were not found to have the construct.

The examination of the use of HR-RT in the making of the artworks over time demonstrated that the use of the HR-RT construct was variable. There was no pattern demonstrated of its use. The art teachers, Daniel and Alan, stated that they were unable to teach the art students the basic artistic principles of HR-RT for the making of an artwork

composition. In looking at 15 students out of the 21 participants, there is no increase or decrease in the accuracy of the use of the construct over time. This finding lends support to the conclusion that the teachers did not influence the use of the mathematical construct by the art students in the making of their artwork compositions over time.

Looking at the factor of dimensionality, which is a crucial aspect of the art students' artwork compositions, gives the relative use of depth perceptual acuity by the art students in the making of their artwork compositions.

- a. 21 participants made a 3D image at a strong level.
- b. 7 participants made a 3D image at a moderate level.
- c. 0 participants made a 3D image at a low level.
- d. 41 participants made a 2D at a strong level.
- e. 21 participants made a 2D at a moderate level.
- f. 25 participants made a 2D at a low level.
- g. 7 participants made a 2D at an inconsistent level.

Out of the 161 participants, 131 (81.37%) of them made images that were 2-dimensional. The review indicates that the use of 2-dimensional depth perception by the participants is consistent with empirical research on the subject of stereopsis vision in persons with Down syndrome (Krinsky-McHale, et al. 2014). The use of HR-RT in the artwork compositions was in the absence of the teacher's influence of communicating the art principles. The finding of the lack of stereopsis for 3-dimensional image making is suggestive that the process of the execution and perception of the bodily kinetic action of proportional gauging possibly engages the peripheral visual system in the perception of

symmetry. This finding is supportive of Locher and Nodine's (1973, 1989) research and Damasio (2012) on perception and the use of peripheral vision.

HR-RT is in all of the artwork compositions except two, and it made no difference in the making of the students' artworks over time. This suggests that of the 21 students that 15 art students (who had made artworks for longer than 2 years) had used the mathematical construct in the making of their artworks and did so irrespective of other influences. The small sample size and archival record restricts generalizing these findings to a larger population.

Question Two: Is there evidence that the art students used HR-RT and ideation similar to the Master artists of the Quattrocento? The Master artists clearly demonstrated that they preferred the  $1/3$ 's, the 2<sup>nd</sup> and 3<sup>rd</sup>  $1/5$ 's, the 4<sup>th</sup> and the 8<sup>th</sup>  $1/12$ 's, 6<sup>th</sup> and 10<sup>th</sup>  $1/16$  divisions, and the frame ratios in both dimensions for the placement of the most significant objects, spacing, or elements within the image space. Their use of the harmonic ratios aligns to the geometric grid relationships in the following manner: the 2<sup>nd</sup>  $1/5 \sim 5^{\text{th}} 1/12$ , the 3<sup>rd</sup>  $1/5 \sim 7^{\text{th}} 1/12$ , the 3<sup>rd</sup>  $1/16 \sim 1^{\text{st}} 1/5$ , the 4<sup>th</sup>  $1/5 \sim 13^{\text{th}} 1/16$ , the 8<sup>th</sup>  $\sim 1/12 = 6^{\text{th}} 1/9$ , the 9<sup>th</sup>  $1/12 = 12^{\text{th}} 1/16$ , the 4<sup>th</sup>  $1/16 = 3^{\text{rd}} 1/12$ , the 4<sup>th</sup>  $1/12 = 3^{\text{rd}} 1/9$ , the 7<sup>th</sup>  $1/16 \sim 4^{\text{th}} 1/9$  (within 0.2 mm), and the 9<sup>th</sup>  $1/16 \sim 6^{\text{th}} 1/9$  (within 0.2 mm). The lines that relate precisely to HR-RT are the 10<sup>th</sup>  $1/16$  and the 6<sup>th</sup>  $1/16 \sim$  to the VFR's and HFR's.

Along with the preference for the HR-RT arrangement of the compositional harmonic ratios, there is evidence that both artists' groups demonstrate two types of symmetry patterns in an analogous manner. First, the use of the vertical centerline of the

picture frame as a symmetry line of reflection is a point of physical orientation. This use of the bilateral symmetry line is similar to the research results of Locher and Nodine (1973, 1989). The grid of geometric lines then follows the symmetry alignment pattern, for example, for the line of reflection for both left and right is red, green and yellow lines of the V1/5<sup>th</sup>'s, VFR's and V1/3's respectively, such as, a figure divided in half vertically with the V1/3 lines bracketing the outside measurement. The VFR's describe the same left to right side item next to the V 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines, which describe the same left/right items closest to the center. All the lines are equidistant on the left and right sides. This symmetrical patterning aligns the image elements from a central symmetry line of reflection.

The second type of symmetry is the asymmetrical alignment to HR-RT. In this case, the center of the object is off the vertical center reflection line to the left or right. The set of grid lines aligns to the elements of the composition in a built fashion. For example, if the primary object of the artwork is a face, the VL1/3 (yellow) may align to the placement of the ear on the left side (looking at the face). The VLFR (green) may align to the edge of the left eye on the left side. The VLFR (yellow) may align to the eye on the left side. The 3<sup>rd</sup> 1/5 (red) may align to the side of the face on the right side and the VRFR may align to the right ear. The VR1/3 may align to the right side of the head and hair. This finding is similar to the Locher and Nodine theory of static and dynamic symmetry, and it expands the known information on symmetry as a fundamental core feature of visual perception, which supports Hasse and Weber (2012).

The use of a HR-RT relationship for a specific major composition line, unique to the artwork, is represented in both the Master artists' group and art students' group. The blue dotted line aligns to both symmetrical and asymmetrical arrangements of the HR-RT compositional alignment. Images #369-1 and #376-3 are symmetrical above the vertical centerline. Images #374-8, #374-9, #380-3 and #388-2 are asymmetrical in respect to the HR-RT compositional arrangement.

The specific set of geometric grid lines per each artwork gives a unique description of the spatial location of the objects and items used in the artwork, the semantic meaning and use of HR-RT, all of which are the intentionality of the artist in the making of the composition. The underlying geometric patterning is coordinated with aesthetic appeal (Baxandall, 1988; Bouleau, 1963, Fechner, 1863; Ferg et al., 2011; Helmholtz, 1863; Huntley, 1970). The Master artists and art students created 2-dimensional perceptual architectures using the HR-RT construct. These are mathematical patterns, which connect the 2-dimensional space of the artwork and the 3-dimensional space between the artist and viewer.

The placement of this relational order is more than just a description of objects in 3-dimension being transformed into a 2-dimensional image. The arrangements represent complex geometric patterns that are in an ordered plurality patterning (the incommensurable construct of HR-RT). The Quattrocento Florentine society manifested the success of the seven Master artists' paintings because of the sensory and cognitive expectation of the people. The people intended these visuospatial art demonstrations of the underlying proportional gauging of HR-RT symmetry because their perception of the

geometrics reinforces the many experiences including semantics of its use in their daily lives (Baxandall, 1988).

The review of the 161 art student artworks provides a “controlled comparison of visual information” (Tuft, 1997, p. 53) to the Master artists’ paintings, which uses for both groups the same shape (quadrangles) the rectangle and square. The units of measurement are the spatial mathematics description of the six harmonic ratios (known to elicit a pleasing response following HR-RT (Baxandall, 1988; Bouleau, 1963; Fechner, 1863; Helmholtz, 1863; Huntley, 1970). Explicitly used by the Master artists’ and inherently used by the student artists.

The participants used the four harmonic ratios that were the basis of the Master artists painting compositions ( $1/2$ ,  $2/3$ ,  $3/4$ ,  $9/12/16$ ) and two additional harmonic ratios that are a variation of the  $2/3$  going to the  $4/6/9$  and the  $3/4$  going to the  $3/5$ . These variations, the  $4/6/9$  and the  $3/5$ , are a slightly more complex spatial arrangement of the geometric lines of compositional delineation than the  $2/3$  and the  $3/4$  respectively. The artworks of the  $4/6/9$  and the  $3/5$  compositions describe more of the artwork composition information.

Table 15 includes information describing each image on the level of accuracy and the specific harmonic ratio to the number of images per the type of depth perception. This information combines the occurrence of HR-RT symmetry, the alignment of the type of depth perception and the most accurate score of the delineation of the grid lines.

<u>Image dimensions /level of harmonic ratio with Rule of Three</u>	<u>Strong 3D</u>	<u>Moderate 3D</u>	<u>Low 3D</u>	<u>Inconsistent 3D</u>	<u>Strong 2D</u>	<u>Moderate 2D</u>	<u>Low 2D</u>	<u>Inconsistent 2D</u>
Number of images	21	7	0	0	41	58	25	7
Harmonic ratio 1/2	0	1	0	0	5	5	4	4
Harmonic ratio 2/3	1	2	0	0	8	23	16	1
Harmonic ratio 3/4	8	3	0	0	9	16	5	1
Harmonic ratio 3/5	6	1	0	0	16	13	0	1
Harmonic ratio 4/6/9	2	0	0	0	1	0	0	0
Harmonic ratio 9/12/16	4	0	0	0	2	1	0	0

*Table 15.* Image dimensions on HR-RT, number of images and specific harmonic ratio  
 \*Two images did not have a harmonic ratio relationship in the composition

As reported in Chapter Four, the analysis of the compositions of the 161 artworks using the 5-step procedure found that 78.87 % of the images were an accuracy of strong or moderate for the use of HR-RT. The comparative analysis of the images indicates that the art students had used HR-RT to produce the compositions of the artworks.

Research on depth perception for persons with Trisomy 21 documents a 2-dimensional acuity (Krinsky-McHale, et al. 2014). Depth perception in 2-dimensions is 82.38% of the total number of artworks. Depth perception in 3-dimensions is 28 (17.62%) of the number of images. There were 21 3-dimensional images with a strong level of accuracy and 7 images with a moderate level of accuracy. No images were 3-dimensional with a low or inconsistent accuracy. The 3-dimensional images (28) were

made primarily using the  $3/4$ ,  $3/5$ , and  $9/12/16$  ratios. This finding contributes to the neuroscience research on the making of artworks by persons with disabilities.

The art students used all of the six variations of the harmonic ratios. The harmonic ratios of  $1/2$ ,  $4/6/9$ , and  $9/12/16$  were used the least for both 2 and 3-dimensional images. The art students had low to inconsistent accuracy in 32 (20.12%) images out of 159 (minus the two in the not found category). The harmonic ratio of  $2/3$  (16 images) was used for the highest number of low scores nearly 3 times greater than any of the other ratios.

The majority of the art students used the harmonic ratios  $2/3$  (51 images),  $3/4$  (42 images),  $3/5$  (37 images) which accounted for 130 (81.76 %) of the 159 (minus the two of the not found category). The harmonic ratios of the  $2/3$ ,  $3/4$  and  $3/5$  were primarily used in the 2-dimensional images at the strong and moderate levels. The harmonic ratio  $3/4$  (8 images) had the most 3-dimensional images. The harmonic ratio of  $3/5$  is a variation of the harmonic ratio  $3/4$ .

The range in the complexity of the artwork compositions of the art students was from very simplistic with low accuracy to images that were complex and accurate. The majority of the art student images were at the strong and moderate levels and demonstrated a consistent use of the mathematical construct. A series of two sample t-tests pvalues do not show significance between the Master artists and students on the use of the HR-RT geometric line placement, which indicates that their use was similar.

The HR  $3/4$  ratio vertical  $1/2$  measurement shows a pvalue = 0.03825. This is the lowest pvalue of all the t-tests and this suggests there are possibly other factors that are



influencing this measurement. The vertical 1/2 is the stabilizing static symmetry point for perception (Locher and Nodine, 1973). Further investigation of this finding would be necessary to answer that finding.

The art students created artworks using the same artistic principles employed by artists historically to create artwork compositions. These compositions of the pictorial elements are tangible evidence of the artist's intention. The review of the art students' images in this study does not show a different consciousness in the making of their artworks from that of the Master artists. The art students' artwork compositions demonstrate an innate ability of HR-RT patterning that aligns to the human ability to geometrize. This cognitive ability allows humans to perceptually read and arrange spatial objects with the specific mathematics of ordered plurality (HR-RT) to coordinate the execution and perception of 3-dimensional space externally and internally with spatial sequencing memory that is integral to emotional sensory perception.

The ideation in a number of the participant artworks is strikingly original. The use of unique visual imagery is one aspect of the result of some persons with cognitive and brain disorders according to the research findings of multiple behavioral psychologists (Chatterjee, 2006; Miller et al., 1998; Viskontas & Lee, 2015; Viskontas & Miller, 2013).

The results of the two IRR independent ratings confirm that the assessment by the first rater was within reasonable agreement with the researcher,  $\kappa = 0.6522$ . and that the IRR for the use of HR-RT by the second rater, an artist, was significantly higher at  $\kappa = 0.9379$ . The second rater identified the harmonic ratios that she thought were used in the artworks,  $\kappa = 0.6708$ . The explanation and execution of the process of the IRR can be

developed in relation to the HR-RT construct, which would further improve the ratings in order to create a psychometric scale to assess the artwork compositions. Further research of this HR-RT methodology would improve the process of artwork composition assessment. A larger group of Master artists' paintings at least 30 individuals would give a stronger standard for the HR-RT measurement. Additionally, a group of art judges would help in creating a psychometric scaling of how artwork compositions are assessed, in other words, the decision of the description of artwork compositions using HR-RT (Gable & Wolf, 1993).

Question Three: Did the actions of the art students demonstrate proportional gauging in the making of their artworks? The observations that the art students used proportional gauging in the making of their artworks were of their actions while they made their art in the studios at JLDF. These actions also demonstrated support for individuals with Down syndrome to represent a capacity for spatial sequential memory (Yang, 2014). This spatial sequencing ability reveals the processes of the making of their artworks.

Of particular interest are the actions of drawing with a pencil or pastel, etching with an engraving tool and painting with an artist's paintbrush. These activities demonstrate the ability of proprioception. Proprioception is the unconscious perception of movement and spatial orientation arising from stimuli within the body and conscious awareness of the position of one's body (Armstrong, 2009; Damasio, 2012). The art students demonstrated that they were able to hold the artistic tools in their hands, and they did not have to look at the hand that was drawing, etching, or painting. They were

looking directly at the artwork. The students also worked up close to the artworks within an inch or two and then got back away from the work to observe the work they were doing. This was another demonstration of the action of proportional gauging. The students would study the work and then make additions or changes per an aggregate of sensory and cognitive procedures while engaged in this manner of concentration they were using their visuospatial sequencing memory.

The organization of the sensory messaging systems for the action of proportional gauging is external and internal. The observable range of the operations of human proportional gauging is from movement in 3-dimensional space to the cortical frequency messaging of abstract reasoning, the ideaation. The body of artworks created by the art students over time shows an advance in their visuospatial and bodily kinetic aptitudes as reported by the art teachers (D. Perez & A. Planells, personal communication, June 4, 2015). The art students' visuospatial sequencing memory improved from the instruction of the art teachers' use of the novel curricular designs and consequently their artworks. This finding adds to the exiting neuroaesthetics research on persons with disabilities and the making of artworks. This finding is also supportive of the current research in neuroaesthetics. Wang et al., (2016) have been conducting research to investigate the relationship of fundamental visual features and memory retrieval; this study is supportive of that research.

Artists consistently use the motoric action of proportional gauging to balance the elements within an artwork composition thus employing artistic principles to create an emotional spatial communication between the artist and viewer of the artwork

(Baxandall, 1988; Bouleau, 1963; Cennini, 1960; Eisner, 1994, 2002; Lanteri, 1985). This intentionality by the artist engages the proprioceptive, exteroception, and interoceptive sensory messaging systems (Damasio, 2012). These systems are both conscious and unconscious coordinated multidimensional neural signal systems that provide a qualitative and quantitative assessment to the “signals arriving in the brain-stem structures and in the insula cortices so as to *compose* diverse landscapes for the ongoing body events” (Damasio, 2012, p. 106). These systems relate to an inherent human expression of symmetry because following Damasio (2012), the internal milieu of sensory and cognitive messaging is guided by the HR-RT symmetry (Damasio, 2012; Roopun et al., 2008) to move the intangible process of thought to the tangible, such as, within artwork composition. This inherent expression is important because it can help us to understand how the interaction of the senses facilitate this cortical frequency messaging (Weiss & Weiss, 2003).

### **Overview of the Study**

The researcher of the investigation has endeavored to describe how visuospatial and bodily kinetic aptitudes are connected in the making of 2-dimensional artworks. An investigation of these aptitudes demonstrated in the artwork compositions of persons with significant cognitive challenges has revealed the use of a mathematics art principle, HR-RT. In addition, this study has documented the use of the core feature of visual perception to be symmetry. The art students generally used the construction approach to making their artworks as described by Lajoie for spatial location tasks (Lajoie, 2003). In their art school, the exposure to a novel curriculum supports the art students existing

visuospatial abilities in order to improve their learning. In some cases, the art students' create a unique visual language and their artworks are expressive.

In this research, an education is toward the design of a more rigorous scientific and mathematics investigation of how the MI visuospatial and bodily kinetic aptitudes are associated with and measured by the HR-RT symmetry. HR-RT facilitates the communication between the brain stem and neo cortex and is part of the highly flexible messaging system that can engage visuospatial sequencing memory.

Antonio Damasio provided in-depth analysis of the cortical processes of the development of the self as a multiple step evolution of complex neuro-sensory messaging systems (Damasio, 2012). He suggested the human brain stem as a crucial evolutionary advancement; however, the brain stem region in modern times is regulated to the status of a homeostatic waystation functioning in the shadows of the neo cortex.

This is where the thalamus came to the rescue, as the enabler of an accommodation. The thalamus accomplishes a dissemination of signals from the brain stem to a widespread territory of the cortical mantle. In turn, the hugely expanded cerebral cortex, both directly and with the assistance of subcortical nuclei such as those in amygdalae and basal ganglia, funnels signals to the small-scale brain stem. Maybe in the end the thalamus is best described as the marriage broker of the oddest couple. The brain-stem-cortex mismatch is likely to have imposed limitations on the development of cognitive abilities in general and on our consciousness in particular. Intriguingly, as cognition changes under pressures such as the digital revolution, the mismatch may have a lot to say about the way the human mind evolves. In my formulation, the brain stem will remain a provider of the fundamental aspects of consciousness, because it is the first and indispensable provider of primordial feelings. Increased cognitive demands have made the interplay between the cortex and brain stem a bit rough and brutal, or, to put it in kinder words, they have made the access to the wellspring of feeling much more difficult. Something may yet have to give. I said it would be foolish to take sides and favor one of the three divisions in the process of making consciousness. And yet one has to agree that the brain-stem component has a functional precedence that it remains an entirely indispensable part of the puzzle, and that, for that very reason as well as for its modest size and jam-packed

anatomy, it is the most vulnerable to pathology among the three divisions. This much needs to be said, if only because in the wars of consciousness the cerebral cortex tends to get the upper hand. (Damasio, 2012, pp. 266-7)

The fundamental cognitive components of sensory communication are just as important now, for the sustainable development of our species, as when the sense of ordered plurality that minimizes the use of energy, the awareness of the aesthetic basis of biological value, and the action of proportional gauging coalesced to prescribe a comparative reasoning adaptation for our survival (Chatterjee, 2014).

Looking only from a logical point of view gives a limited concept of intelligence; an over focus on rational thought devoid of emotional coherence (Eisner, 2002). The systematic search of and assessment for a single feature, a “g” factor, was at one time a good idea. Traditionally, an idea that has been successful tends to remain in use in society. This is because ideas are powerful and have the potential to promote change; it is difficult to let them go. Eventually, additional understandings that have been in the periphery get pushed forward precisely because the once useful idea is found to be useful but limited. The concept of a single factor of intelligence limits the potentiality of the optimal human consciousness (Gardner, 1983), which by natural design operates with incommensurable progression (Dewey, 1934; Eisner, 1994, 2002; Huntley, 1970; Schiralli, 2006) and with the design of primordial feelings of biological value (Damasio, 2012).

HR-RT is possibly a guiding system for the emergence of the singular self (Damasio, 2012). Ideas occur to the self and not to a group. The making of painting compositions is an example of this inherent expression. The visuospatial and bodily

kinetic processes translate the artists' ideas into the compositions of 2-dimensional artworks.

### **Significance and Implications for Education**

This study adds to the body of literature that suggests the use of and preference for symmetry is inherent and biologically based. Symmetry is fundamental to both DEMR and the Rule of Three, which are themselves related to the concepts of aesthetics and artistry. Implications from this study for the understanding of an inherent expression for the HR-RT symmetry aligns to current research in neuroaesthetics. In particular, the work of Reber et al., (2004) who demonstrated the ease of processing fluency theory. This theory identifies symmetry as a core feature of perceptual exploration.

In addition, the research of Chatterjee and Vartanian (2014) that revealed the mimicking action of mirror neurons when participants observed implied actions within art works. These types of studies inform curriculum developers. In today's classroom environments with the advanced teaching tools, such as, the smart board technology, visuospatial information is the primary method of delivery of course content. The ease of the visual processing of this style of presentation will be more effective if the teacher is aware of the perceptual systems that involve the HR-RT symmetry.

In respect to the relationship of the use of HR-RT and the concept of creativity, a realization may be that via the use of the artistic principle the organizing feature of the symmetry is activated by the proprioceptive sense to proportionally gauge. These processes then are remembered through spatial sequencing steps to assist in the intangible

becoming the tangible. The tangible would be the artwork compositions of the art students, which are understood by the viewer as the intention of the artist.

There are three reasons why it is important to understand HR-RT and the relationship to curricular designs. First, HR-RT is a mathematics system that facilitates aesthetic selection (Huntley, 1970). This visuospatial and bodily kinetic concordance establishes an optimal balance between our internal and external sensory communication system, which gives preference to an open-state of cognition (Eisner, 2002). The open-state intelligence of a well-oiled messaging system reveals the opportunity for an infinite number of thought processes. First, the self-awareness of the balance of our logical, spatial and aesthetics thinking provides teachers a manner in which they can promote the practice of freedom in an educational environment to encourage innovation (hooks, 1994). Self-awareness improves a teacher's and student's capacity for engagement, to pay attention and accept the responsibilities of education whether teaching or learning.

Second, this investigation has revealed a visual confound in the perception of the combination of geometric and symmetric lines in a 2-dimensional format. The reason that this physiological restriction occurs is that the human visual system is limited in the perception of geometric and symmetry information simultaneously. Human vision is restricted to 2-dimensions (Krinsky-McHale, 2014). The knowledge of this limitation and the learning and practice of visuospatial and bodily kinetic cognitive components is essential for future curricula that address quantum mechanics as an open-state (incommensurable) spatial design (Boughton, Eisner and Ligtoet, 1996). The processes of multiple visuospatial and bodily kinetic perception of stereopsis, light and dark



shadows, color cues, spatial sequencing memory include the visual memory of the 3-dimensional environment and aesthetics communication of the visual maps of our consciousness (Damasio, 2012). More research is needed in the field of neuroaesthetics.

Third, after admitting that they were not able to teach the art students at the Mexican art school the artist principles of the traditional method, Daniel and Alan, began developing a novel curricular program with the JLDF staff that was entirely based on visuospatial and bodily kinetic teaching and learning. They have worked on the unique lessons for the last 24 years. They state that they are on their fourth generation of art students. Each generation of art students continues to create colorful works of art with original ideas that capture the interest and approval of the global community. The art students' techniques and mastery of the art materials confirms the improvement of their spatial sequencing memory.

Visuospatial and bodily kinetic curriculum facilitates the brain stem messaging systems to access and balance cortical processing for the maximal potential of the students. In this instance, the maximal prospective is ideation for creating art. The combined cognitive balance of logical, spatial, and aesthetics thinking at the level of ability for the art students focused on that goal. That is what Daniel and Alan are doing at the Mexican school of art. Their education objective is to help the art students make unique and appealing artworks with their existing cognitive challenges. At this time, it is obvious that they have, beyond all expectations, accomplished that goal.

Present changes in the evaluation of the behavioral phenotype of persons with Down syndrome has important implications in this study because of the unique art

school. Each individual with Down syndrome has talents and challenges not served well by limited grouping factors and this has prompted a reevaluation related to therapeutic and education methods. The question asked today is, how does this phenotype, which is involved in various disabilities, predispose individuals to specific types of outcomes? (Fidler et al., 2009; Leshin, 2003). Various approaches to this change of the theoretical inquiry on the nature of intellectual disability are adaptive behavioral developments for the self-sustainability of the quality of life and unequal impairment of individual domains of performances, which leads to the organic individual domain (OID) profile (Fidler et al., 2009).

The concept of coherence can expand the understanding of disability to include the term heterotypic continuity, which identifies relations between sets of behaviors across different ages of the individual. This then requires a conceptual record of development and not just a statistical assessment (i.e., cognitive assessment of the behavioral phenotype over time) (Fidler et al., 2009). Of the acknowledged phenotypes for Trisomy 21 outcomes of development are the cognitive, social/emotional and motoric development of the students (Fidler et al., 2009). The art students with Down syndrome have referenced these mental and physical factors in this dissertation concerning the making of painting compositions. The heterotypic continuity approach for OID models has the expectation that a developmental research approach can establish a database with which to assess further the validity of the expanded coherence model (Fidler et al., 2009).

## **Discussion of Findings and Limitations**

The natural ability to perceptually read our surroundings and make decisions using visuospatial and bodily kinetic aptitudes is an open-state cognitive design. That is why there is no limit to good ideas (or bad ideas). The art students with Down syndrome are demonstrating that they do not require an extensive memory or phonological skills to come up with good ideas in the making of their art. They are able to perceptually read the environment they are in and make choices that set up artworks that please them. They are successful artists, in part, because of their existing preference for HR-RT symmetry and improved visuospatial and bodily kinetic aptitudes for spatial sequencing memory.

Damasio stated that the connections between the neo cortex and brain stem are bottlenecked at the thalamus and infinitely tied to our biological value system of pleased or not pleased. Our aesthetic selective sense is so basic to our homeostatic bodily functionality that Damasio proposed, “the brain-stem component has a functional precedence that it remains an entirely indispensable part of the puzzle” (Damasio, 2012, pp. 7). Without acknowledgment of assessments that facilitate rather than bottleneck the two major cortical components, the dilemma of the separation of logic, and the emotions will continue to stymie human consciousness.

The main limitation to this research investigation was that there was no random selection of the art images. The images are part of a 46-year archival collection of JLDF. These artifacts are a convenience sample and the research findings are not generalizable to a larger population. In 2010, Prof. García Escamilla, with support from JLDF, published the book, *Mexican School of Down Art*. The story of the art school, the

teachers, the student artists, and their archival works are in the book. Prof. García Escamilla and the art teachers made the decisions of which paintings were to be included in the publication. Publication of the art helped to organize the artwork for review and comparison in this research. The art students represented in the book have been associated with the school, in some cases, since their birth and are very familiar with the environment, so their continued participation in the arts program provides a stable and well-documented population.

Other art students have arrived recently and are new to the arts program. The published art catalogs are a record of the various art shows that these art students have participated in and the catalogs are an additional source of the student artworks used in the study. These preexisting sources of the published archival data present a possible introduction of bias. Traditionally, published artworks are the best representatives of the artists' intentionality and this was the case for the JLDF book on the *Mexican School for Down Art*. There are no other publications besides the art catalogs and the book *Mexican School of Down Art* with professional records of the art students' artworks.

Additionally, the researcher investigated whether the art teachers had influenced the use of the HR-RT symmetry from their attempts to teach the artistic principle. However, during the guided interviews with the teachers, they stated that the art students did not understand even the most simplistic artistic terms.

### **Suggestions for Future Research**

In conclusion, suggestions for future research have two objectives. The first is in the near future. Assessments for visuospatial and bodily kinetic aptitudes can expand to

address the HR-RT phenomenon to further identify the biological processes and provide teachers with a valid instrument in education to identify the curricular connections between the visuospatial and bodily kinetic MI intelligences.

A multiple step procedure for an assessment development would require that a description of the HR-RT aesthetic phenomenon be made available through technology. A HR-RT aesthetic heuristic is now demonstrated in computer code because of the work of this study. The large amount of data from the geometric examination of the 161 art student images, and Master artists provides a novel database from which to access the mathematical, experiential and emotional aspects of the concept. The work of the initial steps to format and write a computer code that defines the construct has initially provided the two sample t-tests and in time much more will be known. Further, computer-assisted research may also reveal evidence of patterns in the artwork compositions of the JLDF art students on the use of the HR-RT symmetry for additional in-depth understandings of the cortical and the sensory messaging of patterns.

Second, this type of research encourages an education initiative that would concurrently support the development of curricula in conjunction with this new field of neuroaesthetics to aid further research on aesthetics. This is what Eliot Eisner knew because he was an artist and taught art. He understood the importance for the evolution of human intelligence. Artists understand the value of incommensurate awareness. A simple example demonstrates the rationale.

To conclude, in March of 2016, the Deep Mind Alpha GO super computer creator, Demis Hassabis, stated to reporters that the one loss in the GO tournament in

South Korea of the computer to GO Master Lee Sedol was a valuable learning tool. When Mr. Sedol was asked about his only win he stated, “This win is invaluable and I would not trade it for anything else in the world” (Se Young Lee, 2016). The difference between something that is valuable and being invaluable is incommensurate design.

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## APPENDIX A

### Data Analysis

#### Computer code/ fundamental algorithm(s) of HR-RT

Data consists of measurements of art-work dimensions as well as absence/presence/placement of both vertical and horizontal lines at fractional distance of 1/2, 1/3, 1/4, 1/5, 1/6, 1/8, 1/9, 1/12 and 1/16. The presence/absence of the various harmonic ratios (HR) was determined by presence/absence of corresponding lines. When a particular HR is present, a score is determined by applying a heuristic. Lines are scored by distance from the ideal (1/2, 1/3, etc). Scores are in the interval [1, 3]. Horizontal and vertical scores are the average of horizontal and vertical line scores, respectively. Horizontal and vertical scores are averaged to give an overall score for the HR. The score is then used to classify the HR as Strong, Medium or Low/Weak. Data was manually transferred from lab notebooks to electronic form in csv files.

#### Statistical Results:

None of the t-tests rise to the level of statistical significance.  
So no difference between students and masters.

=====  
=====

1/2

vertical

(statistic=-0.70661723282852984, pvalue=0.48127184827134661)

horizontal

(statistic=-0.64789774484081042, pvalue=0.51850682994261599)

=====  
=====

HR 2/3

vertical

1/2 (statistic=-0.36610372192788637, pvalue=0.7159661059222846)

1/3 (statistic=-0.47358819473742825, pvalue=0.63830571339802056)

2/3 (statistic=-0.1020433812473147, pvalue=0.91919661959231225)

horizontal

1/2 (statistic=-0.19621763393050279, pvalue=0.8454333230036486)  
1/3 (statistic=0.27596519229516459, pvalue=0.78419775637333933)  
2/3 (statistic=-0.01465040168447623, pvalue=0.98839672141138502)

=====

HR  $\frac{3}{4}$

vertical

1/3 (statistic=0.11708788258525532, pvalue=0.90824758569007547)  
2/3 (statistic=-0.30595036330845138, pvalue=0.76335740721498524)  
1/4 (statistic=-0.92772390984260544, pvalue=0.36318484452194644)  
2/4 == 1/2 (statistic=2.1787266287080076, pvalue=0.038253702022866591)  
3/4 (statistic=-2.1868053476804596, pvalue=0.038738471425237953)

horizontal

1/3 (statistic=0.33553826643755691, pvalue=0.74186608134457699)  
2/3 (statistic=0.25726834017140626, pvalue=0.80025092112877827)  
1/4 (statistic=-0.74414106749912878, pvalue=0.46828908847976258)  
2/4 == 1/2 (statistic=-0.15304535835491956, pvalue=0.87989608561371635)  
3/4 (statistic=-0.80634144004845498, pvalue=0.43186850813535327)

=====

HR  $\frac{3}{5}$

vertical

1/3 (statistic=-1.1039966261281613, pvalue=0.2954509532481896)  
2/3 (statistic=0.43550355630934745, pvalue=0.67244695607177896)  
1/5 (statistic=1.6803361008333431, pvalue=0.11871493008138972)  
2/5 (statistic=-0.90718758922188647, pvalue=0.38216386803707092)  
3/5 (statistic=-1.1838582630567063, pvalue=0.25939004506671748)  
4/5 (statistic=1.9536182020453439, pvalue=0.074456677130206511)

horizontal

1/3 (statistic=-0.38810394402984644, pvalue=0.70534475030849642)  
2/3 (statistic=1.0258064165263232, pvalue=0.32701248196303379)  
1/5 (statistic=1.1357631270365407, pvalue=0.28019593127485992)  
2/5 (statistic=1.1059071496822372, pvalue=0.29236695899422055)  
3/5 (statistic=1.0823361393533664, pvalue=0.3022588935368834)  
4/5 (statistic=1.2228069171612501, pvalue=0.24695485504583306)

All computer code for data processing and analysis is the property of Cary Miller and Theresa Ferg.

## APPENDIX B

### **Selected List of Research Concerned with the Measurement of the Mathematical Construct Division of Extreme and Mean Ratio (DEMR) aka Harmonic ratio with Rule of Three (HR-RT)**

#### “Fechner’s Aesthetics Revisited”

Abstract Gustav Fechner is widely respected as a founding father of experimental psychology and psychophysics but fewer know of his interests and work in empirical aesthetics. In the later 1800s, toward the end of his career, Fechner performed experiments to empirically evaluate the beauty of rectangles, hypothesizing that the preferred shape would closely match that of the so-called ‘golden rectangle’. His findings confirmed his suspicions, but in the intervening decades there has been significant evidence pointing away from that finding. Regardless of the results of this one study, Fechner ushered in the notion of using a metric to evaluate beauty in a psychophysical way. In this paper, we recreate the experiment using more naturalistic stimuli. We evaluate subjects’ preferences against models that use various types of object complexity as metrics. Our findings that subjects prefer either very simple or very complex objects runs contrary to the hypothesized results, but are systematic none the less. We conclude that there are likely to be useful measures of aesthetic preference but they are likely to be complicated by the difficulty in defining some of their constituent parts. © Koninklijke Brill NV, Leiden, 2010

Authors: Flip Phillips, J. Farley Norman and Amanda M. Beers

#### “Preferences for symmetry in Conspecific Facial Shape Among *Macaca mulatta*”

In human males and females, bilateral symmetry of facial shape influences assessments of attractiveness. It is possible, however, that other primate species also possess preferences for conspecific facial symmetry. To assess this experimentally, we presented 13 adult rhesus macaques (8 females, 5 males) with computer-manipulated images of symmetrical and asymmetrical versions of opposite-sexed conspecific faces. We utilized looking behavior to assess visual preferences for these factors. We found significant preferences for symmetry, raising the possibility that human preferences for facial symmetry are more deeply rooted in our evolutionary history than previously realized. Our results also have implications for the use of facial shape as a mechanism for attractiveness appraisals across the Primates. © International Journal of Primatology, 2006, vol 27(1) pp. 133-145.

Authors: Corri Waitt and Anthony C. Little

### “An Algorithm for the EEG Frequency Architecture of Consciousness and Brain Body Coupling”.

The EEG is traditionally categorized into a handful of different frequency bands ( $\delta$ ,  $\theta$ ,  $\alpha$ ,  $\beta$ ,  $\gamma$ ; c.f. Schomer and Lopes da Silva, 2011). This implies that EEG frequencies do not represent an unstructured continuum. But what could be the reasons for that? One obvious reason is that frequency bands such as e.g.,  $\theta$  and  $\alpha$  exhibit a clear task and event related behavior (Klimesch, 1999, 2012; Buzsaki, 2006). But here the emphasis is on a formal aspect, which is to avoid unwanted “spurious” phase synchronization. If the numerical ratio between two frequencies ( $f_1, f_2; f_1 < f_2$ ) is harmonic ( $f_2 = I * f_1; I = \text{integer}$ ), the excitatory phases of the two frequencies can meet and synchronize according to a strict and regular pattern. This is of great advantage when phase coupling between frequencies is an important aspect of neuronal communication. If the ratio differs from a harmonic, spurious (unwanted) phase synchronization will appear in an uncontrolled way. Pletzer et al. (2010) have shown mathematically that the golden mean ( $g = 1.618 \dots$ ) is the best possible ratio to avoid spurious phase synchronization (see also Roopun et al., 2008). These aspects of phase synchronization can be summarized by two assumptions. (a) The center frequency of each EEG band is harmonically related to those of neighboring bands. A good estimate for  $\delta$ ,  $\theta$ ,  $\alpha$ ,  $\beta$  and  $\gamma$  is 2.5, 5, 10, 20, and 40 Hz. (b) The width of a band is defined on the basis of the “golden mean role” (Klimesch, 2012; for an illustration, see Figure Figure1A1A left panel) to guarantee minimal interference between bands. EEG center frequencies which have these properties are termed frequency domains in the following. *Frontiers in Human Neuroscience*, 2013;7: 766. doi:10.3389/fnhum.2013.00766.

Author: Wolfgang Klimesch

### “Quantum Criticality in a ISing Chain: Experimental Evidence for Emergent E8 Symmetry”

Quantum phase transitions take place between distinct phases of matter at zero temperature. Near the transition point, exotic quantum symmetries can emerge that govern the excitation spectrum of the system. A symmetry described by the E8 Lie group with a spectrum of 8 particles was long predicted to appear near the critical point of an Ising chain. We realize this system experimentally by tuning the quasi-one-dimensional Ising ferromagnet CoNb2O6 through its critical point using strong transverse magnetic fields. The spin excitations are observed to change character from pairs of kinks in the ordered phase to spin-flips in the paramagnetic phase. Just below the critical field, the spin dynamics shows a fine structure with two sharp modes at low energies, in a ratio that approaches the golden mean as predicted for the first two meson particles of the E8 spectrum.

Our results demonstrate the power of symmetry to describe complex quantum behaviors. *Science* 327 (2010), 177-180.

<https://arxiv.org/ftp/arxiv/papers/1103/1103.3694.pdf>

Authors: R. Coldeal, D.A. Tennant, E.M. Wheeler, E. Wawrzynska, D. Prabhakaran, M. Telling, K. Habicht, P. Smeibidl, K. Kiefer

#### “Strange Nonchaotic Stars”

The unprecedented light curves of the Kepler space telescope document how the brightness of some stars pulsates at primary and secondary frequencies whose ratios are near the golden mean, the most irrational number. A nonlinear dynamical system driven by an irrational ratio of frequencies generically exhibits a strange but nonchaotic attractor. For Kepler’s “golden” stars, we present evidence of the first observation of strange nonchaotic dynamics in nature outside the laboratory. This discovery could aid the classification and detailed modeling of variable stars. *Physical Review Letters*, 2015, vol 114(5)

<http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.114.054101>

Author: John F. Lindner, Vivek Kohar, Behnam Kia, Michael Hippke, John G. Learned, and William L. Ditto

#### “Non-standard Visualizations of the Fibonacci Numbers and the Golden Mean”

Fibonacci numbers and the Golden Mean are numbers and thus 0-dimensional objects. Usually, they are visualized in the Euclidean plane using squares and rectangles in a spiral arrangement. The Golden Mean, as a ratio, is an affine geometric concept and therefore Euclidean visualizations are not mandatory. There are attempts to visualize the Fibonacci number sequence and Golden Spirals in higher dimensions [11], in Minkowski planes [12], [4] and in hyperbolic planes (again [4]). The latter has to replace the not existing squares by sequences of touching circles. This article aims at visualizations in all Cayley-Klein planes and makes use of three different visualization ideas: nested sets of squares, sets of touching circles and sets of triangles that are related to Euclidean right angled triangles. Key words: Cayley-Klein geometries, Fibonacci numbers, Golden Mean, *KoG* 18.18. (2015): 36-44

Authors: Gunter Weiss and Sybille Mick

## APPENDIX C

### **A Brief Description of Projective Geometry and the Relation to Artist's use of Linear Perspective and Harmonic Ratios with Rule of Three: In Specific Cases Both Represent the Same Projective Geometry**

From Ian Stewart (2007) *Why Beauty is Truth*:

The Renaissance painters discovered how to apply geometry to perspective. They found geometric rules for drawing images on paper that really looked like three-dimensional objects and scenes. In so doing, they invented a new and extremely beautiful kind of geometry [...] The method was brought to perfection in the paintings of Piero Della Francesca, who was also a consummate mathematician. The essence of perspective is the notion of "projection", by which a three-dimensional scene is rendered on a flat sheet of paper by (conceptually) drawing each point of the scene to the viewer's eye, and seeing where the line meets the paper. A key idea is that projections distort shapes in ways not permitted by Euclid. In particular, projection can turn parallel lines into lines that meet. [...] Every artist who makes perspective drawings with a horizon line and "vanishing points" is using projective geometry. [...] If this reminds you of the Fano plane, you're right. The Fano plane is a finite projective geometry. From the Renaissance perspective to the exceptional Lie groups is now but a short step. The projective plane that was implicit in Alberti's methods was made explicit as a new kind of geometry (Stewart, 2007, p.270). Around 1956, the Russian geometer Boris Rosenfeld, perhaps thinking about the magic square, conjectured that the three remaining exceptional groups  $E_6$   $E_7$  and  $E_8$  are also the symmetry groups of projective planes (Stewart, 2007, p. 272).

From Keith Devlin (1994) *Mathematics: the Science of Patterns*:

[...] There are two kinds of projection. First there is projection from a single point, also known as central projection [...]. This is the kind of projection used by the painter, where the projection is the painter's eye. Then there is parallel projection, sometimes referred to as projection from infinity. [...] This would correspond to the hypothetical case, where the painter's eye was infinitely far away from the scene and the canvas (Devlin, 1994, p. 132).

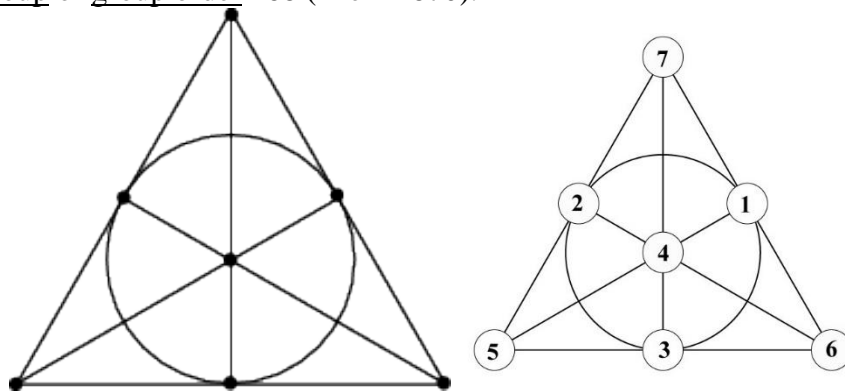
From WolframMathWorld:

The branch of geometry dealing with the properties and invariants of geometric figures under projection. In older literature, projective geometry is sometimes called "higher geometry," "geometry of position," or "descriptive geometry" (Cremona 1960, pp. v-vi).

The most amazing result arising in projective geometry is the duality principle, which states that a duality exists between theorems such as Pascal's theorem and Brianchon's theorem which allows one to be instantly transformed into the other. More generally, *all* the propositions in projective geometry occur in dual pairs, which have the property that, starting from either proposition of a pair, the other can be immediately inferred by interchanging the parts played by the words "point" and "line." The axioms of projective geometry are:

1. If  $A$  and  $B$  are distinct points on a plane, there is at least one line containing both  $A$  and  $B$ .
2. If  $A$  and  $B$  are distinct points on a plane, there is not more than one line containing both  $A$  and  $B$ .
3. Any two lines in a plane have at least one point of the plane (which may be the point at infinity) in common.
4. There is at least one line on a plane.
5. Every line contains at least three points of the plane.

6. All the points of the plane do not belong to the same line (Veblen and Young 1938, Kasner and Newman 1989). Retrieved on August 4, 2016, <http://mathworld.wolfram.com/ProjectiveGeometry.html>. The Lehmers (1974) found an application of the Fano plane for factoring integers via quadratic forms. Here, the triples of forms used form the lines of the projective geometry on seven points, whose planes are Fano configurations corresponding to pairs of residue classes mod 24 (Lehmer and Lehmer 1974, Guy 1975, Shanks 1985). The group of automorphisms (incidence-preserving bijections) of the Fano plane is the simple group of group order 168 (Klein 1870).



The Fano Plane, a geometry with seven points and seven lines

The two-dimensional finite projective plane over  $GF(2)$  ("of order two"), illustrated above. It is a block design with  $v = 7$ ,  $k = 3$ ,  $\lambda = 1$ ,  $r = 3$ , and  $b = 7$ , the Steiner triple system  $S(7)$ , and the unique  $7_3$  configuration. The incidence graph of the Fano plane is the Heawood graph. Weisstein, Eric W. "Fano Plane." From MathWorld--A Wolfram WebResource. <http://mathworld.wolfram.com/FanoPlane.html>



## APPENDIX D

### Down syndrome Condition

#### History of the John Langdon Down Foundation A.C.

The unique group of art students at the Mexican School of Down Art at the JLDF school has the biological condition known as Down syndrome or Trisomy 21. In 1866, a physician, John Langdon Down, wrote about the characteristics of the children in an asylum in Surrey, England that identified them as having Down's syndrome. Today, the term Trisomy 21 is used or the condition can be referred to in the person-first language as persons who have Down syndrome. In 1959, Jerome Lejeune and Patricia Jacobs, working independently, discovered that the cause of Down syndrome was the trisomy (triplication) of the 21<sup>st</sup> chromosome (Leshin, 2003; NIH, 2017).

Human cells have 46 chromosomes, which are arranged in 23 pairs in the typical meiosis (cell division) process. During this reproduction, the cells split in two so that the resulting cells have half the number of chromosomes of each parent cell. A karyotype of the number and type of chromosome shows the 22 evenly paired chromosomes and the sex chromosomes XX (female) and XY (male). In 95% of Trisomy 21 cases, during cell division, the pairs of chromosomes split up and go to distinct locations in the dividing cell; this is called *non*-disjunction. If one pair does not divide, then the entire pair goes to a specific location. That one cell will have 24 chromosomes, but the other will have 22 chromosomes. When the sperm or egg with the nonnormal number of chromosomes combines with a normal matched cell, then the fertilized egg will have cells with two 21<sup>st</sup> chromosomes and not one. This result in the fertilized egg's having three 21<sup>st</sup>

chromosomes and the condition known as Trisomy 21. This non-disjunction occurs after fertilization. The cause of the non-disjunction is not known but is associated with advanced maternal age (Leshin, 2003; NIH, 2017).

Current research has focused on the causes and timing of the nondisjunction event. Additional types of Trisomy 21 are known as Robertsonian translocations. In these partial trisomy cases, two chromosomes, the 14<sup>th</sup> and 21<sup>st</sup> chromosomes, are rearranged so that an extra 21<sup>st</sup> chromosome replaces some of the 14<sup>th</sup> chromosome. This condition may be inherited and can be checked by studying the parent's karyotype. In the case of mosaicism, the individuals have a combination of cells; some are typical and others have Trisomy 21. Less than 2% of the Trisomy 21 types are the result of mosaicism (Leshin, 2003; NIH, 2017).

Because the 21<sup>st</sup> chromosome is thought to contain approximately 200 to 250 genes, it has the smallest quantity in relation to the gene number of the other human chromosomes. A significant amount of research has been focused on this chromosome to map the full configuration. Trisomy 21 gives an extra set of genes, which leads to an overexpression of the genes in the 21<sup>st</sup> chromosome. Studies of the Trisomy 21 condition have established that the presence of variable penetration, which is the effects of the presence or not of an allele, produces a variation within the Trisomy 21 population of the behavioral phenotype (Leshin, 2003; NIH, 2017).

Phenotypical characteristics of the Down syndrome population are slow mental and physical development. The range of intellectual ability as measured by the intelligence quotient (IQ) is from 40 to 70. It is thought that the observation of improved

performance with age in cognitive ability indicates a slower than typical brain maturation. After reaching adolescence the IQ of people with Down syndrome plateaus and may even decrease. Down syndrome is a neurodegenerative disorder. Physical characteristics are upward slanting eyes, flattened facial profile and nose, small ears, hands and feet, low muscle tone and loose joints, and a short neck (Dierssen, 2012).

### **History of the John Langdon Down Foundation A.C.**

The history of the conception of the school and the success of the vision for the purpose of the school has been the catalyst for the creation of the phenomenal artworks. A brief synopsis of the historical events recapitulates a qualitative portraiture (Lawrence-Lightfoot and Davis, 1977) of the school and the founder.

The John Langdon Down Institute was officially opened April 3, 1972 on Boulevard de la Luz 232, Jardines del Pedregal de San Angel in Mexico City, Mexico. The founder Prof. García Escamilla was motivated to begin the school because her first-born son, Eduardo, was born with Down syndrome on May 8, 1967. Prof. García Escamilla was familiar with the experience and knowledge needed to open a school because her parents had created a boarding school for girls and that early life experience was her source of inspiration. The primary focus initially was to find a way to provide an educational future for her son Eduardo. Prof. García Escamilla stated,

At the time, neither in Mexico nor abroad were there any centers dedicated exclusively and specifically to the medical, psychological, and educational care of children with Down syndrome. I decided then to open such a center to specialize in addressing the needs of these children. It would be the first of its kind in Mexico or elsewhere. I anticipated that the task would not be easy and that I would encounter many difficulties and challenges. We would have to develop our own programs and then adapt and modify them over time. Nevertheless, I was

certain that a trail had to be blazed on the long road to success, and so I set to work. (Foundation John Langdon Down A.C, 2010, p. 35)

The Institute was renovated to accommodate the classrooms, offices, dining room, medical office, psychological cubicle and playground “in accordance with plans and programs based on the principles of special education” (Foundation John Langdon Down A.C., 2010, p. 36).

Tragically, Eduardo died of injuries from an accidental fall on December 31, 1972 and this situation was devastating to Prof. García Escamilla and her family. Prof. García Escamilla came to understand that Eduardo had provided her with a life’s mission that belonged to both of them and that through the mission of continuing the school they would share in the goal of the other students’ successes. In her grief she realized,

Eduardo did not live in vain. He came to accomplish a mission and then was gone in the blink of an eye, leaving indelible, eternal memories. He left me his love and a new path previously unknown to me. He taught me to know children like him, to understand them to love them and to fight for them. It became crystal clear to me that it is essential for such children to be given every opportunity to attain their optimal development. They deserve what all children deserve: to be recognized as human beings with every right to a dignified, full, and happy life. (Foundation John Langdon Down A.C., 2010, p. 38)

We all receive experiences that build within us greater strengths and Prof. García Escamilla’s conviction to continue the school, in memory of Eduardo, was a decisive moment. As the years progressed and the school initiated programs for medical exams, language therapists, psychologists, and special education teachers, community awareness of the school began to impact local then regional groups who were organized to disseminate the wealth of information coming from the school. Prof. García Escamilla was invited to attend and then organize numerous conferences and groups, the National

Down Syndrome Congress (NDSC) in 1972, the American Association on Intellectual and Developmental Disabilities (AAIDD) in 1972 and the First National Conference on Down Syndrome in México in 1973 (Foundation John Langdon Down A.C., 2010). It was at this time that Prof. García Escamilla made a perceptive observation. She realized that the school had to be ready to make substantial changes to accommodate developments in the education and care of the students.

One of the changes was to create a school for the parents of students with Down syndrome. The parents were great collaborators who supported and maintained the training the students were receiving from the school. In 1979, Dr. Valentine Dimitriev from the University of Seattle, Washington, recommended that Prof. García Escamilla write a book on the progress her school had made in program development for the early intervention of children with Down syndrome. The book was *El Niño con Síndrome de Down* (1981) and the publication of the information led directly to the organization of the first and second World Conferences on Down Syndrome in México City in 1981 and 1983 (Foundation John Langdon Down A.C., 2010).

A group of influential people in México with a vision for the future combined their efforts with Prof. García Escamilla to ensure the success of the school and provide for new and expanded facilities to create the renamed John Langdon Down Foundation and dedicated on July 6, 1993 (Foundation John Langdon Down A.C., 2010). This change brought about two significant events. First, the expansion of the facilities allowed for a state of the art building and grounds through which the interactions with the global community increased and brought additional medical, scientific and psychological

advancement information about the Down syndrome condition to the school for dissemination to the Mexican and Latin American communities.

Secondly, the additional space of four large workshops to create art studios gave an opportunity for artistic creative expression. Prof. García Escamilla had placed, for the first generation of art students, those students that had been involved at the school for the student's entire life. The students were very familiar with the school and had great confidence that the new arts experiences would be just as positive and nurturing as they had already experienced in the school environment. In 1994, Prof. García Escamilla observed that the students who were taking the arts classes had demonstrated remarkable artistic talent.

Prof. García Escamilla's response for the artistic educational development of the students was to hire two teachers, Daniel Perez and Alan Planells, from the famous "La Esmeralda" National School of Painting, Sculpture and Engraving in Mexico City. These excellent artists were to teach the students at the arts school (Foundation John Langdon Down A.C., 2010). With gentle guidance by the teachers, their work with the students during the last 20 years has helped to bring out the creativity and artistic genius. Prof. García Escamilla recounts the experience of the discovery.

The thrill we experienced in those early days is unforgettable. The joy we felt when discovering the talents that had been kept hidden for so long in our students and noticing the positive effect this revelation brought to them, giving their lives meaning, proved the best possible reward we could receive. Seeing the pride in their faces and the glow in their eyes when they show their works to visitors, we feel as though we are part of that achievement. Their joy is our joy, their passion, our passion. (Foundation John Langdon Down A.C., 2010, p. 79)

In 1995, the artwork *My City* by Victor Lora won first prize in the Coyoacán neighborhood in Mexico City. The event was called “Paint Your World: Images of the Place Where I Live” and organized by the National Population Council, and the United Nations Population Fund and the Population State Council of the Federal District. The artwork was then sent to the contest in Mexico City, where it won first prize again. The painting was sent to the national level contest in all of Mexico where it received an honorable mention, and then, on to a contest in New York City. None of the judges in the various contests knew that the artist was a young adult with Down syndrome (Foundation John Langdon Down A.C., 2010). At another venue, the art students were in the Mexico City Museum and asked to participate in an impromptu painting contest. Armando Robles created a drawing that won first prize and a new bicycle.

The first show of the artist’s works was held at the Mexicana de Aviación Gallery in 1997. The show was a success and Prof. García Escamilla, after hearing the advice and opinions of art specialists, realized that it was time to become an art school. The art school was formally called the Mexican School of Down Art. The main goals of the school were “to foster the development of abstract thought, to promote expression and communication, to foster full enjoyment of their human rights and fundamental freedom, to develop awareness in society, and to fight stereotypes and prejudices regarding their artistic capacities” (Foundation John Langdon Down A.C., 2010, p.87). The fine arts program was divided into five categories:

1. Visual and artistic education
2. History of art
3. Expression and picture appreciation
4. Expression and graphic appreciation

5. Tools and materials  
(Foundation John Langdon Down A.C., 2010, p. 87)

In 1999, Prof. García Escamilla had the opportunity to participate in a conference organized by the American Association on Intellectual and Developmental Disabilities (AAIDD). Some of the artists' work was on display and one of the visitors was Travis Thompson, a specialist in intellectual and developmental disabilities. Dr. Thompson was very impressed with the artists' works and invited them to show at the John F. Kennedy Center for Research and Human Development at Vanderbilt University in Nashville, Tennessee (Foundation John Langdon Down A.C., 2010).

Then, in 2002, Dr. Thompson, who was the director of the Child Development Center at the University of Kansas, arranged to have the artworks displayed in Kansas City. After hearing about the show in Kansas City, David Braddock, associate vice-president of the University of Colorado and executive director of the Coleman Institute for Cognitive Disabilities planned for the art to be shown at the Boulder Museum of Contemporary Art in an exhibit called *Artists without Borders* in 2002. The artist's works were again displayed in Boulder, Colorado in 2003 at the University Memorial Center Art Gallery (Foundation John Langdon Down A.C., 2010).

The Mexican School of Down Art was invited to participate in the International Cervatine Festival in Guanajuato, Mexico in 2004 and from this event; a connection was made with, Christine Aebi, the director of a pediatric hospital in the town of Biel, Switzerland. Dr. Aebi arranged for the artworks of the students to be exhibited at the Paul Klee Museum in the city of Bern. An important exhibit held in Geneva, Switzerland in



2007 was hosted by the Office of the United Nations High Commissioner for Human Rights at the Palais Wilson on the Shores of Lake Geneva.

During the speech given by the U.N. High Commissioner for Human Rights, Louise Arbour, stated that the Convention on the Rights of Persons with Disabilities would soon be ratified and that the artworks of the artists from the Mexican School of Down Art were “tangible representations of the objectives and principles of the new Convention” (Foundation John Langdon Down A.C., 2010, p. 94). As a result of the two exhibits in Switzerland in 2007, the artworks were incorporated into Mexico’s Foreign Cultural Program at the Educational and Cultural Cooperation Office of the Foreign Affairs Ministry. The works were divided into two travelling exhibits: *Colors of the Soul* and *Colors of the Wind*. The two exhibits were sent to forty cities in Europe, the United States and Asia.

There have been continuous student art exhibits in Switzerland, Germany, Denmark, Poland, Spain, United States, Japan, France, Italy, China, Belgium, Korea, Indonesia, Brazil, and Chile from 2006 to 2016. These events have been held in some of the world’s most famous locations and buildings. Prof. García Escamilla confidently reviews the amazing accomplishments and purpose of the last 22 years of the art school.

The mission of the Mexican School of Down Art serves as an example for the whole world to witness as our itinerant exhibitions travel throughout the Americas, Europe and Asia. We are proud to convey the light and colors of Mexico through the works of our exceptional artists, whose artistic maturity bears witness to a hard-fought and admirable effort to overcome adversity. The history of Mexican painting thus opens a new cultural chapter that is fascinating and, first and foremost, all inclusive. (Foundation John Langdon Down A.C., 2010, p. 101)

APPENDIX E

**Participant Questionnaire**



Cuestionario para el estudiante de la Fundación John Langdon Down

Número de secuencia

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Gracias por su disposición de participar voluntariamente en este estudio. Responda a cada uno de los siguientes ítems haciendo un círculo en la respuesta o escribiendo la respuesta que lo representa con más exactitud. Por favor escriba en letra de imprenta. Sus respuestas serán estrictamente confidenciales.

Género 1. Femenino 2. Masculino

Edad \_\_\_\_\_

Antecedentes educativos

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Circunstancias familiares actuales

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Tipo de síndrome de Down

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Historial medico

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Interés en el arte

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Comentarios sobre el aprendizaje para realizar trabajos de arte.

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Confirme las acciones y los movimientos del estudiante de arte; describa cómo realiza su arte:

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¿Algún otro comentario?

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## APPENDIX F

### Informed Consent Form Signed by Prof. Escamilla on Behalf of the 21 Participants

*University of Denver  
Social, Behavioral, and Educational Research  
Informed Consent Form*

**Approval Date: May 14, 2015 Valid for Use Through: May 13, 2016**

**Project Title: Investigation of the Visuospatial Ability of Art Students with  
Trisomy 21**

**Principal Investigator: Theresa Ferg**

**Faculty Sponsor: Dr. Karen Riley**

**DU IRB Protocol #: [574005-3]**

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Informed Consent Letter

Dear Student/Parent Guardian,

I am asking that you participate in a research project which is to study how people process information as they learn. This letter will explain what I am asking you to agree to so that you can decide whether or not to participate. Read this letter carefully and ask any questions. If you agree to participate, sign the letter. Signing a letter such as this is known as "informed consent," and we are required by law to provide it to you and to answer any questions you have about the research it describes. You will be given a copy of the letter to keep.

Your participation will require that you give permission for the researchers to analyze the composition of your artwork(s) that were published in the book, *Mexican School of Down Art*, by the John Langdon Down Foundation and School. Also, you will be asked to fill out a questionnaire. This should take about 30 minutes. Only the research personnel on this project, myself and Dr. Karen Riley, the faculty sponsor, will be able to link you to your answers on the survey or your artwork. None of the other collaborators will have access to this information. Each student artist will be given a study number that will be used in place of a name or other identifier for this study.

**What will happen if you decide to participate:**

- a) Both the participant and his or her parent or guardian will sign this informed consent letter.
- b) You will be given a questionnaire by someone at the school to fill out for the study.
- c) Your records at the school will be reviewed.
- d) Your art works will be analyzed for a mathematical composition.

**Risks:** There are possible risks and benefits to all research. There are no physical risks in this study. It is possible that you might be embarrassed as you provide your responses to the questionnaire, but remember there are no right or wrong answers. Participants may choose to skip any questions and may stop participation in the survey at any time. **However, it is**

**University of Denver  
Social, Behavioral, and Educational Research  
Informed Consent Form**

**important to note that once de-identified data has been published, we cannot remove your information.**

Your time commitment may cause some minimal inconvenience. You will be asked to set aside time to answer the questions and give the completed questionnaire to *Prof.* García-Escamilla. If you choose to not participate you will not be penalized or have a loss of benefits in any way. You may be assured that the information you provide will be kept confidential.

**Benefits:** Your participation will be contributing to information that will be helpful for education projects. Additionally, the information will be used to further scientific research about the knowledge of human perception.

**Contact information:** If you have any questions about this research study, please contact me through email Theresa.Ferg@du.edu or *Prof.* García-Escamilla at Selva 4 Insurgentes Cuicuilco, Coyoacan, 04530 Mexico City, Mexico. Her email, ~~contacto@fjldown.org.mx~~ *sylviagescamilla@fjldown.org* and Tel: (52-55) 5666 8580. You may also contact the Office of Research and sponsored programs at the University of Denver 2199 S. University Blvd., 222 MRB, Denver, CO 80208, phone 303-871-2121, email orsp@du.edu with questions concerning your rights as a research participant.

I have read the above letter from Theresa Ferg and consent to participate in this study.

Participant name *Johanna Angdon Down Foundation*  
*Students from the Mexican School of Down Art* Date *09/06/2015*  
Parent/ Guardian *Prof. Sylvia Garcia Escamilla* Date *June 5, 2015*  
Phone *(52-55) 5666-8580* Email address *sylviagescamilla@fjldown.org.mx*



## APPENDIX G

### **Role of the Researcher**

The researcher brings artistic, science and mathematical backgrounds to the investigation of the use of the HR-RT construct by the JLDF art students. She is qualified to analyze the artwork compositions of the two art groups and to observe the art school where the JLDF art students make the art. The researcher is an accomplished artist, who is known internationally for her commissioned realistic sculpture portraits and figures. The researcher received a Bachelor of Fine Arts (BFA) degree in 1974 with a dual major in painting and sculpture from the University of Colorado (CU) Denver campus. She received a Master of Arts (MA) degree in 1976 with a major in bronze casting and sculpture from the University of Northern Colorado (UNC). The researcher completed a Master of Integrated Sciences (MIS) degree in 2005 at the University of Colorado Health Sciences Center (UCHSC) downtown campus.

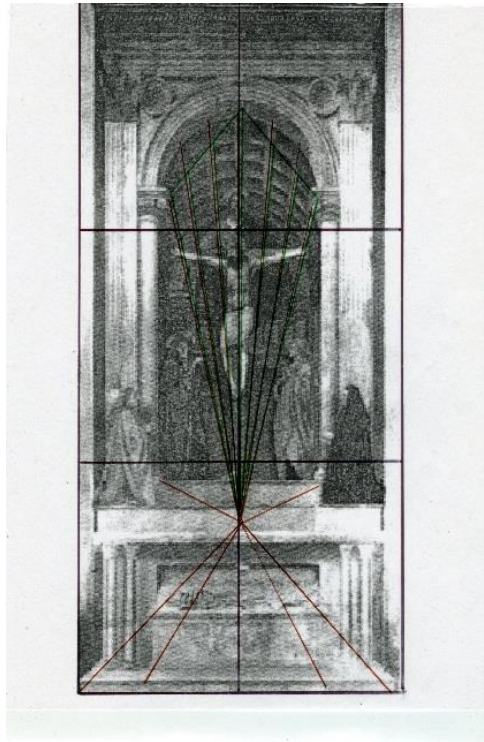
A novel 77-step geometric proof expanding the known information on the mathematical construct division of mean and extreme ratio (DEMR), a part of the mathematical property of HR-RT, was created for the psychophysics human subjects research on a preference for dynamic symmetry i.e., DEMR, for the Master's Degree. Project Title: *Investigation of a causal relationship of an aesthetic appeal to a mathematical construct division of extreme and mean ratio (DEMR)*. Principal Investigator: Theresa Ferg Faculty Sponsor: Dr. Peter Kaplan, Chair of the Psychology Department, University of Colorado Health Sciences Downtown Campus Human Subjects Research Protocol #: [981]. The geometric proof, "Identify the Human's

Pleasing Unconditional Response to Dynamic Symmetry,” reference case number CU1192D, contact Kate Tallman, Licensing Associate, Technology Transfer Office, University of Colorado at Boulder, 303-492-5732 or [kate.tallman@colorado.edu](mailto:kate.tallman@colorado.edu).

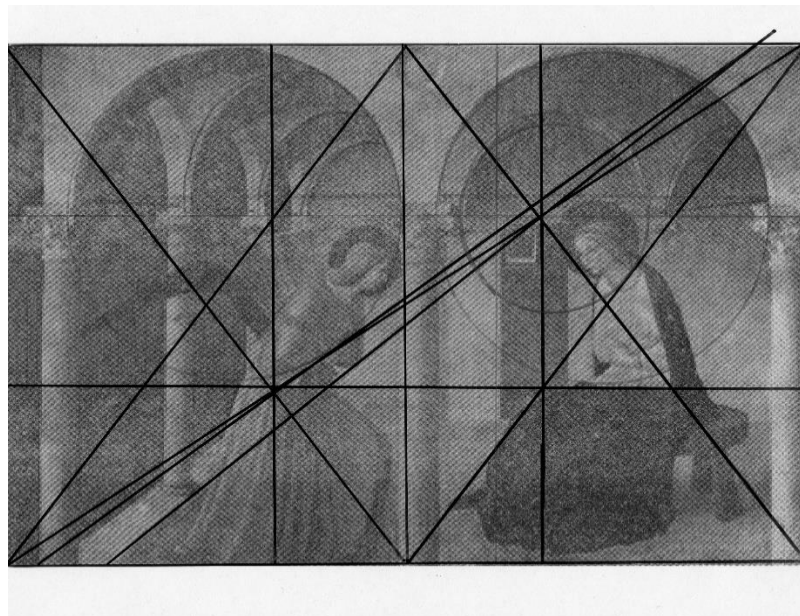
In 2011 the Journal of the International Association of Empirical Aesthetics, *Empirical Studies of the Arts*, Baywood Publishing, Executive Editor: Dr. Oshin Vartanian Title of Manuscript: *Preference Judgment for Dynamic Symmetry* (Ferg, Kaplan, Coussons-Read, & Briggs, 2011) published the information from the Master’s Thesis in the article in the July 2011, Volume 2 ISSN: 0276-2374.

APPENDIX H

The Historical Painting Composition Analyses of the Seven Master Artists

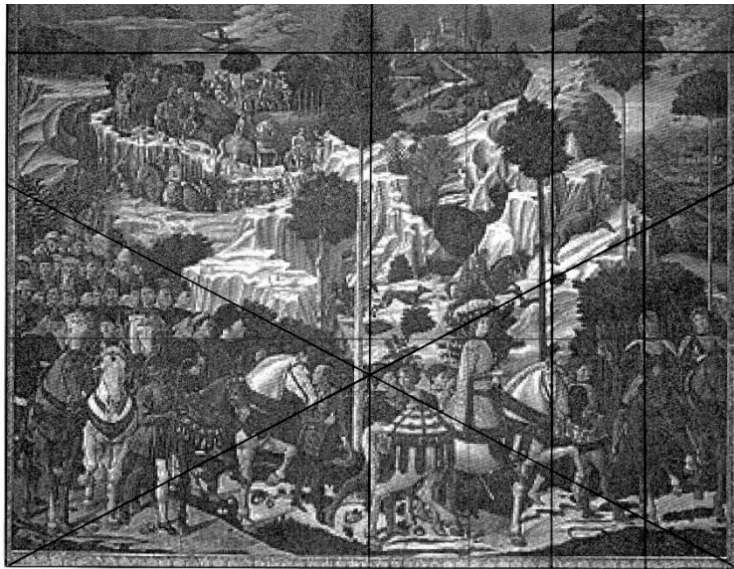


1. *The Trinity* by Masaccio

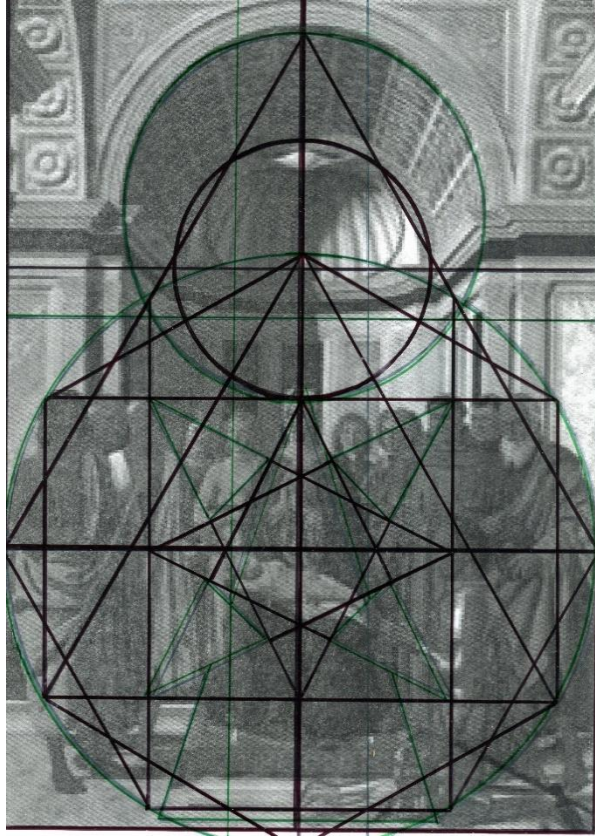




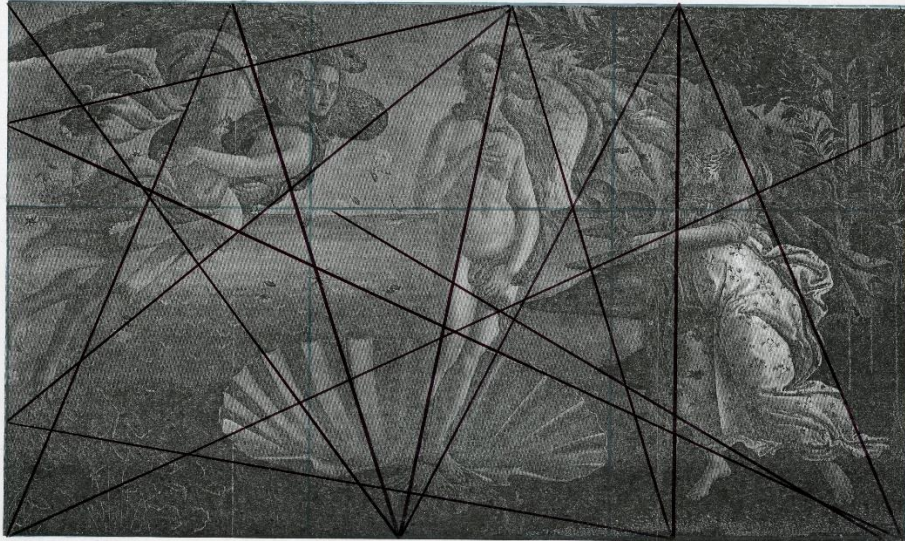
2. *The Annunciation* by Fra Angelico



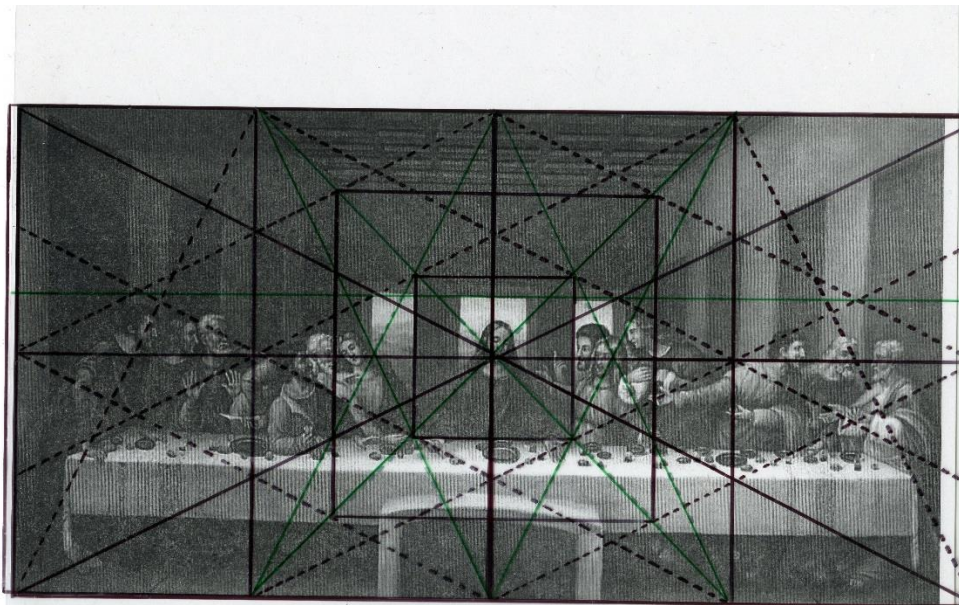
3. *Procession of the Magi* by Benozzo Gozzoli



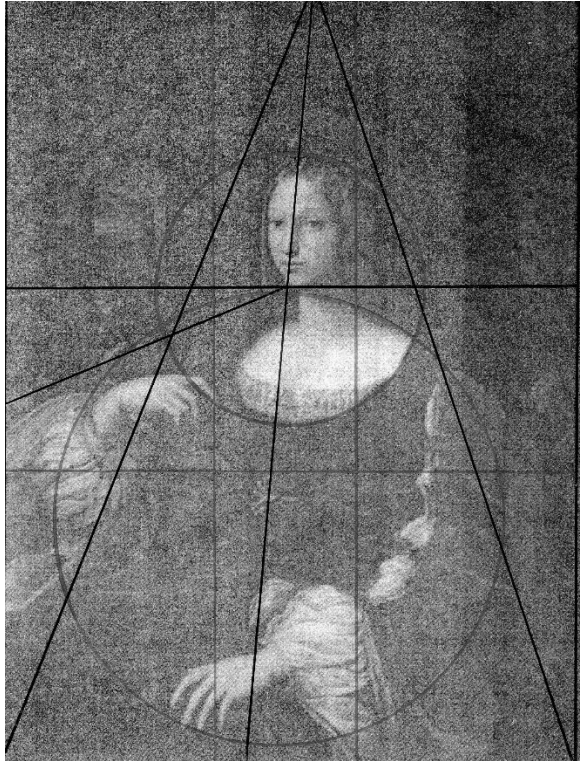
4. *Madonna with Child and Saints* by Piero della Francesca



5. *The Birth of Venus* by Botticelli



6. *The Last Supper* by Leonardo da Vinci

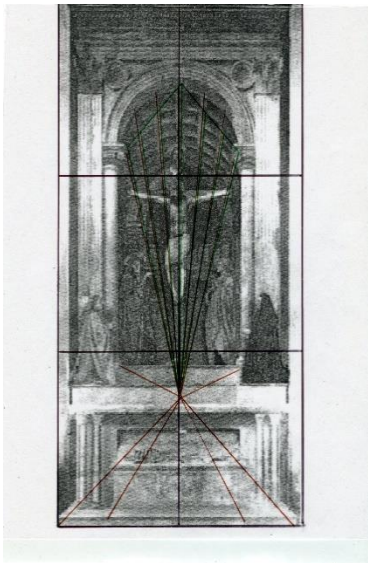


7. *Lady Viceroy of Naples* by Raphael

For this study, seven images from the Quattrocento that demonstrate the HR-RT construct will be used to compare to the art student works. These images include *The Trinity with the Virgin and Child and St. John* (1425–1427), *The Annunciation* (1432), *Procession of the Magi*, c. 1459–1464, *Pinacoteca di Brera of the Madonna with Child and Saints* (1472-1474), *The Birth of Venus* (1482-1485), *The Last Supper* (1495-1498) and *Dona Isabel de Requesens, Lady Viceroy of Naples* (1518). These seven master artist painting were chosen because they are excellent examples of the use of HR-RT in the

making of the compositions of the artworks. Each image will be described in chronological order. This progression of the Master artworks over time is important because it shows a consistent use of the HR-RT.

In 1425, the painter Tommaso di Ser Giovanni di Simone, aka Masaccio (1401–1428) created one of the first frescos that demonstrated linear one-point perspective. The fresco is entitled *The Trinity with the Virgin and Child and St. John* (1425–1427). The location of the painting is the Santa Novella Church in Florence, Italy. It is nearly 667 cm x 317 cm in size and is displayed on the left wall of the nave of the church, which is directly opposite the entrance.



*Figure 2.* Historical Compositional Painting Analysis for *The Trinity* by Masaccio.

The underlying harmonic composition is a diapente,  $\frac{2}{3}$  the fifth, and there is a vertical line down the middle and the two horizontal intersection lines cross the vertical at the location of the dove (representing the Holy Spirit) and near the base of the cross marked by the height of the shadow on the garment of St. John. The vanishing point is

below the base of the cross and from the vaulted ceiling perspective lines, a described dynamic symmetry kite image (Ferg et al., 2011). This is precisely aligned, using the same mathematic concept as HR-RT to the space that encloses the area where God, the Holy Spirit, and Christ are simultaneously described to the linear perspective of the vaulted ceilings in the painting. Therefore, the linear perspective is precisely a HR-RT construction in the focal point of the painting. The size of the fresco engages the viewer at eye level to participate in the experience of the crucifixion of Christ (Baxandall, 1988; Harris & Zucker, 2005).

Fra Angelico created the painting *The Annunciation* in 1432. The painting was a fresco; the dimensions are 230cm x 321cm. The artwork is in the corridor at the top of the second floor stairs at the San Marco Monastery in Florence, Italy. The painting is of the Archangel Gabriel announcing to the Blessed Virgin Mary the Immaculate Conception. For the fundamental harmonic composition, Fra Angelico used the diapason double (ratio 1/2). On this framework, he placed a subdivision of a root two rectangle. The nine rectangles and a portion of the interlocking triangles are HR-RT relationships. The vanishing point in the painting lines up with both large circles of the double diapason. The harmonic subdivisions and linear perspective all identify the doorway to the Virgin's garden, a crucial religious icon in the representation of the story of the Annunciation. Fra Angelico aligned the modular harmonic design with circles (after Brunelleschi) to a complex root two division with one-point linear perspective to give a spatially balanced composition with muted emotion. The painting was placed openly in the monastery where the monks would be reminded throughout the day of their devotional humility to

God and the Virgin's acceptance of the Annunciation as was depicted in the painting (Hood, 1993; Welch, 1977).

Benozzo Gozzoli created the painting *Procession of the Magi*, c. 1459–1464, for the Medici family. The fresco, which is approximately 405 cm x 516 cm, is on the east wall that leads to the main altarpiece in the Chapel of the Medici Palace in Florence, Italy. This painting was one of three that Gozzoli created and it shows the procession of the youngest king. The fundamental harmonic composition of the fresco was a  $2/3/4$  division of the octave  $1/2$  into the fifth  $2/3$  (diapente) and the fourth  $3/4$  (diatessaron). In the painting, Gozzoli narrated the story of the procession of the Magi over time. He used the idea of a winding pathway to depict the events that were associated with the religious narrative. This method of pictorial storytelling was a strategy of the Quattrocento Master artists to engage the viewer's attention. Each event of the story was spatially segregated into vignettes. In addition, the use of the  $2/3/4$  division of the octave into the fourth and fifth harmonic ratios gives the impression of movement when one views the painting while walking along the hallway (Bouleau, 1963; Cole Ahl, 1996).

Gozzoli designed the composition of the wall painting as an optical effect to move the viewer's eye down the hallway toward the central altarpiece. The composition of the tall trees in progression across the fresco helps to create that sensation. Gozzoli used a high vanishing point at the castle along the landscape. There are double vanishing points off the painting frame aligned with the harmonic composition. A vertical HR-RT division from the picture frame aligns with the castle and the *condottiero* (a military leader), the prominent figure in the picture. A HR-RT horizontal line that crosses the painting frame

through the crowd of participants aligns with the military leader and enhances the painting composition. The Medici families had great political influence in Florence, Italy, and as the patrons of the arts, their likenesses were incorporated in the painting along with the *condottiero* of the region. This strategy implied the nobility aspirations and religious piety of the Medici's dynasty (Bouleau, 1963; Cole Ahl, 1996).

The painting, *Pinacoteca di Brera of the Madonna with Child and Saints*, A Montefeltro Altarpiece by Piero della Francesca, is a multifaceted painting composition. The complexity of the religious milieu gives viewers the context in which they lived, the symbols they understood, and the relationships of these items to one another in a comprehensive humanist manner. The painting known as a *sacra conversazione* (a sacred conversation) and was commissioned by Federico III de Montefeltro, the Duke of Urbino, to announce the birth of his son, Guidobaldo, and the military acquisition of the Sarema Castles. The original execution of the art was for the Convent of San Bernardino near Urbino. The painting title is the Brera at Milan (Baxandall, 1988; Bouleau, 1963). The work was tempera on wood panel, 248 cm x 150 cm (98in x 59in) in size, and designed for the Montefeltro altarpiece. The work was completed between 1472 and 1474 (Lavin, 2002).

The work depicts the Virgin with a sleeping Christ child in the middle of the picture plane surrounded by a host of somber angels (who are looking outward to engage the audience) and saints. The Virgin is enthroned in the center space with the child sleeping on her lap. She is set in front of a high portal known in gothic Christian church architecture design as an *apse*. The apse created by Piero della Francesca is for a church



of a Renaissance classical style. It is shown in precise linear perspective with ornate ceiling tiles. In the back of the semi dome, a giant half of a seashell is depicted with an ostrich egg hanging down to the level of the building border defining the apse from the wall panels. The compositional line that describes this location in the painting is a HR-RT. The shell and egg have multiple meanings. These may represent the fecundity of Mary and the promise of regeneration and immortality. The shell also is a symbol of the new Venus (eternal beauty), and the egg may be a pearl that references the Immaculate Conception as the shell can generate the pearl without male intervention (Lavin, 2002).

In addition, the ostrich was one of the heraldic symbols of the Montefeltro family. In the lower right-hand side of the painting is a left-side profile portrait of Duke Federico da Montefeltro kneeling in full military armor. He was the Duke of Urbino, a patron of the arts, and the *condottiero* of the region (Lavin, 2002). Four angels stand behind the Virgin Mary and Child. They are depicted as young women and have a subdued countenance. On the left side of the Virgin are the saints, St. John the Baptist, St. Jerome, and St. Bernardino of Sienna, the dedicatee of the painting for the original location. St. John the Baptist was the patron saint of the wife of the Duke, Battista Sforza. St. Jerome was the protector of the humanists (Lavin, 2002). On the right side stands St. Francis of Assisi, as the painting also had been planned for the Franciscan church San Donato degli Osservanti where the Duke was buried. St. Peter stands behind the duke and, in the back, a figure is identified by the Italian historian, Ricci, as a portrait of Luca Pacioli (Lavin, 2002).

Baxandall (1988) gives evidence that Piero Della Francesca articulated a compositional device of figure grouping to enhance the relationship between the viewer and the painting. In the Brera Madonna painting, this technique was with the angels surrounding the Virgin and Child.

The painter's version of this suggestiveness was muted, but even the most notoriously reticent painter in these matters, Piero della Francesca, relied on the beholders disposition to read relationships into groups. . . The role is always a minor one, an attendant angel or a lady-in-waiting; but it will be standing in a close relationship with other similar figures . . . In this way we are invited to participate in the group of figures assisting at an event. We alternate between our own frontal view of the action and the personal relationship with the angel group, so that we have a compound experience of the event: the clarity of one kind of access is enriched by the intimacy of the other. (Baxandall, 1988, pp. 75–76)

The composition of the painting was a fundamental harmonic diapente,  $2/3$ . In addition, the painting divided in half both vertically and horizontally. Piero della Francesca used strong, linear, one-point perspective to describe the Albertian dome. A horizontal line goes across the top of all of the heads of the figures. An isosceles triangle is aligned to the linear perspective from the bottom of the painting frame to the head of the Blessed Virgin Mary. The HR-RT relationships form the larger circle to the next largest circle, the isosceles triangle, and four smaller triangles that frame the Christ Child.

The bottom of the dome is the top horizontal HR-RT and the head of the Christ child is aligned to the left vertical HR-RT. The artist *geometrically united in precise measurement and complex harmonic balance*, 3 circles, 2 hexagons, and 3 dart figures with 2 rectangles to create a progression of triangles. This progression of triangles focuses the viewer's perception on the grouping effect of the painting, which literally draws in the viewer to the scared conversation in a four-dimensional, emotional, spatially

guided aesthetic communication along with the visual engagement of the compound experience of the attendant angels' direct frontal gaze (Baxandall, 1988; Bouleau, 1963). The geometric construction of the painting composition requires the use of a compass to measure with precision the alignment of each shape.

Botticelli's painting, *The Birth of Venus*, is in the Uffizi Museum in Florence. Botticelli painted the allegorical story from Ovid's *Metamorphoses*, the birth of Venus, between 1482 and 1485. The painting size is 172.5 cm x 278.5 cm. Venus is shown on a shell at seaside with the figurative winds blowing her to shore where a handmaiden waits with clothes to dress her (Baxandall, 1988). This painting represents an example of the integration of Latin literature with the iconographic narrative style of the Quattrocento. The Medici family commissioned the work, which was the first example of tempera painting on canvas in Tuscany (Baxandall, 1988).

Botticelli used the harmonic composition of the double diatessaron, 9/12/16. This arrangement allowed the artist to create a dance movement across the canvas from left to right in alignment with the figurative winds that blow the symbolic image of beauty (both physical and spiritual) to the shore and the waiting handmaiden. The slight angle of the Venus figure is aligned with the 9/16 ratio. The one-point perspective horizon line is the sky to ocean imagery and is the top horizontal line of HR-RT.

The overall dimensions of the painting are a precise HR-RT relationship, so the diatessaron was designed within that alignment. Botticelli used the size of the figures to give some depth to the painting rather than emphasize the linear perspective. Decreasing size, which has the visual effect of flattening the painting scene, develops the foreground,

middle ground, and background. Botticelli also created the sensation of blowing clothes, leaves, and violets (a symbol of love) to support the ideation of movement (Baxandall, 1988; Bouleau, 1963).

*The Last Supper* by Leonardo da Vinci was a tempera-on-plaster painting commissioned by Ludovico Sforza, the Duke of Milan. Leonardo da Vinci began the painting in 1495 and completed it in 1498. The painting is on a wall of the refractory (dining hall) at the Dominican Convent of Santa Maria delle Grazie in Milan, Italy. The painting is 460cm x 880 cm in size, which covers an entire wall in the convent. The iconographic interpretation of the painting is both as an invitation to the religious order to be reminded of the celebration of the Eucharist with Christ and the moment of the announcement, that one of the disciples would betray Christ. Leonardo da Vinci grouped the 12 apostles into 4 sections with the arrangement aligned to the lunettes above the painting. These lunettes depict information about the patron's family and are believed to be the reason the artist structured the painting in that manner. The figures of the disciples indicate varying degrees of emotional response to the news of the imminent betrayal (Zöllner, 2011).

The fundamental harmonic of the painting is the diapason,  $1/2$ ; it is a double square. The horizon line is horizontal to the height of the back of Christ's head. Numerous lines of one-point linear perspective align with the front of the table structure, the panels along the walls on the sides, and the grid of wooden ceiling supports, all of which converge to the area behind Christ's head. The HR-RT horizontal line aligns with the top of the open windows in the back of the room.

A complex geometric design of diagonals and triangles creates a series of progressing squares that converge on and enclose the head of Christ. Within this geometric framework are two HR-RT forms that cross at the center of the geometric design at Christ's head. The overall perceptive effect of the composition of the painting is a rigidly placed geometric structure that provides a direct and lasting focus to the head and shoulders of Christ. This composition of the subject is in line with the intentionality of the artwork to assist the strict religiosity of the inhabitants of the Dominican refractory to conjoin with Christ in the Last Supper during their personal meals (Baxandall, 1988; Bouleau, 1963).

Raphael's portrait painting of *Dona Isabel de Requesens, Lady Viceroy of Naples*, formerly known as *Jeanne d'Aragon* in the Musée du Louvre in Paris, France, was created in 1518. There were two nearly identical versions of this portrait; the primary difference is the figure depicted in the background looking out of the window (Pezzutto, 2013). The painting is oil on wood, 120 cm x 95 cm. Cardinal Bibbiena as a gift for Francis I, the King of France, commissioned the painting. The artwork was designed by the artist and completed by one of his students (Pezzutto, 2013). The portrait shows the young Dona in the red, ornate dress of a noblewoman. She is situated in a large, elegant, Albertian edifice with grand portals and dome.

For the portrait painting, Raphael used the harmonic ratio 9/12/16. The slightly sloping axis of the figure is the caesuras 9 of the musical alignment going from the right at the top and from the left on the bottom (Bouleau, 1963). The linear one-point perspective from the structure of the building produces a vanishing point behind the head

of the sitter at the position directly behind the nose. The outside landscape horizon point and line also crosses the portrait at the same place.

The HR-RT top horizontal line of the painting is the same line as the horizon line. There are two circles, the smaller of which encircles the head and top of the dress with its center point at the chin of the woman. The top of the larger circle is at this center point and encompasses the full body, hands, and dress. These two circles are in HR-RT relationship to one another. Raphael coordinated all three mathematical relationships to produce a graceful and pleasing guided aesthetic communication of the woman's likeness, nature, and surroundings (Bouleau, 1963).

Each artist was considered a Master painter accomplished in the rendering of outstanding artistic paintings highly revered by the Quattrocento populace and patrons during their lifetimes and over time to the present day (Baxandall, 1988; Bouleau, 1963). This detailed review of the painting compositions is the traditional artistic analysis (Baxandall, 1988; Bouleau, 1963).

The Master artists group, the fifteenth century pre- Renaissance (Quattrocento), is representative of artists whose artwork was a religious iconographic realism (Baxandall, 1972; Bouleau, 1963). This unique historical period was the time when linear perspective was rediscovered and a strict adherence to ratios of consonance (HR-RT) was employed by the Master artists to satisfy the interest of and comprehension by the educated people of the society of the specific use of proportional gauging from the mercantile geometry (Baxandall, 1988; Bouleau, 1963, Cennini, 1960). The educated people of Florence brought about the existence of this characteristic of the Quattrocento painting because

that was what was pleasing for them to see. They were familiar with the geometric concept on a daily basis and through multiple venues. They were also knowledgeable about the religious symbols and images in relation to the HR-RT construct. These cognitive abilities required both visuospatial and bodily kinetic intelligence.

Each of the Master artist group painting compositions' has linear perspective and the HR-RT construct. In some of the compositional designs, linear perspective and HR-RT are the same mathematical measurement. These geometric compositional elements were familiar to the people of the society and the artists to elicit a pleasing response (Baxandall, 1988; Bouleau, 1963; Devlin, 1994; Stewart, 2007).

## APPENDIX I

### **Brief Synopsis of the Fundamentals of the Elements and Principles of Art**

#### **Used in Painting or Drawing Compositions**

The Elements of Art are the visual tools the artist uses to create a composition and to convey an idea, emotion, or image, real or imagined. They are used in both representational and abstract art. Here is a list of elements that is generally agreed upon by artists and theorists:

##### *Line*

A line is a mark that is longer than it is wide. It is a dot moving through space. Lines can be real or implied, as in a row of parked cars. A line can be loose and gestural, or tight and controlled. It can be straight or curvy, zig zag or loopy. A line can be heavy and thick, or light and thin. A single line can have different characteristics, such as varying line weight or direction.

Lines can be horizontal, vertical, or diagonal. Horizontal and vertical lines convey stability; diagonal and orthogonal lines convey movement and space. In a painting we often read a horizontal line as a horizon line, even if the work is abstract. A horizon line and a vertical one often read together as a landscape. A contour line defines where edges meet. This includes the outline as well as interior lines.

##### *Shape*

A shape is made when the ends of a line meet each other. A shape can also be made by value, color, and texture. A shape can be organic or geometric. An organic shape is one often found in nature, such as a leaf, puddle, or cloud. It often has irregular curvilinear edges. A geometric shape is measurable and can be made using geometric tools. Most geometric shapes are man-made, such as a stop sign shape (octagon), circle, or rectangle.

Shapes are also positive or negative. A positive shape is an object or figure. The negative shape is the shape of the space in and around the object. For example, a doughnut is a positive shape, the hole in the middle is a negative shape.

Negative and positive shapes share edges. Therefore, if you draw the negative shape correctly, the positive shape will also be accurate.

##### *Color*

Color is the element often noticed first. It has three primary characteristics: hue, saturation, and value.



Color can be cool or warm. A cool color generally contains more blue or purple, a warm color contains more yellow. Cool colors tend to be calming, peaceful, and relaxing. Warm colors tend to be invigorating and stimulating.

### *Value*

Value, also called tone, is how light or dark something is. It helps to create the illusion of space and depth and to define form.

### *Form*

Form is something that appears three-dimensional. For example, a circle is a shape; a sphere is a form. Shifts in value, or toning, help to turn a two-dimensional shape into a three-dimensional form.

### *Texture*

Texture is how something in two-dimensions looks like it feels to the touch, whether it is smooth or rough, fuzzy or metallic.

### *Space*

Space is the illusion of depth. It can be shallow or deep. Value is most significant in creating the illusion of space, but the other elements of design can also create spatial shifts or give spatial cues.

While these elements of art and design are the artist's tools, it is up to the artist how to use them. All of the elements exist in a composition, but they exist in relation to one another and at the behest of the artist's hand, making a composition that is unique and singular.

The Elements and Principles of Art and Design are the foundation of the language we use to talk about art. The Elements of Art are the visual tools that the artist uses to create a composition. These are: line, shape, color, value, form, texture, and space.

The Principles of Art represent *how the artist uses the elements of art* to create an effect and to help convey the artist's intent. The principles of art and design are: *balance, contrast, emphasis, movement, pattern, rhythm, and unity/variety*. The use of these principles can help determine whether a painting is successful, and whether or not the painting is finished.

The artist decides what principles of art he or she wants to use in a painting. While an artist might not use all the principles of design in one piece, the principles are intertwined and the use of one will often depend on another. For example, when creating emphasis, the artist might also be using contrast, or vice versa. It is generally agreed that a successful painting is unified, while also having some *variety* created by areas of *contrast* and *emphasis*; is visually *balanced*; and *moves* the viewer's eye around the composition. Thus it is that one principle of art can influence the effect and impact of another.

The seven principles of art:

*Balance* refers to the visual weight of the elements of the composition. It is a sense that the painting feels stable and "feels right." Imbalance causes a feeling of discomfort in the viewer.

Balance can be achieved in 3 different ways:

1. *Symmetry*, in which both sides of a composition have the same elements in the same position, as in a mirror-image, or the two sides of a face.
2. *Asymmetry*, in which the composition is balanced due to the contrast of any of the elements of art. For example, a large circle on one side of a composition might be balanced by a small square on the other side
3. *Radial symmetry*, in which elements are equally spaced around a central point, as in the spokes coming out of the hub of a bicycle tire.

*Contrast* is the difference between elements of art in a composition, such that each element is made stronger in relation to the other. When placed next to each other, contrasting elements command the viewers' attention. Areas of contrast are among the first places that a viewer's eye is drawn. Contrast can be achieved by juxtapositions of any of the elements of art. Negative/Positive space is an example of contrast. Complementary colors placed side by side is an example of contrast. *Emphasis* is when the artist creates an area of the composition that is visually dominant and commands the viewer's attention. This is often achieved by contrast.

*Movement* is the result of using the elements of art such that they move the viewer's eye around and within the image. A sense of movement can be created by diagonal or curvy lines, either real or implied, by edges, by the illusion of space, by repetition, by energetic mark-making.

*Pattern* is the uniform repetition of any of the elements of art or any combination thereof. Anything can be turned into a pattern through repetition. Some classic patterns are spirals, grids, weaves. *Rhythm* is created by movement implied through the repetition of elements of art in a non-uniform but organized way. It is related to rhythm in music. Unlike pattern, which demands consistency, rhythm relies on variety.

*Unity/Variety* You want your painting to feel unified such that all the elements fit together comfortably. Too much unity creates monotony, too much variety creates chaos. You need both. Ideally you want areas of interest in your composition along with places for your eye to rest.

*Balance* An unbalanced object or scene causes discomfort in a viewer, so, unless this is a desired effect, we should strive to ensure that our images are balanced. For physical objects, they will balance on a scale if they have equal weight, not equal size. For an image, the unit of measure is visual interest, i.e., our image should be balanced by visual interest. Balance by visual interest can be achieved in a variety of ways, as discussed below. Visual balance is achieved about both the horizontal and the vertical axes.

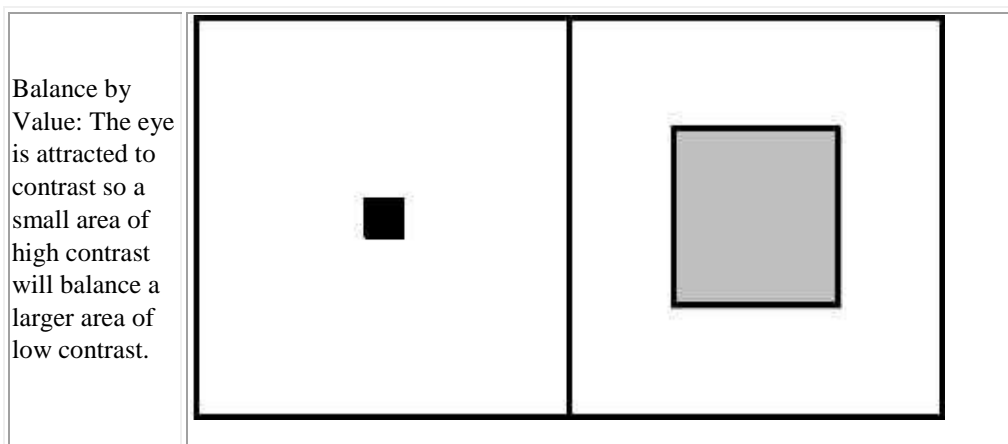
#### Balance about the Horizontal Axis

Because of our experience with reality, and with film and video, the horizontal axis is usually placed below the middle of the image. This axis tells us how tall we are, how high up we are, if we might bump our heads on something, and the relative importance of something. Height is usually perceived as a dominating characteristic and characters that are taller are considered more important. So, for example, placing a short character high in the frame and a tall character low in the frame leads us to believe the short character is dominating the taller character.

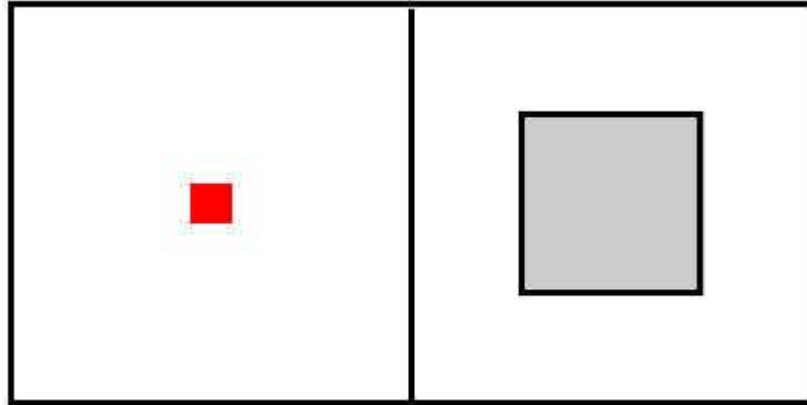
#### Balance about the Vertical Axis

*Symmetrical* balance, i.e., the two sides are mirror images of each other, is the easiest type of balance to achieve. Symmetrical balance is used extensively in architecture and it feels very stable, permanent, and calm. The attention is automatically focused on whatever is placed at the center of the frame. This is a good way to organize a formal scene, e.g., a wedding or graduation scene.

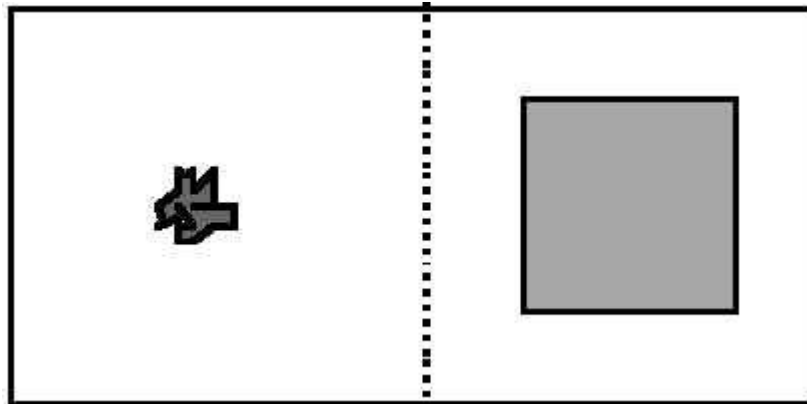
Asymmetrical balance is more common, more interesting, and more difficult to achieve. Balance is achieved by using dissimilar elements with different visual interests. These different methods are discussed below. Always remember that there is an interaction between these and so balance can be achieved by a combination of the methods discussed below.



Balance by Color: The eye is more attracted to color than to a neutral image, so a small region of color, especially a bright red color, can balance a larger neutral or dull colored region. Adjacent complementary colors weigh more than adjacent similar colors.

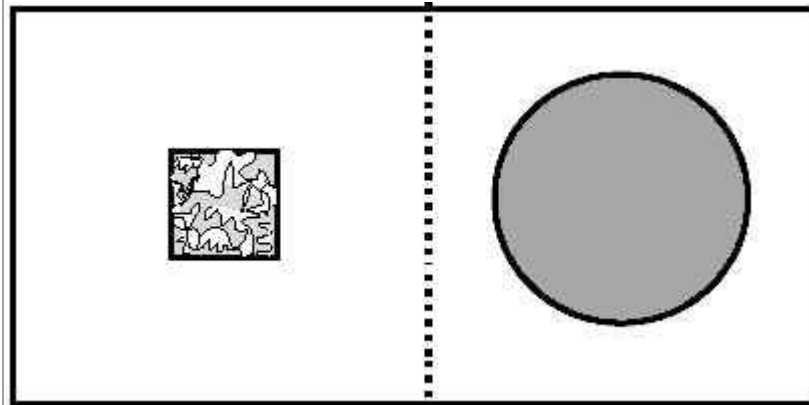


Balance by Shape: A small complicated shape can balance a large simple shape. Also, a large uncluttered area can balance a small busy area containing many shapes. We can minimize busy areas by placing them in shadow or enhance them by lighting them well. Large simple areas can be enhanced by even bright lighting or by breaking them

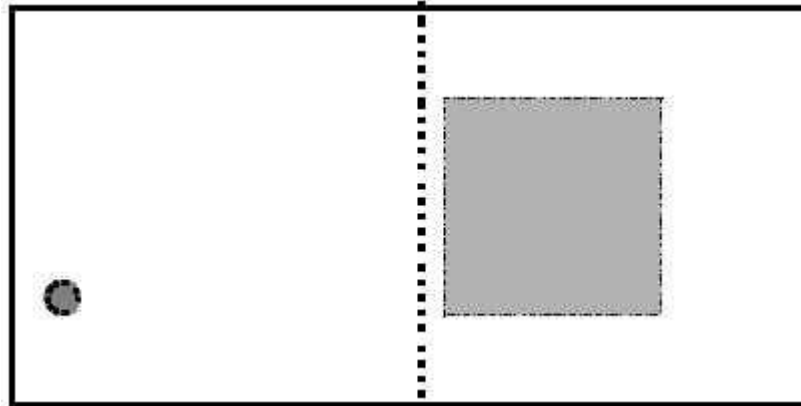


up with shadows, thereby making them more complex.

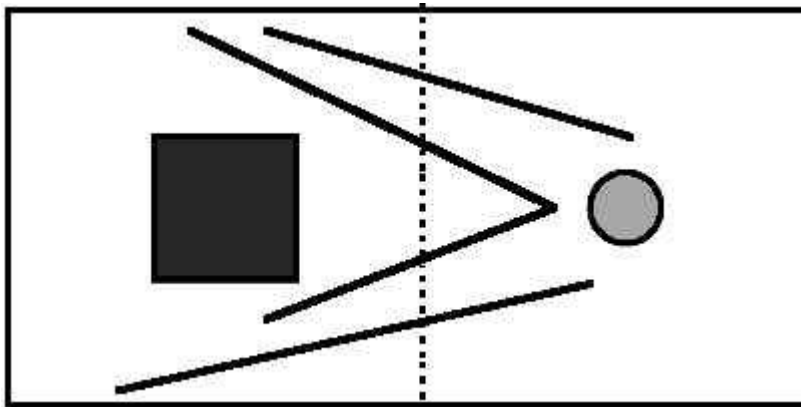
Balance by texture:  
Texture and surface are similar to value, color, and shape, i.e. a busy, high contrast texture on a small shape will balance a larger shape with a smooth, matte surface. Texture can give an emotional quality to a scene, e.g., soft, fuzzy objects are more inviting than smooth, polished objects. The attraction of the texture can be enhanced or minimized by appropriate lighting, e.g., bright and hard to enhance or soft and dim to minimize.



Balance by position: A smaller object farther away from the center will balance a larger object that is closer to the center. Even if we cannot move an object in a scene, its visual weight can be affected by the lighting.



Balance by eye direction: Edges, shapes, and/or groups all imply a visual direction. This can be used to balance a heavier side by having the eye direction point to the lighter side, thus transferring visual importance. A linear object, a shadow edge, or the edge of a light can achieve a strong directional effect. Having the same color on opposite sides of an image can also cause the eye to be led from



one side to the other.	
Balance by Physical Weight: The perceived physical weight of an object contributes to its visual interest, with a heavier object having more visual interest than a lighter object of the same size.	

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Retrieved August 4, 2016.

<http://painting.about.com/od/paintingforbeginners/fl/Elements-of-Art-and-Design.htm>

<http://painting.about.com/od/paintingforbeginners/fl/The-Principles-of-Art-and-Design.htm>

[https://www.siggraph.org/education/materials/HyperGraph/design/composition/balance\\_in\\_composition.htm](https://www.siggraph.org/education/materials/HyperGraph/design/composition/balance_in_composition.htm)

## APPENDIX J

### Key for Geometric Grid Analysis

S = strong representation: a. The grid of HR-RT lines delineates the key compositional elements b. There are more than one examples of HR-RT defined in the image that reinforce the composition. The frame ratio (FR) lines support HR-RT c. The accuracy of the lines of the grid demonstrate a distance of within 0-3 millimeters (a score of 2.1-3) of the lines and the image item.

M = moderate representation: a. The grid of the HR-RT lines delineates the key compositional elements b. There are multiple examples of HR-RT defined in the image that reinforce the composition. The frame ratio (FR) lines support HR-RT c. The accuracy of the lines of the grid demonstrate a distance of within 3.1-5 millimeters (a score of 1.1-2) of the lines and the image item.

L = low representation: a. The grid of HR-RT lines delineates the key compositional elements b. There is one example of HR-RT defined in the image that reinforces the composition. The frame ratio (FR) lines support HR-RT c. The accuracy of the lines of the grid demonstrate a distance of greater than 5.1 millimeters off the specific placement (a score of 1 or less) of the lines and the image item.

I = inconsistent representation: indication of HR-RT but the descriptive lines are not consistent enough to describe the relationships within the picture frame.

Not found (NF) = no evidence HR-RT.

A = accuracy of line placement of the composition of the artwork; 0 through 3 scale; 2.1-

3 = strong, 1.1 - 2 = moderate, 1- 0 = low

V = vertical



H = horizontal

D = diagonal; orange lines are measured horizontally starting from the left going to the right and vertically from the bottom to the top of the picture frame.

Dotted blue line = geometric DEMR relationship within the composition that is a significant compositional line.

L = left of vertical orientation

R = right of vertical orientation

Upper = top half of horizontal orientation

Lower = bottom half of horizontal orientation

1/2 = division of space in half vertically or horizontally (black lines)

V 1/2 = vertical 1/2 line

H 1/2 = horizontal 1/2 line

1/4 = division of space in quarters vertically or horizontally (black lines)

V R 1/4 = vertical right 1/4 line

V L 1/4 = vertical left 1/4 line

H U 1/4 = horizontal upper 1/4 line

H L 1/4 = horizontal lower 1/4 line

1/8 = division of space in eighths vertically or horizontally (black lines)

V R 1/8 = vertical right 1/8 line

V L 1/8 = vertical left 1/8 line

H U 1/8 = horizontal upper 1/8 line

H L 1/8 = horizontal lower 1/8 line

1/12 = division of space in twelfths vertically or horizontally (black lines)

V R 1/12 = vertical starting with right 1st 1/12 line, then, 2nd 1/12, 3rd 1/12; 4th 1/12, 5th 1/12, 6th 1/12, 7th 1/12, 8th 1/12, 9th 1/12, 10th 1/12, 11th 1/12

H 1/12 = horizontal starting with the upper 1st 1/12 line, then, 2nd 1/12, 3rd 1/12; 4th 1/12, and 5th 1/12, 6th 1/12, 7th 1/12, 8th 1/12, 9th 1/12, 10th 1/12, 11th 1/12

1/16 = division of space in sixteenths vertically or horizontally (black lines)

V R  $1/16$  = vertical starting with right 1st  $1/16$  line, then, 2nd  $1/16$ , 3rd  $1/16$ ; 4th  $1/16$ , 5th  $1/16$ , 6th  $1/16$ , 7th  $1/16$ , 8th  $1/16$ , 9th  $1/16$ , 10th  $1/16$ , 11th  $1/16$ , 12th  $1/16$ , 13th  $1/16$ , 14th  $1/16$ , 15th  $1/16$

H  $1/16$  = horizontal starting with the upper 1st  $1/16$  line, then, 2nd  $1/16$ , 3rd  $1/16$ ; 4th  $1/16$ , 5th  $1/16$ , 6th  $1/16$ , 7th  $1/16$ , 8th  $1/16$ , 9th  $1/16$ , 10th  $1/16$ , 11th  $1/16$ , 12th  $1/16$ , 13th  $1/16$ , 14th  $1/16$ , 15th  $1/16$

$1/3$  = division of space in thirds vertically or horizontally (Rule of Three, yellow lines)

V R  $1/3$  = vertical right  $1/3$  line

V L  $1/3$  = vertical left  $1/3$  line

H U  $1/3$  = horizontal upper  $1/3$  line

H L  $1/3$  = horizontal lower  $1/3$  line

$1/6$  = division of space in thirds vertically or horizontally (Rule of Three, yellow lines)

V R  $1/6$  = vertical right  $1/6$  line

V L  $1/6$  = vertical left  $1/6$  line

H U  $1/6$  = horizontal upper  $1/6$  line

H L  $1/6$  = horizontal lower  $1/6$  line

$1/9$  = division of space in ninths vertically or horizontally (yellow lines)

V R  $1/9$  = vertical starting with right 1st  $1/9$  line, then, 2nd  $1/9$ , 3rd  $1/9$ ; 4th  $1/9$ , 5th  $1/9$ , 6th  $1/9$ , 7th  $1/9$ , 8th  $1/9$

H  $1/9$  = horizontal starting with the upper 1st  $1/9$  line, then, 2nd  $1/9$ , 3rd  $1/9$ ; 4th  $1/9$ , and 5th  $1/9$ , 6th  $1/9$ , 7th  $1/9$ , 8th  $1/9$

$1/5$  = division of space in fifths vertically or horizontally (red lines)

V R  $1/5$  = vertical starting with right 1st  $1/5$  line, then, 2nd  $1/5$ , 3rd  $1/5$ ; 4th  $1/5$ , 5th  $1/5$

H  $1/5$  = horizontal starting with the upper 1st  $1/5$  line, then, 2nd  $1/5$ , 3rd  $1/5$ ; 4th  $1/5$ , and 5th  $1/5$

FR = frame ratio; division of the line by 0.61803... (Golden Mean ratio, green lines)

additional evidence of HR-RT

V R FR = vertical right frame ratio

V L FR = vertical left frame ratio

H U FR = horizontal upper frame ratio

H L FR = horizontal lower frame ratio

## APPENDIX K

### **Image descriptions for Participants, the Control Group and the Key for the Mathematical Grid Analysis**

The textual descriptions for the artwork analysis described the procedure for the Photoshop visual record of compositional lines in an image summary. The information about the image was placed in a table. The following list is the order in which the table was filled in.

1. Participant coded ID number- this is a sequential number intended to code the identity of the art students. After this number is listed the gender, age, years at JLDF, years at the art school, ophthalmology, range of time of the making of the artworks and socioeconomic status. An example of the demographic information (in bold type).  
Participant; #369, male, 37years old, 37 years at the JLDF, 17 years at the art school, needs glasses; range of time of the artwork used for the study 1998-2011; socioeconomic status/low.
2. The image information is given on the next line. First, the ID number-and the artwork number; title of the artwork in Spanish and English; the orientation of the artwork whether a vertical or horizontal presentation; artwork dimensions- vertical/horizontal and the ratio of the two for the picture frame; depth perception- image rendered in 2D or 3D; a list of the vertical lines that indicate the HR-RT ratio(s) lines of compositions; a list of the horizontal lines that indicate the HR-RT ratio(s) lines of compositions; a count of how many lines were used of a particular color; the actual line description from the KEY.
3. The next line indicated the accuracy of the placement of the items of the artwork composition, which was a number from 0-3 mm. A numeric value of the distance from the HR-RT geometric line to the geometric placement of the item in the composition. If, the item was between 0-3 mm from the exact geometric measurement of the HR-RT line this was a strong representation given the range of values of 2.1 to 3. The range of values were determined by the amount of compositional information that was aligned to this HR-RT ratio line. For example, if the line was within the 0-3 mm and the composition was aligned to on half of the length of the line, the accuracy was 2.5. Each HR-RT line that was used to describe the composition was analyzed in this manner. The average of the vertical line accuracy was averaged and the same done for the horizontal these two numbers were divided, which was the calculation of the accuracy score. If there were multiple harmonic ratios, the procedure was repeated. A moderate level was 1.1 to 2 and a low level representation was 0 to 1.
4. A table that organized the type of HR-RT ratio on the x-axis and the level of HR-RT representation was on the y-axis. In addition, there are two columns on the

right side of the table that recorded the use of the Rule of Three lines (the yellow lines) and the Frame Ratio (FR) lines that are green lines. This measurement is the exact measurement of the DEMR construct from both sides of the picture frame in both dimensions. The boxes in the table are checked at the appropriate type of HR-RT ratio and level of representation. The Rule of Three and Frame Ratio lines are indicated with the identifying orientation of vertical and horizontal. Either 1 or 2 lines for each. The calculated accuracy number is at the bottom of the first column and the number is placed under the column of the correct HR-RT.

5. A summary of the information of 1-4 is stated in the first paragraph of the analysis section placed below the table.
6. The final portion of the process is the second section, Additional Notes. In this section, a written description is given on the actual image of the artwork. The details of how the stated HR-RT was calculated is documented. If, there are multiple harmonic ratios this is also included. For the analysis of the artwork, an explanation may be necessary so this section accounts for the observations made by the researcher. Specific, composition aspects are noted and further details as necessary. A description of the artistic techniques used in the image are noted.

**Participant: #369, male, 37 years old, 37 years at JLDF, 17years at the art school, needs glasses; range of time of artwork in study 1998-2011, socioeconomic status/low.**

**#369-1; *Robot del Espacio, Space Robot*, 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description**

		4	black	V1/2, 1/4; H1/2
		2	yellow	V1/3; Hna
1.	red		Vna; H1/5	
		3	green	VFR; upper FR
		1	blue dotted line	Vna; H
		Total lines = 14		

Measurements: length 9 cm; height 20.3 cm; ratio = 0.443	
V: 1/2, 1/4, 1/3, FR	H: 1/2, 1/5, upper FR
1/2 = 4.5	1/2 = 10.15
1/4 = 2.25, 6.75	1/5 = 4.06, 8.12, 12.18, 16.24
1/3 = 3.0, 6.0	upper FR = 12.546
FR = 3.437, 5.56	blue dotted line = 8.8
Total = 7 lines	Total = 7 lines

Accuracy of lines: HR1/2 = (H1/2) = 2; HR 2/3 (V1/3, H1/2) = 3 + 2.8 = 2.9, 2.9 + 2 = 2.45; HR3/5 (V1/3, H1/5); VL1/3 = 3, VR1/3 = 2.8, V1/3: 3 + 2.8 = 2.9;

H1<sup>st</sup> 1/5 = 3, H2<sup>nd</sup>1/5 = 3, H3<sup>rd</sup>1/5 = 3, H4<sup>th</sup>1/5 = 3, H1/5: 3 + 3 + 3 + 3 = 2.96, A= 2.9 + 2.96 = 2.93

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2	V2 H1
Moderate	x	x						
Low								
Inconsistent								
Not Found			x	x		x		
Accuracy 0- 3	2.0	2.45			2.93			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-1; vertical/ 9 cm, 20.4 cm; ratio 0.443 cm; vertical lines: 1/2, 1/4, 1/3, FR; horizontal lines: 1/2, 1/5, upper FR, dotted blue line; accuracy of line placement: 2.93; harmonic ratio: 3/5, the sixth: overall composition assessment: HR3/5 strong. The composition analysis of #369-1 is at the level of strong representation of a 3/5, sixth harmonic V1/3, H1/5. Additional notes: The artist divided the composition in half horizontally. The head of the figure is 1/2 of the top of the picture space and the rest of the body is in the bottom half. This harmonic ratio is the horizontal 1/2, the accuracy is a score of moderate. The vertical lines describe the placement of the features of the figure. The V1/2 accurately divides the figure vertically. The VL1/4 in general describes the head and right side of the figure and the VR1/4 accurately describes the head and left side of the figure. The VL1/3 line accurately describes the placement of the pupil of the right eye, the right side of the mouth, the neck and the right leg. The VR1/3 accurately describes the placement of the left eye, shoulder pad, front of the uniform and left leg. The VLFR supports the VR1/3 and the VRFR supports the VL1/3 with an accurate alignment to the cigarette in the left hand. The horizontal lines also align with the placement of the features of the figure. The H1/2 moderately indicates the division of the figure, head and body. The resulting harmonic ratio of 2/3 is an accuracy score of 2.45. Underlying the HR1/2 are the four lines of the H1/5 divisions, which accurately defines the placement of the figure into five parts. The H1<sup>st</sup> 1/5 describes the helmet at the forehead and across the face, the H2<sup>nd</sup>1/5 describes the bottom of the right side of the helmet to the top of the mouth, the H3<sup>rd</sup>1/5 describes the front of the uniform and top of the buttons dividing the neck and shoulders. The H4<sup>th</sup>1/5 describes the bottom of the uniform at the top of the legs. The H upper FR accurately defines the left side of the

bottom of the helmet and the bottom of the nose. One additional horizontal compositional line is an imbedded DEMR rectangle that is a horizontal line across the helmet through the center of both shapes on the side of the helmet and center of the eyes and across the nose bridge. The blue dotted line divides the frame of the picture in a DEMR rectangle at the horizontal line of the eyes. The eyes gaze directly outward to the viewer. This is a significant compositional line. The horizontal blue dotted line  $[8.8/14.3 = 0.615]$  is from across the eyes to the length of the picture, a rectangle alignment of a DEMR division within the composition. Using the geometric grid analysis, the lines identify the unique placement of the figure's helmet as a juxtaposition of the H 2<sup>nd</sup>1/5 and the H upper FR. If a teacher had influenced the student's artwork, he would have suggested an even alignment of both sides of the helmet. Overall, there is evidence of the multiple use of harmonic ratios with Rule of Three, 1/2, 2/3 and 3/5 in the artwork. The image is primarily 2-dimensional and made with shapes and thick black lines. The artist symmetrically aligned the parts of the figure's face, head and body the varying harmonic ratio lines, Rule of Three and FR. The vertical lines interconnect the 1/2, 1/4, 1/3 and FR of the composition, the visuospatial effect of this alignment is to facilitate a pleasing perception of the image. Underlying the H1/2 division is the delineation of the space horizontally into fifths. The most accurate harmonic ratio composition is a 3/5 harmonic ratio with Rule of Three strengthened by the VFR's and upper HFR. The accuracy is 2.93 and more of the image composition is described by the HR3/5; V1/3, H1/5.

**#369-2; *Virgen, Virgin*, 2008; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description**

5 black V1/2, 1/4; H1/2  
 2 yellow V1/3; Hna  
 3 green VFR; upper FR  
 6 red Vna; H1/5  
 Total lines = 16

Measurements: length 15.58 cm; height 21.47 cm; ratio = 0.7256

V: 1/2, 1/4, 1/3, LFR, 1 <sup>st</sup> 1/5, 2 <sup>nd</sup> 1/5	H: lower 1/4, upper 1/8, 1/3, 1/5, FR
1/2 = 7.79	lower 1/4 = 16.1
1/4 = 3.895, 11.685	upper 1/8 = 2.68
1/3 = 5.193, 10.38	
1 <sup>st</sup> 1/5, 2 <sup>nd</sup> 1/5 = 3.12, 6.23	1/5 = 4.294, 8.588, 12.882, 17.176
LFR = 5.95	FR = 8.20, 13.268
Total = 8 lines	Total = 8 lines

Accuracy of lines: HR3/5(V1/3, H1/5); VL1/3 = 2.8, VR1/3 = 2.4, V1/3 = 2.6; H1<sup>st</sup> 1/5 = 1.5, H2<sup>nd</sup> 1/5 = 2.5, H3<sup>rd</sup> 1/5 = 2.6, H4<sup>th</sup> 1/5 = 2.4, H1/5 = 2.25; A = 2.425

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of</u>	<u>Use of Frame Ratio</u>

							<u>Three lines</u>	
<i>Level of Evidence</i>								
Strong					x		V2	V1 H2
Moderate		x						
Low								
Inconsistent								
Not Found	x		x	x		x		
Accuracy 0- 3		2.375			2.425			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-2; vertical; 15.58 cm, 21.47 cm; ratio = 0.7256; vertical lines: 1/2, 1/4, 1/3, 1<sup>st</sup> 1/5, 2<sup>nd</sup> 1/5, LFR; horizontal lines: lower 1/4, upper 1/8, 1/5, FR; accuracy of line placement: 2.425; harmonic ratio: 3/5, the sixth: overall composition assessment: HR3/5 strong. The composition analysis of #369-2 is at the level of strong representation of a 3/5, sixth harmonic V1/3H1/5. Additional notes: The image is a portrait of a woman wearing a hooded garment with her head bowed, holding her hands together against her upper chest. The artist divided the vertical space in half along the top of the head through the temple to the chin and aligned the figure's left hand and arm. The V1/2 describes this division. The VL1/4 describes the placement of the figure's right eye (going through the center). The VR1/4 describes the placement of the back of the head. The VL1/3 describes the forehead, nose and alignment to the figure's right hand. The VLFR aligns with the 2<sup>nd</sup> 1/5 to describe the placement of the figure's left eye, chin, and right hand placement. The H 1<sup>st</sup> 1/5 indicates the placement front of the head. The distance between the 1<sup>st</sup> 1/5 line and the V1/2 line is approximately one-third the facial width, which is the placement of the center of the figure's left eye, the V 2<sup>nd</sup> 1/5. This is the correct portraiture spacing. There is an indication of the harmonic ratio 2/3, the fifth, V1/2 H1/3. Accuracy: V1/2 = 2.6, H upper 1/3 = 2, H lower 1/3 = 2.3; A = 2.375. However, the 3/5, the sixth is more accurate as there are more grid lines of the harmonic that describe the placement of the composition (A= 2.425). This is a 2-dimensional image and the artist used thick outlines for the image shapes. There is minimal light and dark shading artistic technique.

**#369-3; *Figura Prehispánica, Prehistoric Figure* 2011; pirograbado en madera, Pyrograph in wood; assessment grid lines: count /color/ description:**

- 5 black V1/2, 1/4; H1/2
  - 2 yellow V1/3; Hna
  - 4 red Vna; H1/5
  - 2 green VFR; upper FR
- Total lines = 13



Measurements: length 10.61 cm; height 15.56 cm; ratio = 0.6775

V: 1/2, 1/4

1/2 = 7.83

1/4 = 2.65, 7.96

H: 1/2, lower 1/4, 1/3, 1/5, FR

1/2 = 5.30

lower 1/4 = 11.76

1/3 = 5.22, 10.44

1/5 = 3.132, 6.26, 9.396, 12.52

FR = 5.98, 9.678

Total = 3 lines

Total = 10 lines

Accuracy of lines: HR3/4 (V1/4, H1/3); VL1/4 = 1, V1/2 = 1, VR1/4 = 1, V1/4 = 1;

H upper 1/3 = 0.5, H lower 1/3 = 1, H1/3 = 0.75; A = 0.875

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low			x				H2	H2
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			0.875					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-3; vertical; length 10.61 cm, height 15.56 cm; ratio = 0.6775; vertical lines: 1/2, 1/4; horizontal lines: 1/2, lower 1/8, 1/3, 1/5, FR; accuracy of line placement: 0.875; harmonic ratio: 3/4, the fourth: overall composition assessment: HR3/4 low. The composition analysis of #369-3 is at the level of low representation of a 3/4, fourth harmonic, HR L3/4, V1/4 H1/3. Additional notes: The image is primarily of two objects. The vertical 1/2 and 1/4 lines in general follow the composition of the placement of the main figure. The horizontal 1/3 lines in general align to the design of the main figure H upper 1/3 and the smaller figure H lower 1/3. There is an indication of the use of the H 1/5 lines and the H1/2, lower 1/4 to describe the composition. In general, the artist used the HR 3/4 with Rule of Three to arrange the objects in the picture. However, the accuracy of the lines is greater than 5 mm for the most part from the item placement. The image is interesting and appealing but because of the active use of the textural marks, it is not definitive where the lines of composition are found. There is low evidence of the use of harmonic ratio with Rule of Three. The image is 2-dimensional with heavy black

outlines and texture marks on the linoleum. There is a slight stereoptic effect because of the linotype medium.

#369-4; *Copa de Caballo, Horse Cup* 1999; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description:

- 8 black V1/2, 1/4, 1/8; H lower 1/4, 1/8
- 3 yellow VL1/3; H 1/3
- 4 green VFR; HFR
- Total lines = 15

Measurements: length 10.31 cm; height 12.24 cm; ratio = 0.842  
 V: 1/2, 1/4, 1/8, L1/3, FR H: lower 1/4, 1/8, 1/3, FR  
 1/2 = 5.155 lower 1/4 = 9.18  
 1/4 = 2.577, 7.73 1/8 = 1.53, 10.71  
 1/8 = 1.288, 9.02 1/3 = 4.08, 8.16  
 L1/3 = 3.44 FR = 4.68, 7.56  
 FR = 3.93, 6.37  
 Total = 8 lines Total = 7 lines

Accuracy of lines: HR2/3 (V1/2H1/3); V1/2 = 0.75, V1/2 = 0.75; H upper 1/3 = 0.5, H lower 1/3 = 1, H1/3 = 0.75; A = 0.75

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V 1 H2	V2 H2
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.75						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-4; vertical; length 10.31 cm, height 12.24 cm; ratio = 0.842; vertical lines: 1/2, 1/4, 1/8, 1/3, FR; horizontal lines: lower 1/4, 1/8, 1/3, FR; accuracy of line placement: A = 0.75; harmonic ratio: 2/3, the fifth: overall composition assessment: HR2/3 low. The composition analysis of #369-4 is at the level of low representation of a 2/3, a fifth harmonic, HR L2/3; V1/2 H1/3. Additional notes: The picture frame is

divided horizontally with a large globe in the center that is placed on a base. The horizontal upper 1/3 line in general divides the globe. The lower 1/3 horizontal line in general aligns to the top of the base. The vertical 1/2 line indicates the center of the globe and base with an accuracy of  $A = 0.75$  as the distance from the center is greater than 5 mm. The FR lines both horizontal and vertical only support the placement of the objects and shapes of the background in general. Overall there is a 2/3 harmonic division of the space in general terms. This is a 2-dimensional image with black outlines of the shapes in the image. Light and dark values give a slight indication of 3-dimensions as do the globe and base.

#369-5; *Paloma Blanca, White Dove* 2007; grabado sobre madera, engraving on wood; assessment grid lines: count /color/ description:

1 black V1/2, Hna

Measurements: length 15.75 cm; height 6.81 cm; ratio = 0.432

V: 1/2 Hna

1/2 = 7.88

Total = 1 lines

Total = 0 lines

Accuracy of lines: HR1/2; V1/2, Hna; V1/2 = 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low	x							
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.0							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-5; horizontal; length 15.75 cm, height 6.81 cm; ratio = 0.432; vertical lines: 1/2; horizontal lines: Hna; accuracy of line placement:  $A = 1.0$ ; harmonic ratio: 1/2, the octave: overall composition assessment: HR1/2 low. The composition analysis of #369-5 is at the level of low representation of a 1/2, an octave harmonic, HR L1/2, V1/2 Hna. Additional notes: The picture frame is divided in half vertically. Each half of the picture has a distinct subject and these are stand-alone objects. The 1/2 octave harmonic

is indicated in general. An independent compositional analysis for the two half's #369-5a and #369-5b are given for the artwork.

**#369-5a.** Figure image from 369-5; grabado sobre madera, engraving on wood; assessment grid lines: count /color/ description:

- 3 black V1/2, H1/4
- 2 yellow Vna, H1/3
- 3 green VFR, H lower FR
- 4 red V1/5, Hna
- Total lines 12

Measurements: length 7.26 cm; height 6.6 cm; ratio = 0.909

V: 1/2, 1/5, FR H: 1/4, 1/3, lower FR

1/2 = 3.63 1/4 = 1.65, 4.95

1/5 = 1.45, 2.9, 4.35, 5.8 1/3 = 2.2, 4.4

FR = 2.77, 4.49 lower FR = 4.01

Total = 7 lines Total = 5 lines

Accuracy of lines: V1/2, H1/3; V1/2 = 2.7, H upper 1/3 = 2.8, H lower 1/3 = 2.5; V1/2 = 2.7, H1/3 = 2.65, A = 2.675

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		H2	V2 H1
Moderate		x						
Low								
Inconsistent								
Not Found	x		x	x		x		
Accuracy 0- 3		2.675			2.5125			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-5a; horizontal; length 7.26 cm, height 6.6 cm; ratio = 0.909; vertical lines: 1/2, 1/5, FR; horizontal lines: 1/4, 1/3, lower FR; accuracy of line placement: A = 2.5125; harmonic ratio: 3/5, the sixth: overall composition assessment: HR3/5 strong. The composition analysis of #369-5a is at the level of a strong representation of a 3/5, sixth harmonic, HR S3/5; V1/5 H1/3. Additional notes: The vertical lines of the V1/5ths align

to the placement of the head on the shoulders. The V1<sup>st</sup> 1/5 is indicated by the change in texture marks and is near the right ear of the figure. The V 2<sup>nd</sup> 1/5 is within 1 mm of the outside line of the right eye and lines directly to the outside line of the right side of the mouth. The change in texture marks the front of the neck and chest. The V 3<sup>rd</sup> 1/5 line directly aligns to the division of the hair on the head to the inside line of the right eye. This compositional line also describes the placement of the center of the mouth and indicated moustache. The V 4<sup>th</sup> 1/5 line describes within 1 mm the outside of the left eye and eyebrow. The vertical line of the V1/2 goes directly through the center of the right eye and aligns to the width of the right side of the nose. A VR1/8 line aligns to the left ear, the VR1/4 line describes the center of the left eye, outside of the mouth on the left side, and the change in the texture marks of the neck and front of the chest. The two FR vertical lines support the 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines of the composition. There are no vertical RT lines that identify a compositional line. The horizontal upper H1/4 line describes the top of the eyes and aligns to the bottom of the eyebrow. The H lower 1/4 at a moderate level of accuracy describes the bottom of the moustache and in general aligns to the description of the shoulders. The H upper 1/3 lines directly describes the bottom of the eyes and the center of the ears. The H lower 1/3 accurately describes neck and shoulders in relation to the face and the center of the mouth horizontally. The H lower FR supports the H lower 1/3 line by describing the right shoulder line of the edges of the mouth and nostrils at the bottom of the nose. In summary, from the vertical lines of the 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines, the H upper 1/4 and 1/3 lines, the eyes, eyebrows and the alignment to the center of the ears is fully delineated with an accuracy at a strong level. The nose, mouth, neck and shoulders are also accurately described with the interconnectedness of the vertical and horizontal lines of the placement of the figure in the picture frame. The HR3/5 gives the most information about the composition of the artwork.

**#369-5b.** Bird image from 369-5; grabado sobre madera, engraving on wood; assessment grid lines: count /color/ description:

4	black	V1/2, 1/4, H1/2
2	yellow	Vna, H1/3
1	green	Vna, H lower FR
Total lines 7		

Measurements: length 7.72 cm; height 6.8 cm; ratio = 0.88

V: 1/2, 1/4

1/2 = 3.86

1/4 = 1.93, 5.79

Total = 3 lines

H: 1/2, 1/3, lower FR

1/2 = 3.4

1/3 = 22.7, 4.53

lower FR = 2.59

Total = 4 lines

Accuracy of lines: HR3/4 (V1/4H1/3); VL1/4 = 0.5, V1/2 = 1, VR1/4 = 0.5, V = 0.66; H upper 1/3 = 1, H lower 1/3 = 1, H1/3 = 1.0; A = 0.83

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low			x				H2	H1
Inconsistent								
Not Found	x	x		x		x		
Accuracy 0- 3			0.83					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-5b; horizontal; length 7.72 cm, height 6.8 cm; ratio = 0.88; vertical lines: 1/2, 1/4; horizontal lines: 1/2, 1/3, lower FR; accuracy of line placement: A = 0.83; harmonic ratio: 3/4, the fourth: overall composition assessment: HR3/4 low. The composition analysis of #369-5b is at the level of a low representation of a 3/4, fourth harmonic, HR L3/4, V1/4 H1/3. Additional notes: The compositional lines are the V1/2 and V1/3 and the lower FR, which in general describe the two objects and their interaction and placement. Another observation is the stereo optic effect created by the texture pattern within the body of the bird figure in the fore ground section of the picture. The visual effect is most notable when the picture is viewed on a computer screen.

**#369-6; *Joven Cantante, Young Singer* 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

8	black	V1/2, L1/4, R1/8; H1/2, 1/4, 1/8
3	yellow	V1/3, H lower 1/3
2	green	VRFR, H upper FR
Total lines 13		

Measurements: length 8.02 cm; height 10.16 cm; ratio = 0.789

V: 1/2, L1/4, R1/8, 1/3, RFR	H: 1/2, 1/4, 1/8, lower 1/3, upper FR
1/2 = 4.00	1/2 = 5.08
L1/4 = 2.0	1/4 = 2.54, 7.62
R1/8 = 7.0	1/8 = 1.27, 8.89
1/3 = 2.67, 5.3466	lower 1/3 = 6.77
RFR = 4.49	upper FR = 3.88
Total = 6 lines	Total = 7 lines

Accuracy of lines: HR3/4 (V1/3H1/4); VL1/3 = 1.5, VR1/3 = 2, V1/3 = 1.75; H1/2 = 1.5, H upper 1/4 = 2, H lower = 1.5, H1/4 = 1.667; A = 1.708

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2 H1	V1 H1
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.708					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-6; vertical; length 8.02 cm, height 10.16 cm; ratio = 0.789; vertical lines: 1/2, 1/3, L1/4, R1/8, R FR; horizontal lines: 1/2, 1/4, 1/8, lower 1/3, upper FR; accuracy of line placement: A = 1.708; harmonic ratio: 3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 moderate. The composition analysis of #369-6 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4, V1/3H1/4. Additional notes: The vertical lines of the composition emphasize a main construction line at the R1/3. The line aligns the left side of the head, shoulder, left hand on the leg and center of the left leg. The weight of the figure is indicated along this line (A= 2). The RFR further supports the dance movement. The RFR line goes directly through the center of the left eye of the figure, the chin line, waist, left hand fingers, and inside left leg (A = 2.5). The L1/3 line aligns directly to the inside of the right leg and at a moderate accuracy describes the upper body position. The vertical L1/4 and R1/4 lines delineate the outer dimensions of the figure's feet, arms and hat. The centerline V1/2 describes the asymmetrical shift of a movement from the center of the body at the pelvis and waist to a shift to the left side of the upper torso of the figure, which moves the balance of the figure to the left side of the body. Horizontally, the H1/2, upper and lower 1/4 lines indicate the placement of the body into quarters. This division is further supported by the two sets of textural lines behind the figure. Both sets and lines indicate movement and this is aligned to the H1/4 sections. There are H 1/8 lines that indicate a figure division into 8 parts and this is a standard artistic principle for the dimensions of the figure. These

H 1/8 lines are at an accuracy of moderate. The H lower 1/3 line supports the placement of the background lines indicating movement and the H upper FR supports the H upper 1/4. The upper FR also directly indicates the waistline of the figure. The composition is sophisticated and lively. The accuracy of the lines is a moderate level. This is a 2-dimensional image. The artist primarily used line and shapes to indicate the form of the figure. There are two distinct patterns of lines used in the background to indicate music.

#369-7; *Caballo, Horse*, óleo sobre tela, oil on canvas; 1998; assessment grid lines: count /color/ description:

6	black	V1/2, 1/4, R1/8; H upper 1/4, upper 1/8
4	yellow	V1/3, H 1/3
8	red	V1/5, H1/5
4	green	VFR, H FR
2	orange	diagonal
Total lines 24		

Measurements: length 14.78 cm; height 23.93 cm; ratio = 0.6176

V: 1/2, 1/4, 1/3, 1/5, R1/8, FR	H: upper 1/4, upper 1/8, 1/3, 1/5, FR
1/2 = 7.39	upper 1/4 = 5.98
1/4 = 3.695, 11.08	upper 1/8 = 2.99
R1/8 = 12.93	1/3 = 7.97, 15.94
1/3 = 4.92, 9.84	1/5 = 4.786, 9.572, 14.358, 19.14
1/5 = 2.956, 5.912, 8.868, 11.824	FR = 9.11, 14.788
FR = 5.64, 9.13	

LFR ° VR1/8, 5.64 ° 12.93

RFR ° H diameter, 9.13 ° 14.78

Total = 14 lines

Total = 10 lines

Accuracy of lines: HR3/4 (V1/4H1/3); VL1/4 = 1.5, V1/2 = 2, VR1/4 = 2.6, V1/4 = 2; H upper 1/3 = 1.8, H lower 1/3 = 2.4, H1/4 = 2.1; A = 2.05

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V2 H2	V2 H2
Moderate								
Low								



Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.05					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-7; vertical; length 14.78 cm, height 23.93 cm; ratio = 0.6176; vertical lines: 1/2, 1/4, 1/3, 1/5, R1/8, FR, LFR ° VR1/8, RFR ° H diameter; horizontal lines: upper 1/4, upper 1/8, 1/3, 1/5, FR; accuracy of line placement: A = 2.05; harmonic ratio: 3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 strong. The composition analysis of #369-7 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4, V1/4 H1/3. Additional notes: There are two objects in this composition a horse and a figure. The artist outlined the horse shapes in thick black lines that vary in light and dark values. The figure is hugging the horse and is a dark shadow so the outline is subdued. The vertical lines divide the picture in 1/2, 1/4, 1/3, 1/5's. Each set of lines depicts the placement of the horse and figure in the picture frame. A harmonic ratio of V1/5H1/3 is indicated as a secondary ratio of the composition. The 2<sup>nd</sup> and 3<sup>rd</sup> 1/5's of both the vertical and horizontal dimensions support the FR's of both dimensions as well as the 1/3's of both dimensions. The artist placed a large white shape (the only one) within the horse body that draws the eye to the location in the picture frame that is in the (6.65/10.9 = 0.61009) rectangle in center of the V1/3 and H1/3 grid pattern. This area of the artwork is both vertical and horizontal lines of the 2<sup>nd</sup> and 3<sup>rd</sup> 1/5's and FR. In addition, the two diagonal lines VLFR ° VR1/8 and VRFR ° H diameter (read vertical left frame ratio connecting to the vertical right 1/8 and the vertical right frame ratio connecting to the horizontal length measurement) align to the feet, body and eye placements of the composition (A = 2.8). The HR3/4 describes the placement of the black outlines for the various shapes of the horse and figure. There is a convergence (crossing) of the lines of the V 3<sup>rd</sup> 1/5 and the diagonal of the VLFR ° VR1/8 aligned to the VRFR. This point of the composition describes the three-quarter angle of the horse's position just below the white shape and within the central DEMR rectangle. There is a second diagonal line (VRFR ° H diameter) that begins at the bottom of the picture frame at the VRFR connecting to the H length diameter in the upper right corner. The line directly aligns to the position of the horse's left leg, the horse's nose and left eye. Overall, the vertical 1/2, 1/4 and 1/8 lines describe the majority of the picture composition with the support of the underlying HR3/5, V1/5H1/3. The FR lines support both HR ratios. There is no H1/2 delineation for the composition. The H upper 1/4 accurately aligns to the placement of the bottom of the horse's eyes and in general the location of the figure lying on the horse. The H upper 1/8 gives a general indication of the height of the horse. The H upper 1/3 accurately describes the figure lying on the body of the horse and gives a moderate accuracy for the location of the bottom of the horse's mouth. The H lower 1/3 describes the bottom of the horse's body and legs. The H 1/5 lines in general support the picture composition. The H FR lines accurately describe and support the placement of the

shapes within composition of the horse. The more accurate composition is the HR3/4 V1/4 H1/3 and this is supported by the DEMR rectangle in the center of the mathematical grid, which is conceivable because the ratio of the picture frame dimensions is 0.6176 ~ DEMR. This is a 2-dimensional image of shapes and line.

#369-8; *Eduardo*, 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

2 black V1/2; H1/2  
 4 yellow V1/3, H 1/3  
 Total lines 6

Measurements: length 17.12 cm; height 22.3 cm; ratio = 0.7677

V: 1/2, 1/3 H: 1/2, 1/3  
 1/2 = 8.56 1/2 = 11.15  
 1/3 = 5.70, 11.40 1/3 = 7.43, 14.86  
 Total = 3 lines Total = 3 lines

Accuracy of lines: HR2/3 (V1/2H1/3); V1/2 = 2.8, V1/2 = 2.8; H upper 1/3 = 2.8, H lower 1/3 = 2.6, H1/3 = 2.7; A = 2.75

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x					V2 H2	
Moderate								
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.75						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-8; vertical; length 17.12 cm, height 22.3 cm; ratio = 0.7677; vertical lines: 1/2, 1/3; horizontal lines: 1/2, 1/3; accuracy of line placement: A = 2.75; harmonic ratio: 2/3, the fifth, V1/2, H1/3; overall composition assessment: HR2/3 strong. The composition analysis of #369-8 is at the level of a strong representation of a 2/3, fifth

harmonic, HR2/3; V1/2H1/3. There is evidence of the use of the HRV1/2, octave, at a high accuracy of 2.8. Additional notes: The image is a linotype portrait of Eduardo. The artist juxtaposed light and dark shapes within the space of the portrait image. The human face has a vertical symmetry reflection line (i.e. both sides of the lines are in general a mirror image of one another). There is a use of light and dark values as a reverse symmetry design of juxtaposing tonal qualities corresponding to the facial features. The vertical 1/2 line is the reflection line of the face (A = 2.8). This composition is a harmonic ratio HR1/2, however, because of the values variations and line delineations that accurately describe the artist's placement of the facial features and neck and shoulders the HR2/3 gives more information about the composition (A = 2.75) with a strong accuracy. Underlying the V1/3 is a V1/5. The V 1<sup>st</sup> 1/5 describes the outside corner of the right eye, eyebrow and neck. The V 2<sup>nd</sup> 1/5 describes the inside corner of the right eye, eyebrow and at a moderate level the right side of the corner of the mouth. The V 3<sup>rd</sup> 1/5 line accurately describes the top of the mouth on the left side. The V 4<sup>th</sup> 1/5 line describes the outside of the left eye, eyebrow, left ear and neck. Underlying the V1/5 composition is the V 1/9, which is the harmonic ratio of 4/6/9, a double fifth. A significant compositional line is accurately aligned to the V 4<sup>th</sup> 1/9, the delineation starts at the bottom of the portrait. The line divides the white and black areas below the chin, the inside of the right side of the mouth, the right nostril and the forehead division of black and white (A = 2.8), this line parallels the V1/2 line. The V 4<sup>th</sup> 1/9 line cuts the H 1/3 lines ~ in DEMR. The V 1<sup>st</sup> 1/9 aligns to the top and bottom attachments of the right ear to the head. The V 2<sup>nd</sup> 1/9 supports the V 1<sup>st</sup> 1/5 with moderate accuracy, the V 3<sup>rd</sup> 1/9 is the VL1/3, the V 4<sup>th</sup> 1/9 is the major compositional line just described, the V 5<sup>th</sup> 1/9 supports the VL1/3, the V 6<sup>th</sup> 1/9 is the VR1/3, the V 7<sup>th</sup> 1/9 aligns to the left side of the head and the V 8<sup>th</sup> 1/9 aligns to the connection of the bottom of the left ear to the head and in general to the top of the left ear. Overall, the harmonic ratio of HR2/3 V1/2 H1/3 (A = 2.75) is the most accurate ratio with the best description of the reverse symmetry. This is a 2-dimensional image. There is no indication of depth. The V1/2 compositional line is supported by the implied line of the V 4<sup>th</sup> 1/9, which gives the image appeal and structure at the symmetry line of reflection. The image is so original and mathematically intricate it can be used to teach portraiture techniques.

**#369-9; *La fotografía, The Photograph*, 2008; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

7	black	V1/4; H1/2, 1/4, 1/8
3	yellow	V1/3, H upper 1/3
1	green	VRFR
Total lines 11		

Measurements: length 13.54 cm; height 26.44 cm; ratio = 0.512  
 V: 1/4, 1/3, RFR H: 1/2, 1/4, 1/8, upper 1/3

1/4 = 30385, 10.155  
 1/3 = 4.513, 9.02  
 RFR = 8.367

Total = 5 lines

1/2 = 13.22  
 1/4 = 6.61, 19.83  
 1/8 = 3.30, 23.1  
 upper 1/3 = 8.81

Total = 6 lines

Accuracy of lines: HR3/4 (V1/3, H1/4); VL1/3 = 2.3, VR1/3 = 2.5, V1/3 = 2.4; H upper 1/8 = 2.3, H upper 1/4 = 2.3, H1/2 = 2.1, H lower 1/4 = 2, H lower 1/8 = 2.7, H1/4 = 2.28; A = 2.34

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V2 H1	V1
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x	x	x		
Accuracy 0- 3			2.34					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-9; vertical; length 13.54 cm, height 26.44 cm; ratio = 0.512; vertical lines: 1/4, 1/3, RFR; horizontal lines: 1/2, 1/4, 1/8, upper 1/3; accuracy of line placement: A = 2.34; harmonic ratio: 3/4, the fourth, V1/3, H1/4; overall composition assessment: HR34 strong. The composition analysis of #369-9 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4; V1/3H1/4. Additional notes: The image of the artwork depicts a family of a mother, father and children. The vertical lines of the V1/3's accurately delineate the placement of the mother and infant on the right side of the picture, the child in the center and the father and child on the left side. The VL1/3 aligns to the mother's profile, shoulder, hand and left foot. The VR1/3 aligns to the right side of the father's head and body in direct alignment to the child he is holding, his right leg and top of the right foot. The RFR (A = 2.8) supports the VR1/3, the placement of the child's face and line of the blanket covering the child. The horizontal H1/4 divide the image at placement of the 1/2 position of the mother's lap with baby, the pelvis of the father and

the point at where the father's left hip goes off the picture frame. The H upper 1/8 correctly aligns to the position of the father's eyes. The H upper 1/4 aligns to the mother's ear, eye position and father's left arm holding the child. The H lower 1/4 aligns the edges of the baby's blanket and the knees of the father. The H lower 1/8 closely aligns to the floor lines the artist drew. The H upper 1/3 aligns the chin placement of the mother, the center of the center child's eyes and the rib cage of the father. The linotype is made with thick dark outlines around the shapes. There is a primitive use of the anatomy of the figures. There is a slight indication of linear perspective on the floor with lines slightly angled toward a vanishing point. The mother's dress lines have compositional lines that indicate linear perspective.

#369-10; *La muñeca, The Doll*, 2009; pirograbado en madera, pyrograph on wood; assessment grid lines: count /color/ description:

8 black V1/2, 1/4, 1/8; H1/2, 1/8  
 4 yellow V1/3, H 1/3  
 4 green VFR, HFR  
 Total lines 16

Measurements: length 15.98 cm; height 10.76 cm; ratio = 0.673

V: 1/2, 1/4, 1/8, 1/3, FR	H: 1/2, 1/8, 1/3, FR
1/2 = 7.99	1/2 = 5.38
1/4 = 3.995, 11.985	1/8 = 1.345, 9.41
1/8 = 1.998, 13.98	1/3 = 3.586, 7.17
1/3 = 5.32, 10.646	FR = 4.11, 6.649
FR = 6.10, 9.875	
Total = 9 lines	Total = 7 lines

Accuracy of lines: HR2/3 (V1/2H1/3); V1/2 = 2.4, V1/2 = 2.4; H upper 1/3 = 2.6, H ower 1/3 = 2, H1/3 = 2.3; A = 2.35

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x					V2 H2	V2 H2
Moderate								
Low								
Inconsistent								

Not Found	x		x	x	x	x		
Accuracy 0- 3		2.35						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-10; horizontal; length 15.98 cm, height 10.76 cm; ratio = 0.673; vertical lines: 1/2, 1/4, 1/8, 1/3, FR; horizontal lines: 1/2, 1/8, 1/3, FR; accuracy of line placement: A = 2.35; harmonic ratio: 2/3, the fifth, V1/2H1/3; overall composition assessment: HR2/3 strong. The composition analysis of #369-10 is at the level of a strong representation of a 2/3, fifth harmonic, HR2/3; V1/2 H1/3. There is evidence of the use of the HR3/4; V1/3H1/4, the fourth, at a moderate accuracy of 1.8. Additional notes: This image can be divided both vertically and horizontally in half. The composition of the face and head of the doll are symmetric about the V and H 1/2 lines. The vertical V 1/4 line aligns to the description of the left and right sides of the head. The V 1/8 lines in general align to the placement of the bubble pipe on the left side of the image and the right side of the head looking at the image. The V 1/2 line is the placement of the centerline of the face. The VL 1/3 is equidistant from the V 1/2 line the same distance as the VR1/3 line, which goes through the center of the right pupil. This alignment of eyes, pupils and the centerline of the face is the correct spatial arrangement for a face and head at the angle presented in the image. The vertical FR lines, LFR and RFR both support the facial composition of the vertical and horizontal lines. The eyes and nose of the doll are precisely arranged in a Rule of Three alignment. The four FR lines support this arrangement. There is an indication of linear perspective with the alignment of the consecutive lines and vertical shapes of the left side of the doll's head. The bubble pipe is angled such that there is an indication of volume and depth. Overall, this is a 2-dimensional image with the use of points as delicate lines to give the illusion of the doll image.

**#369-11; *Enfermos, Sick*, 2002; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

8	black	V1/2, V1/8; H1/2, 1/4, 1/8
2	yellow	V1/3, Hna
2	green	Vna, HFR
Total lines 12		

Measurements: length 16.04 cm; height 12.14 cm; ratio = 0.7568

V: 1/2, 1/8, 1/3

H: 1/2, 1/4, 1/8, FR

1/2 = 8.02

1/2 = 6.07

1/8 = 2.00, 14.04

1/4 = 3.03, 9.10

1/3 = 5.346, 10.69

1/8 = 1.51, 10.625

FR = 4.63, 7.50

Total = 5 lines

Total = 7 lines

Accuracy of lines: HR2/3 (V1/3, H1/2); VL1/3 = 0.7, VR1/3 = 0.7, V1/3 = 0.7; H1/2 = 1, H1/2 = 1; A = 0.85

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2	H2
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.85						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #369-11; horizontal; length 16.04 cm, height 12.14 cm; ratio = 0.7568; vertical lines: 1/2, 1/8, 1/3; horizontal lines: 1/2, 1/4, 1/8, FR; accuracy of line placement: A = 0.85; harmonic ratio: 2/3, the fifth, V1/3, H1/2; overall composition assessment: HR2/3 low. The composition analysis of #369-11 is at the level of a low representation of a 2/3, fifth harmonic, HR L2/3; V1/3 H1/2. Additional notes: The imagery of the artwork is primarily a figure lying on a bed. The picture is divided in half in general indicated by a figure standing behind the bed next to the figure. There is an indication of the HR 2/3 V1/3H1/2 composition. The H 1/2 is aligned to the figure lying down on the bed. The H lower 1/4 aligns to the bed frame. The H upper 1/4 in general aligns to the small objects in the background. The V L1/3 line in general divides the figure on the bed in thirds and the objects in the background. The V R1/3 line in general aligns to the placement of the head of the figure and the two objects in the background that are on the right side. There is a slight indication of linear perspective from the line of the bed at the feet of the figure. This is a 2 dimensional image with the use of black outlines and shapes.

**Participant: #370; male; 30 years old; 30 years at JLDF; 13 years at the art school; myopia and astigmatism- does not use glasses; range of time of artwork used in the study: 2003 -2010, socioeconomic status/ medium**

**#370-1; *Te extraño amada, Miss You My Dear*, 2008; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

5 black Vna; H1/2, 1/4, 1/8  
 3 yellow VL1/3, H1/3  
 8 red V1/5, H1/5

2 green Vna, HFR  
 3 diagonal V3, Hna  
 Total lines 21

Measurements: length 13.34 cm; height 18.75 cm; ratio = 0.6581  
 V: L1/3, 1/5 H: 1/2, 1/4, 1/8, 1/3, 1/5, FR  
 L1/3 = 4.113 1/2 = 9.375  
 1/5 = 2.468, 4.936, 7.404, 9.872 1/4 = 4.687, 14.06  
 V 2<sup>nd</sup> 1/5 ° VR1/3 = 4.936 ° 8.226 1/8 = 2.34, 16.41  
 V1/2 ° V RFR = 6.17 ° 7.626 1/3 = 6.25, 12.5  
 V1/2 ° V 4<sup>th</sup> 1/5 = 6.17 ° 9.872 1/5 = 3.75, 7.5, 11.25, 15  
 FR = 4.63, 7.50  
 Total = 8 lines Total = 13 lines

2.7, Accuracy of lines: HR3/5; V1/5H1/3; V1st 1/5 = 1, V2nd 1/5 = 2.3, V3rd 1/5 =  
 V4th 1/5 = 1; H upper 1/3 = 2.8, H lower 1/3 = 2.2;  
 V1/5 = 1.75, H1/2 = 2.5; A = 2.125

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V1 H2	H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.125			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-1; vertical; length 12.34 cm, height 18.75 cm; ratio = 0.6581; vertical lines: L1/3, 1/5, V 2<sup>nd</sup> 1/5 ° VR1/3, V1/2 ° V RFR, V1/2 ° V 4<sup>th</sup> 1/5; horizontal lines: 1/2, 1/4, 1/8, 1/3, 1/5, FR; accuracy of line placement: A = 2.125; harmonic ratio: 3/5, the sixth, V1/5 H1/3; overall composition assessment: HR3/5 strong. The composition analysis of #370-1 is at the level of a strong representation of a 3/5, sixth harmonic,



HR3/5; V1/5 H1/3. Additional notes: The image is of a woman dancing. The vertical lines of the composition are divided at an accuracy of  $A = 2.125$ . The  $V 1^{st} 1/5$  and the  $V 4^{th} 1/5$  delineate the left and right side of the balance of the figure in wide and flowing dress at a moderate level. The vertical lines align to the upper background lines of composition. The  $V 2^{nd} 1/5$  describes the spacing of the right side of the figure placement of the head and hips, which is the description of the line of contrast that carries the weight of the figure. The  $V 3^{rd} 1/5$  ( $A = 2.7$ ) aligns with the left side of the face, side of the body, and inside left leg to the inside left ankle. There are three vertical diagonal lines that follow the composition. The first is the  $V 2^{nd} 1/5 \text{ }^c \text{ VR}1/3$ , ( $A = 2.8$ ) the measurement starts at the  $VR1/3$  and goes to the  $V 2^{nd} 1/5$ . The line aligns to the right side of the head and across the body, which indicates the movement of the body dancing. The second diagonal line  $V1/2 \text{ }^c \text{ V RFR}$  ( $A = 3$ ) aligns to the description of the center of the face, body and the left ankle position of the pose. The third diagonal line,  $V1/2 \text{ }^c \text{ V } 4^{th} 1/5$  ( $A = 2.8$ ), aligns to the description of the left side of the body, head and left leg position of the dance. The horizontal lines align to the  $H1/2$  division across the waist position of the dress. The upper  $H1/4$  in general divides the area between the head and body. The  $H$  upper  $1/8$  aligns to the top of the figure and hat positioning. The  $H$  lower  $1/4$  in general describes the flow of the dress across the picture frame. The  $H$  lower  $1/8$  repeats the same alignment. The  $H$  upper  $1/3$  accurately describes the division the area of the top third of the background and middle ground,  $A = 2.8$ . The  $H$  lower  $1/3$  accurately divides the bottom third of the middle ground and foreground,  $A = 2.2$ . There is an indication of the  $H 1/5$  lines. The  $H 1^{st} 1/5$  aligns to the chin of the figure, the  $H 2^{nd} 1/5$  aligns to the placement of the middle ground patterns, the  $H 3^{rd} 1/5$  aligns to the placement of the pelvis of the figure, and the  $H 4^{th} 1/5$  is aligned to the division of the middle ground and the foreground. The  $H$  lower  $FR$  supports the  $H 3^{rd} 1/5$  along the line of the pelvis where the greatest movement of the figure would occur for the dancing. This artwork composition demonstrates a strong use of HR-RT with both vertical and horizontal dimensions to depict movement of the dancer. This is a 2-dimensional image with white lines and texture marks. The overall picture frame measurement is close to DEMR at 0.6581. This compositional design is complex not simple. The three diagonal lines highly support the HR 3/5 composition of the artwork.

**#370-2**; Cazador, Hunter, 2008; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

9	black	$V1/2, 1/4, 1/8; H1/2, 1/4, \text{upper } 1/8$
4	yellow	$V1/3, H1/3$
4	red	$Vna, H1/5$
3	green	$VLFR, HFR$
Total lines 20		

Measurements: length 8.53 cm; height 18.89 cm; ratio = 0.451

V: 1/2, 1/4, 1/8, 1/3, LFR  
 1/2 = 4.265  
 1/4 = 2.13, 6.398  
 1/8 = 1.066, 7.46  
 1/3 = 2.84, 5.687  
 LFR = 3.258

Total = 8 lines

H: 1/2, 1/4, upper 1/8, 1/3, 1/5, FR  
 1/2 = 9.445  
 1/4 = 4.72, 14.167  
 upper 1/8 = 2.36  
 1/3 = 6.296, 12.59  
 1/5 = 3.778, 7.556, 11.334, 15.11

FR = 7.216, 11.67

Total = 12 lines

Accuracy of lines: HR3/5; V1/3H1/5; VL1/3 = 2.8, VR1/3 = 2.8; H1<sup>st</sup> 1/5 = 2.8, H2<sup>nd</sup>1/5

= 2.4, H3<sup>rd</sup>1/5 = 1.5, H4<sup>th</sup>1/5 = 2.8; V1/3 = 2.8, H1/5 = 2.375; A = 2.5875

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H2	V1 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.5875			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-2; vertical; length 8.53 cm, height 18.89 cm; ratio = 0.451; vertical lines: 1/2, 1/4, 1/8, 1/3, LFR; horizontal lines: 1/2, 1/4, upper 1/8, 1/3, 1/5, FR; accuracy of line placement: A = 2.5875; harmonic ratio: 3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #370-2 is at the level of a strong representation of a 3/5, sixth harmonic, HR 3/5; V1/3H1/5. Additional notes: There is evidence of a multiple use of harmonic ratio, HR3/5, the fifth, V1/3H1/5. The accuracy of the V1/2 line is A = 2.8. This line delineates the position of the head, body, and inside left leg ankle, which is the correct compositional line for describing the weight and balance of the figure. The H1/3 lines have less accuracy, the upper 1/3 (A = 1.5) and the lower (A = 1.5) overall accuracy for V1/3H1/2 is A = 1.933. The V1/2 line is accurate but the overall composition placement is not strongly divided into thirds. The composition of the H1/5's more correctly describes the manner in which the artist

composed the artwork. The HFR's aligned with the H 2<sup>nd</sup> 1/5 and H 3<sup>rd</sup> 1/5 to further support the H3/5. In looking at the figure composition, the artist elongated the figure into five sections and this distorted the figure image. H 1<sup>st</sup> 1/5 aligns accurately to the placement of the right arm to the shoulder and chin. The H 2<sup>nd</sup> 1/5 describes the width of the figure's belly and the placement of the upper instrument he is carrying. The 3<sup>rd</sup> 1/5 line in general is aligned to the placement of the bottom of the lower instrument. The H 4<sup>th</sup> 1/5 accurately aligns to the area where the background texture stops near the bottom of the picture. The H upper and lower 1/3 lines support the 2<sup>nd</sup> 1/5 and 3<sup>rd</sup> 1/5 figure descriptions. This is a 2-dimensional image the artist used black and white values with line and shape to create the image.

#370-3; *Tigre, Tiger*, 2007; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

5 black V1/2, 1/4, R1/8; H1/2  
 6 yellow V1/6, H1/3  
 8 red V1/5, H 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> 1/5  
 4 green VFR, HFR  
 Total lines 23

Measurements: length 12.82 cm; height 10.36 cm; ratio = 0.808

V: 1/2, 1/4, R1/8, 1/5, 1/6, FR	H: 1/2, 1/3, 1 <sup>st</sup> , 2 <sup>nd</sup> and 4 <sup>th</sup> 1/5, FR
1/2 = 6.41	1/2 = 5.18
1/4 = 3.205, 9.615	1/3 = 3.45, 6.90
R1/8 = 11.22	1 <sup>st</sup> , 2 <sup>nd</sup> and 4 <sup>th</sup> 1/5 = 2.07, 4.144, 8.288
1/5 = 2.564, 5.128, 7.692, 10.256	FR = 3.957, 6.40
1/6 = 2.1366, 4.27, 6.4, 8.546, 10.68	
FR = 4.897, 7.92	
Total = 15 lines	Total = 8 lines

Accuracy of lines: HR3/5; V1/5H1/3; V1<sup>st</sup> 1/5 = 2.5, V2<sup>nd</sup> 1/5 = 2.3, V3<sup>rd</sup> 1/5 = 2.3, V4<sup>th</sup> 1/5 = 2.5; H upper 1/3 = 2.8, H lower 1/3 = 0.7; V1/5 = 2.4, H1/3 = 1.75; A = 2.075

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								

Low								
Inconsistent					x		V2 H2	V2 H2
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.075			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-3; horizontal; length 12.82 cm, height 10.36 cm; ratio = 0.808; vertical lines: 1/2, 1/4, R1/8, 1/5, 1/6, FR; horizontal lines: 1/2, 1/3, 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> 1/5, FR; accuracy of line placement: A = 2.075; harmonic ratio: 3/5, the sixth, V1/5H1/3; overall composition assessment: HR3/5 inconsistent. The composition analysis of #370-2 is at the level of an inconsistent representation of a 3/5, sixth harmonic, HR I3/5; V1/3 H1/5. Additional notes: The artist's image of the Tiger is composed as a HR3/5; V1/5, H1/3. However, an inconsistent use of the harmonic ratio composition is indicated. The vertical 1/5 lines align best with the artist's composition but the horizontal line placement of the image becomes inconsistent as the artist used the idea of five legs for the tiger. Simultaneously, the image of the tiger in the lower portion of the picture frame attempts to describe a profile and front view tiger position. This creates visual confusion and is reflected in the harmonic ratio composition. The V 1<sup>st</sup> 1/5 is aligned to the right eye of the tiger. The V 1<sup>st</sup> 1/6 line aligns to the right side of the tiger's face and ear. The V 2<sup>nd</sup> 1/6 (the 1<sup>st</sup> 1/3) accurately aligns to the left eye and left profile leg of the tiger, the V 2<sup>nd</sup> 1/5 supports the V LFR, which accurately aligns to the left side of the tiger's head and left profile leg of the tiger. The V 2<sup>nd</sup> 1/5 also aligns to the inside of the left leg of the tiger that is facing forwards. The V 1/2 delineates the texture line on the body of the tiger and the area between the two front facing legs. The V 3<sup>rd</sup> 1/5 moderately aligns to the left front facing leg and the edge of the cloud in the background. The V RFR supports the 3<sup>rd</sup> 1/5 delineation. The V 4<sup>th</sup> 1/6 (the 2<sup>nd</sup> 1/3) divides the body of the tiger if viewed from a profile posture, this is indicated by the alignment to the tiger body line and the fold of the underneath of the body line of tiger at that point. The V R1/4 in general divides the rear of the tiger and marks the position of the sun in the background. The V 4<sup>th</sup> 1/5 indicates the position of the rear left leg in a profile angle and the V 5<sup>th</sup> 1/6 supports that line with an alignment to the leg also. The V R1/8 is a moderate placement of the right leg. The horizontal lines follow the division of harmonic ratio lines in 1/5's but are inconsistent to the composition. The H 1<sup>st</sup> 1/5 accurately describes the top of the tiger's head and the bottom of the cloud and the sun (A = 2.5). The H upper 1/3 accurately aligns to the center of the eyes and height of the back of the tiger (A = 2.8). The H upper FR and 2<sup>nd</sup> 1/5 support the H upper 1/3, which is the placement of the nose. The H1/2 line accurately aligns to the placement of the mouth. The H lower FR in general supports the H lower 1/3 line, which at a low level (A = 0.7) aligns to the lower part of the body of the tiger. The H 3<sup>rd</sup> 1/5 does not support the H lower 1/3 nor the H lower FR. The only compositional

placement that is at a low level would be the tip of the tiger's tale. The H 4<sup>th</sup> 1/5 accurately describes the placement of the line of the body that delineates the connection to the front legs in a front facing view. Overall the composition of the tiger in an outdoor environment on grass and under clouds and the sun is an inconsistent use of the HR 3/5; V1/5 H/13. The vertical lines of the V 1/5's and VFR supported primarily a front view of the tiger. The V 1/6's supported a profile view of the tiger. The horizontal line of the H upper 1/3 is accurate (A = 2.8), however, the H lower 1/3, H 3<sup>rd</sup> 1/5 and H lower FR are at a low level of accuracy as this area of the composition gives the convergence of the leg positions of profile and front view. The H 4<sup>th</sup> 1/5 line identifies the body in a front view at the connection to the legs (A = 2.5). The image described a tiger with five legs and the combination of the two body positions were simultaneously aligned to the V1/5 and V1/6 grid positions. The VL1/3 (A = 2.8) and VR1/3 (A = 2.5) lines accurately describe the tiger in a profile position. The horizontal delineations and placements of the elements of the composition were the H1/5 and H1/3. The H 3<sup>rd</sup> 1/5 was not represented. This combination of grid lines shows the consistent building of the image by altering the grid line pattern i.e. the V 1<sup>st</sup> 1/6 aligns to the right side of the tiger's head and the center of the left eye and right profile leg. The V 1<sup>st</sup> 1/5 aligns to the description of the right eye of the tiger and the V 2<sup>nd</sup> 1/5 aligns to the outside of the left side of the tiger's head, ear and what would be the left profile leg (but is the right front facing leg). This line supports the V LFR. The V LFR aligns closely to the left side of the tiger's head and ear and right profile leg. This is the "built architecture" that has been demonstrated in the participants' artworks. The composition in the lower portion of the artwork changes that pattern to read: the V 2<sup>nd</sup> 1/5 and 3<sup>rd</sup> 1/5 supported by the VFR, which are symmetric in the description of the front facing composition of the tiger's legs. There is evidence of the use of harmonic ratio HR3/5 V1/5H1/3 and a break in the HR and RT patterns in the two horizontal halves of the picture frame.

**#370-4;** *Castillo, Castle, 2007;* técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

8	black	V1/2, R1/4, L1/8; H: 1/2, 1/4, 1/8
3	yellow	VR1/3, H1/3
2	green	VFR, Hna
Total lines 13		

Measurements: length 16.83 cm; height 20.65 cm; ratio = 0.815

V: 1/2, R1/4, L1/8, R1/6, FR	H: 1/2, 1/4, 1/8, 1/3
1/2 = 8.415	1/2 = 10.325
R1/4 = 12.62	1/4 = 5.16, 15.4875
L1/8 = 2.10	1/8 = 2.58, 18.07
R1/6 = 14.02	1/3 = 6.88, 13.76
FR = 6.429, 10.4	
Total = 6 lines	Total = 7 lines

Accuracy of lines: HR1/2; V1/2, Hna; V1/2 = 1, Hna; A = 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low								
Inconsistent	x						V1 H2	H2
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.0							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-4; vertical; length 16.83 cm, height 20.65 cm; ratio = 0.815; vertical lines: 1/2, R1/4, L1/8, R1/6, FR; horizontal lines: 1/2, 1/4, 1/8, 1/3; accuracy of line placement: A = 1.0; harmonic ratio: 1/2, the octave, V1/2, Hna; overall composition assessment: HR1/2 inconsistent. The composition analysis of #370-2 is at the level of an inconsistent representation of a 1/2, octave harmonic, HR1/2; V1/2 Hna. Additional notes: This artwork is a mixed media on canvas. In general, the artist divided the composition in half. There is a large figure on the left side and a large figure on the right side of the picture. There is space in the center with three objects a cloud at the top, a picture of an angel and an image of three small figure grouped together. The vertical FR lines delineate the more or less empty space in the middle. The V1/2 line identifies the center of the picture, A = 1. The V1/8 and V R1/4 lines in general describe the placement of the two large figures. The VR 1/3 aligns to the left side on the right of the picture frame.

A H1/2 line that in general aligns to the placement of the small group of figures. The H 1/8 lines moderately align to the top and bottom positions of the large figures. The H upper and lower 1/3 lines in general describe the objects in the 1/3 sections. Overall the composition of the artwork indicates the 1/2 harmonic ratio but the relationship of the objects and figures does not follow a consistent use of the proportionality. There is an inconsistent and confusing alignment of the objects, shapes and figures. This is a mixed media on canvas venue juxtaposed to the oil painting techniques. There is no clear pattern other than the 1/2. The representation overall is at an inconsistent level.

**#370-5; *El dragón egipcio, Egyptian Dragon*, 2006; técnica mixta sobre madera, mixed media on wood; assessment grid lines: count /color/ description:**

20 black V1/16 (minus 13<sup>th</sup> 1/16); H: 1/2, 1/4, 1/8  
 10 yellow VR1/3, H1/9  
 8 red V1/5, H1/5  
 4 green VFR, HFR  
 Total lines 42

Measurements: length 15.8 cm; height 19.19 cm; ratio = 0.823

V: 1/2, 1/16, 1/3, 1/5, FR,

1/2 = 7.9

1/16 (minus 13<sup>th</sup> 1/16) = 0.9875, 1.975, 2.96, 3.95, 4.937, 5.9, 6.9, 7.9, 8.88,  
 9.875, 10.86, 11.85, 13.8, 14.81

1/3 = 5.267, 10.53

1/5 = 3.16, 6.32, 9.48, 12.64

FR = 6.035, 9.764

Total = 23 lines

H: 1/2, 1/4, 1/8, 1/9, 1/5, FR

1/2 = 9.595

1/4 = 4.797, 14.39

1/8 = 2.398, 16.79,

1/9 = 2.13, 4.26, 6.39, 8.52, 10.65, 12.78, 14.91, 17.04

1/5 = 3.838, 7.676, 11.514, 15.35

FR = 7.33, 11.859

Total = 19 lines

Accuracy of lines: HR 9/12/16; V1/16 H1/9; V 1<sup>st</sup> 1/16 = 2.5, V 2<sup>nd</sup> 1/16 = 2, V 3<sup>rd</sup> 1/16 = 2.5, V 4<sup>th</sup> 1/16 = 2.5, V 5<sup>th</sup> 1/16 = 2.7, V 6<sup>th</sup> 1/16 = 2.5, V 7<sup>th</sup> 1/16 = 2, V 8<sup>th</sup> 1/16 = 2.5, V 9<sup>th</sup> 1/16 = 2, 10<sup>th</sup> 1/16 = 2.5, V 11<sup>th</sup> 1/16 = 2.5, V 12<sup>th</sup> 1/16 = 1, 14<sup>th</sup> 1/16 = 1, V 15<sup>th</sup> 1/16 = 2.5; H 1<sup>st</sup> 1/9 = 2, H 2<sup>nd</sup> 1/9 = 2.8, H 3<sup>rd</sup> 1/9 = 2.5, H 4<sup>th</sup> 1/9 = 2.5, H 5<sup>th</sup> 1/9 = 2.8, H 6<sup>th</sup> 1/9 = 2, H 7<sup>th</sup> 1/9 = 2.8, H 9<sup>th</sup> 1/9 = 2.5; A = 2.338

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>

<i>Level of Evidence</i>								
Strong				x			V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy 0- 3				2.338				

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-5; vertical; length 15.8 cm, height 19.19 cm; ratio = 0.823; vertical lines: 1/2, 1/16, 1/3, 1/5, FR; horizontal lines: 1/2, 1/4, 1/8, 1/9, 1/5, FR; accuracy of line placement: A = 2.338; harmonic ratio: 9/12/16, from the fifth and the fourth; overall composition assessment: HR9/12/16 strong. The composition analysis of #370-5 is at the level of a strong representation of a 9/12/16, harmonic from the fifth and the fourth, V1/16 H1/9. Additional notes: The artwork is a mixed media on wood with the image of a dragon extending from the top to the bottom of the picture frame. The arms and fire extend to the edge of the right side and the fire from the dragon's mouth goes off the picture frame. The wings of the dragon extend off the left side of the picture frame. The legs and feet of the dragon are placed at the bottom of the space. The vertical 1/16<sup>th</sup> lines define accurately the composition of the dragon as placed by the artist. The V L1/3 and V 5<sup>th</sup> 1/16 described the placement of the dragon's eye, body and left leg. The 6<sup>th</sup> 1/16, VLFR and V 2<sup>nd</sup> 1/5 aligned with the placement of the head, arms, body and left leg. This position is the description of the balance of the dragon's weight. The V3rd 1/5, VRFR, and 10<sup>th</sup> 1/16 are aligned to the wings, back, and body of the dragon. The V 1<sup>st</sup> 1/5 accurately describes the placement of the nose, arm and body on the right side of the picture. This line is supported by the V 3<sup>rd</sup> 1/16. The V 15<sup>th</sup> 1/16 is aligned to the placement of the back of the dragon. The division of the 1/9's best describes the horizontal composition of the artwork. The H 1<sup>st</sup> 1/9 aligns with the placement of the mouth and teeth. The V L1/3, H upper 1/8 and the V 5<sup>th</sup> 1/16 support that placement. The H 1<sup>st</sup> 1/5 and the H 2<sup>nd</sup> 1/9 identify the placement of the mouth and teeth. The H 3<sup>rd</sup> 1/9 is the delineation of the arms of the dragon. The H upper FR and H 2<sup>nd</sup> 1/5 align to the fire, lower arm (center shape of the body, which gives the illusion of depth and volume) and the back section of the upper body. The V 5<sup>th</sup> 1/16 is a significant compositional line, the delineation of the background of dark space and textured foreground (A = 2.7) on the left side and on the shorter right side. Overall the artwork is A = 2.338 and the lines of the 1/16's, 1/9, 1/5's and FR's describe the placement of the dragon. This alignment is an example of the harmonic ratio 9/12/16. The composition of the artwork demonstrates the V 1/16 and H 1/9 divisions of the HR 9/12/16. This is a complex demonstration of the use



of harmonic ratio. The artist used a perceptual technique called optical illusion to describe the volume of the dragon's body. Specifically, the artist created a pattern of larger and smaller oval and quadrangle shapes that increase in size and shape to move the viewers' eye from the narrow slanted angle of the side to the widest angle of the shape, which is a frontal view and induces a sense of depth perception. This technique was employed to describe the body of the dragon in three dimensions. This is a 3-dimensional image.

**#370-6; Cuarenta principals. Top Forty, 2007;** grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

3 black V1/2, 1/4; Hna  
 4 yellow VR1/3, H1/3  
 4 red Vna, H1/5  
 3 green VFR, H upper FR  
 Total lines 14

Measurements: length 7.97 cm; height 11.84 cm; ratio = 0.673

V: 1/2, 1/4, 1/3, FR	H: 1/3, 1/5, upper FR
1/2 = 3.985	1/3 = 3.946, 7.89
1/4 = 1.99, 5.977	1/5 = 2.368, 4.736, 7.104, 9.47
1/3 = 2.656, 5.31	upper FR = 4.52
FR = 3.04, 4.925	
Total = 7 lines	Total = 7 lines

Accuracy of lines: HR3/5, V1/3H1/5; VL1/3 = 2.8, VR1/3 = 2.3; H 1<sup>st</sup>1/5 = 2.7, H 2<sup>nd</sup> 1/5 = 2.8, H 3<sup>rd</sup>1/5 = 1.5, H 4<sup>th</sup>1/5 = 2.7; V = 2.55, H = 2.425; A = 2.487

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.487			

### Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-6; vertical; length 7.97 cm, height 11.84 cm; ratio = 0.673; vertical lines: 1/2, 1/4, 1/3, FR; horizontal lines: 1/3, 1/5, upper FR; accuracy of line placement: A = 2.4875; harmonic ratio: 3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #370-6 is at the level of a strong representation of a 3/5, sixth harmonic, HR 3/5; V1/3 H1/5. Additional notes: This is an image of a DJ in a recording studio. The picture is rendered in 3-dimensions. The DJ is sitting at the controls in the studio. The DJ is looking at a monitor and has on a set of earphones. The vertical line describing the composition from the left is the L1/4, which aligns to the placement of the earphones on the J's head. The VL1/3 describes the placement of the stand where the DJ is sitting on the chair and the center of his body directly delineating his eye and the tab at the top of the picture (A = 2.487). The VLFR aligns to the face of the DJ and his hair. The V 1/2 in general aligns to the division of the space of the picture with the DJ on the left side and the studio controls on the right side along the right edge of the monitor. The RFR aligns the knee, shirt at the wrist, center of the monitor and to the left side of the number four. The VR 1/3 aligns to the placement of the DJ's right hand, monitor and the center of the number four. The R1/4 delineates the right side of the monitor and the left side of the zero. The horizontal grid lines describing the composition are (starting at the top of the picture) the H 1<sup>st</sup> 1/5 line, which accurately aligns to the placement of the thick black line depicting the studio wall space. The H upper 1/3 line goes across the picture just slightly above the DJ's head and divides the number 40 in half. The H upper FR line aligns to the hairline of the DJ and the bottom of the monitor and the shelf it is sitting on. The H lower FR accurately describes the placement of the eyebrow, eye of the DJ and the shelf the monitor is on. The H 3<sup>rd</sup> 1/5 line moderately describes the placement of the top of the chair and the DJ's hands. The H lower 1/3 accurately aligns to the placement of the elbow. The H 4<sup>th</sup> 1/5 accurately aligns to the bottom of the chair the DJ is sitting on and the exact point in the composition that connects the studio shelf with monitors to the foreground object. Overall, the image composition is a strong representation of a HR3/5 harmonic ratio. The vertical space is divided into third's and the VFR is at a strong level and supports the V 1/3's. The horizontal 1/5's accurately align to the 1/5's spacing of the composition. The artist leads the viewer into the scene with the foreground object that slants up to the right edge of the picture. The viewer's eye moves up the diagonal of the shelf of monitors to the DJ and his attention on the main monitor in front of him. This diagonal is repeated three times horizontally going up the picture vertically. The VL1/4 to the VR1/4 between the H 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines defines a horizontal DEMR rectangle. The same size of DEMR rectangle is centered over the first in a vertical position; it is framed by the four Rule of Three lines in the center of the image. The main composition subjects are located in the cross of the two DEMR rectangles the DJ's head, face and hands and the lower edge of the large monitor. The curved lines of the image depict a 3- dimensional room. The artist used black and white

lines and shapes with texture and a strong rendition of foreground, middle ground and background to make the picture.

#370-7; *Caballero de la muerte, Death Knight* (diptych), 2010; técnica mixta sobre tela, mixed media on canvas; assessment grid lines:

count /color/ description:

6 black V1/2; H: 1/2, 1/4, 1/8  
 4 yellow V1/3, H1/3  
 4 red Vna, H1/5  
 4 green VFR, HFR

Total lines 18

Measurements: length 14.83 cm; height 24.9 cm; ratio = 0.59558

V: 1/2, 1/3, FR H: 1/2, 1/4, 1/8, 1/3, 1/5, FR

1/2 = 7.415 1/2 = 12.45

1/3 = 4.94, 9.88 1/4 = 6.225, 18.675

FR = 5.66, 9.16 1/8 = 3.112, 21.787

1/3 = 8.3, 16.6

1/5 = 4.98, 9.96, 14.94, 19.92

FR = 9.511, 15.3889

Total = 5 lines

Total = 13 lines

Accuracy of lines: HR1/2: VnaH1/2; H1/2 = 2.8, A = 2.8; HR2/3: V1/3H1/2, VL1/3 = 2.5, VR1/3 = 2.7; H 1/2 = 2.8, V = 2.6, H = 2.8, A = 2.5; HR3/4, V1/3H1/4, VL1/3 = 2.5, VR1/3 = 2.7; H1/2 = 2.8, H upper1/4 = 2.8, H lower 1/4 = 1, V = 2.6, H = 2.2, A = 2.4; HR3/5, V1/3H1/5, VL1/3 = 2.5, VR1/3 = 2.7; H 1<sup>st</sup> 1/5 = 2.9, H 2<sup>nd</sup> 1/5 = 2.7, H 3<sup>rd</sup> 1/5 = 1.5, H 4<sup>th</sup> 1/5 = 1.8, V1/3 = 2.6, H15 = 2.225, A = 2.4125

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong	x	x	x		x		V2 H2	V2 H2
Moderate								
Low								
Inconsistent								

Not Found				x		x		
Accuracy 0- 3	2.8	2.5	2.4		2.4125			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-7; vertical; length 14.83 cm, height 24.9 cm; ratio = 0.59558; vertical lines: 1/2, 1/3, FR; horizontal lines: 1/2, 1/4, 1/8, 1/3, 1/5, FR; accuracy of line placement: A = 2.4125; harmonic ratio: 3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #370-7 is at the level of a strong representation of a 3/5, sixth harmonic, HR3/5; V1/3 H1/5. There is evidence of the use of multiple harmonic ratios in the image. Additional notes: The HR1/2, VnaH1/2, (A = 2.8) is the division of the diptych artwork. The HR2/3, V1/3H1/2 (A = 2.5) shows a composition of the 1/2 octave with the vertical division of the thirds. This description does not encompass the complexity of the picture. The HR3/4, V1/3H1/4, is the combination and extension of the HR1/2, VnaH1/2 and HR2/3, V1/3H1/2. The HR3/4 divisions describe the placement of the mouth at the upper 1/4 and the lower 1/4 do not describe a significant compositional element. The H 1/8 lines do support the placement of the top of the head and feet of the figure. The HR3/5, V1/3 H1/5 (A = 2.4125) is the vertical 1/3's and horizontal 1/5's. The H 1<sup>st</sup> 1/5 accurately describes the placement of the eyes, which are closed, clothing and hair placement. The H 2<sup>nd</sup> 1/5 line accurately delineates the center clasp of the dress at the waist of the figure. H 3<sup>rd</sup> 1/5 moderately describes the top portion of the dress and is indicted by a horizontal line on the dress. The H 4<sup>th</sup> 1/5 line aligns to the placement of the left side portion of the dress near the bottom of the dress (A = 1.8). Whereas, the accuracy of the 1/2 and 2/3 harmonic ratios, which combined are the HR3/4, the HR 3/5 depicts the major composition elements and are supported by the HR3/4. The HR3/5 is an extension of the HR3/4. There is an alternating use of the horizontal 1/4, 1/8, 1/5 and FR lines that aligns to the placement of the elements of the composition. There is a symmetric use of the vertical lines to describe the composition. The vertical 1/3's align to the outside of the head positions and the position of the feet. The FR's align to the description of the face lines on the right and left sides. This is a 2-dimensional image with the use of light and dark shadows and heavy black outlines.

**#370-8; *Fidella y su hijo, Fidella and Her Son*, 2009; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

6	black	V1/2, 1/4, 1/8; H: 1/2
2	yellow	VR1/3, Hna
4	red	Vna, H1/5
4	green	VFR, HFR
Total lines 16		

Measurements: length 15.12 cm; height 18.24 cm; ratio = 0.8289

V: 1/2, 1/4, 1/8, 1/3, FR  
 1/2 = 7.56  
 1/4 = 3.78, 11.34  
 1/8 = 1.89, 13.23  
 1/3 = 5.04, 10.08  
 FR = 5.775, 9.344  
 Total = 9 lines

H: 1/2, 1/5, FR  
 1/2 = 9.12  
 1/5 = 3.648, 7.296, 10.94, 14.59  
 FR = 6.97, 11.27  
 Total = 7 lines

Accuracy of lines: HR4/6/9, V1/9H1/4; V 1<sup>st</sup>1/9 = 2.6, V 2<sup>nd</sup> 1/9 = 2.7, V 3<sup>rd</sup>1/9 = 2.5, V 4<sup>th</sup> 1/9 = 2.8, V 5<sup>th</sup> 1/9 = 2.8, V 6<sup>th</sup> 1/9 = 2.7, V 7<sup>th</sup> 1/9 = 2.6, V 8<sup>th</sup> 1/9 = 1.5; H upper 1/4 = 1, H1/2 = 2.4, H lower 1/4 = 1; V = 2.215, H = 1.46, A = 1.84  
 HR3/5, V1/3H1/5; V L1/3 = 2.5, V R1/3 = 2.7; H 1<sup>st</sup> 1/5 = 3, H 2<sup>nd</sup> 1/5 = 2.7, H 3<sup>rd</sup> 1/5 = 2.6, H 4<sup>th</sup> 1/5 = 2.7; V = 2.6, H = 2.75, A = 2.675

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2	V2 H2
Moderate						x		
Low								
Inconsistent								
Not Found	x	x	x	x				
Accuracy 0- 3					2.675	1.84		

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-8; vertical; length 15.12 cm, height 18.24 cm; ratio = 0.8289; vertical lines: 1/2, 1/4, 1/8, 1/, FR; horizontal lines: 1/2, 1/5, FR; accuracy of line placement: A = 2.675; harmonic ratio: 3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #370-8 is at the level of a strong representation of a 3/5, sixth harmonic, HR 3/5; V1/3 H1/5. Additional notes: The image is of a mother and child. The figures extend to the edge of the picture frame from top to bottom. There is some evidence of the HR4/6/9, V1/9H1/4. The lines of the vertical 1/9's describe accurately (V1/9 = 2.5) the compositional elements of the picture. However, the H1/4's are a moderate accuracy (A = 1.466). The H upper 1/4 and lower 1/4 (A = 1) are in general descriptions of the figure placement. The H1/2 is aligned to the placement of the eyes of the son (A = 2.4). The overall V1/9H1/4 is a moderate accuracy (A = 1.84).

However, the most accurate HR is the HR3/5 V1/3H1/5, A = 2.675. The V1/3 lines follow the placement of the left and right sides of the face, parts of the mother's body and son's body. The V L1/3 is the 3<sup>rd</sup> 1/9 and the 6<sup>th</sup> 1/9 is the V R1/3 measurement. The H 1<sup>st</sup> 1/5 accurately aligns to the center of the mother's eyes. The H 2<sup>nd</sup> 1/5 accurately describes the bottom of the chin of the mother. The H 3<sup>rd</sup> 1/5 accurately describes the bottom of the son's ear, mouth, and button on the mother's dress. The H 4<sup>th</sup> 1/5 accurately describes the bottom of the son's right arm, the bottom of the mother's left arm. The H FR's support the H 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines. The artist's placement of the compositional elements symmetrically aligned the VL1/3, VLFR, V1/2, VRFR and VR1/3. This image is a 3-dimensional rendering of the subject of a mother and son.

**#370-9; *La Guerra de Independencia de México, Mexican War of Independence*, 2010; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

10 black V1/2, 1/4, 1/8; H: 1/2, 1/4, 1/8  
 4 yellow VR1/3, H1/3  
 4 green VFR, HFR  
 Total lines 18

Measurements: length 24.43 cm; height 18.44 cm; ratio = 0.7548

V: 1/2, 1/4, 1/8, 1/3, FR	H: 1/2, 1/4, 1/8, 1/3, FR
1/2 = 12.215	1/2 = 9.22
1/4 = 6.10, 18.32	1/4 = 4.61, 13.83
1/8 = 3.053, 21.376	1/8 = 2.3, 16.135
1/3 = 8.14, 16.2867	1/3 = 6.147, 12.29
FR = 9.33, 15.098	FR = 7.44, 11.395
Total = 9 lines	Total = 9 lines

Accuracy of lines: HR3/4; V1/3H1/4; V L1/3 = 1.8, V R1/3 = 1.8; H upper 1/8 = 1,

H upper 1/4 = 2.8, H 1/2 = 2.7, H lower 1/4 = 1; H lower 1/8 = 0.5; V = 1.8, H = 1.6,

A = 1.7

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2 H2	V2 H2

Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.7					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-9; horizontal; length 24.43 cm, height 18.44 cm; ratio = 0.7548; vertical lines: 1/2, 1/4, 1/8, 1/3, FR; horizontal lines: 1/2, 1/4, 1/8, 1/3, FR; accuracy of line placement: A = 1.7; harmonic ratio: 3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 moderate. The composition analysis of #370-9 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/3H1/4. Additional notes: This image has as composition that follows the geometric lines of a 3/4 harmonic ratio at a moderate level of representation. The arrangement of the compositional elements is indicated by the grid lines of the vertical Rule of Three, 1/3 lines, which are supported by the VFR lines. The artist depicted the background in three distinct areas. On the right side is a light textured surface, in the middle is a darker textured surface and on the left side is the Mexican flag. The horizontal lines of the H upper 1/8 moderately aligns to the top of the horseman's head. The H upper 1/4 accurately aligns to the placement of the nose of the horseman, the eye of the horse and the top of the emblem on the Mexican flag (A = 2.8). The H1/2 division aligns to the placement of the tail and rear end of the horse, the horseman's hand, the soldier's hand holding the sword and the bottom of the Mexican flag where it connects to the flag pole (A = 2.7). The H lower 1/4 and 1/8 are in general descriptive of the composition of the soldier laying on the ground. The artist used light and dark values to enhance the action of the story between the two soldiers. The figures, horse, flag and various objects in the picture are composed with an underlying harmonic ratio. The image is a 3-dimensional painting.

**#370-10; *Mujer desnuda, Naked Woman*, 2006; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

10 black V1/2, 1/4, 1/8; H: 1/2, 1/4, 1/8  
4 yellow VR1/3, H1/3  
3 green VFR, H upper FR  
Total lines 17

Measurements: length 23.65 cm; height 20.01 cm; ratio = 0.846  
V: 1/2, 1/4, 1/8, 1/3, FR H: 1/2, 1/4, 1/8, 1/3, upper FR  
1/2 = 11.825 1/2 = 10  
1/4 = 5.9, 17.7 1/4 = 5, 15.9  
1/8 = 2.95, 20.7 1/8 = 2.5, 17.51  
1/3 = 7.88, 15.767 1/3 = 6.67, 13.34  
FR = 9.03, 14.61 upper FR = 7.643





and H1/8's. Any relational harmonic ratio must be aligned to the initial placement of the figure in a horizontal position.

**#370-11; *El brujo, The Warlock*, 2003; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

6 black V1/2, 1/4, 1/8; H: 1/2  
 2 yellow VR1/3, Hna  
 4 red Vna, H1/5  
 4 green VFR, H upper FR  
 Total lines 16

Measurements: length 10.3 cm; height 20.811 cm; ratio = 0.49

V: 1/2, 1/4, 1/8, 1/3, FR

H: 1/2, 1/5, FR

1/2 = 5.15

1/2 = 10.4

1/4 = 2.575, 7.725

1/5 = 4.16, 8.32, 12.48, 16.64

1/8 = 1.2875, 9

FR = 7.949, 12.8

1/3 = 3.433, 6.867

FR = 3.93, 6.365

Total = 9 lines

Total = 7 lines

Accuracy of lines: HR3/5; V1/3H1/5; V L1/3 = 2.3, V R1/3 = 2; H 1<sup>st</sup> 1/5 = 2.5, H 2<sup>nd</sup> 1/5 = 2.4, H 3<sup>rd</sup> 1/5 = 3, H 4<sup>th</sup> 1/5 = 1.5; V = 2.15, H = 2.35, A = 2.25

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.25			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-11; vertical; length 10.3 cm, height 20.81 cm; ratio = 0.49; vertical lines: 1/2, 1/4, 1/8, 1/3, FR; horizontal lines: 1/2, 1/5, FR; accuracy of line placement: A = 2.25;

harmonic ratio: 3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #370-11 is at the level of a strong representation of a 3/5, the sixth harmonic, HR3/5; V1/3H1/5. Additional notes: This image is of an elongated figure. The artist divided the picture frame into two parts. The division is precisely the H 3<sup>rd</sup>1/5 line. The H 1<sup>st</sup> 1/5 accurately describes the placement of the head of the figure at the neck and chest. The H 2<sup>nd</sup> 1/5 gives the accurate location of the placement of the bottom of the right side of the pelvis and the H upper FR gives the correct placement of the left side of the pelvis, which is shorter by about 0.7mm than the other side of the pelvis. The H1/2 aligns to the placement of the knees of the figure at the middle of the 2<sup>nd</sup> 1/5 and 3<sup>rd</sup> 1/5 lines. The H 4<sup>th</sup> 1/5 in general describes the area above the socks and shoes of the figure. The vertical L1/3 accurately delineates the head, torso, and right leg of the figure. The VLFR supports the VL1/3. The VR1/3 aligns at a moderate level the left side of the body. The VR1/3 supports the VR1/3. The V1/2 directly crosses the H 1<sup>st</sup> 1/5 line at the connection of head to neck and shoulders. The artist clearly marked this exact point. The VL1/8 and VR1/8 lines align to the width of the extension of the figures' arms. The VL1/4 and VR1/4 border the width of the placement of the figures' arms. Overall, there is strong representation for the HR3/5 V1/3H1/5 harmonic ratio. The measurement grid aligns to the composition of the artwork. This is a 2-dimensional image. The artist used light and dark values, the elongation of the figure and black outlines of thin weight to distinguish the shapes.

**#370-12; *La pareja, The Couple*, 2008; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

9	black	V1/2, 1/4, 1/8; H: 1/2, 1/4, upper 1/8
2	yellow	VR1/3, Hna
2	green	VFR, Hna
Total lines 13		

Measurements: length 10.96 cm; height 16.98 cm; ratio = 0.652

V: 1/2, 1/4, 1/8, 1/3, FR	H: 1/2, 1/4, upper 1/8
1/2 = 5.48	1/2 = 8.49
1/4 = 2.74, 8.22	1/4 = 4.245, 12.735
1/8 = 1.37, 9.59	upper 1/8 = 2.1225
1/3 = 3.65333, 7.30667	
FR = 4.18672, 6.77328	
Total = 9 lines	Total = 4 lines

Accuracy of lines: HR3/4; V1/3H1/4; V L1/3 = 1.5, V R1/3 = 2; H upper 1/4 = 1.7, H 1/2 = 1, H lower 1/4 = 1; V = 1.75, H = 1.233, A = 1.49

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2	V2
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.49					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-12; vertical; length 10.96 cm, height 16.98 cm; ratio = 0.652; vertical lines: 1/2, 1/4, 1/8, 1/3, FR; horizontal lines: 1/2, 1/4, upper 1/8; accuracy of line placement: A = 1.49; harmonic ratio: 3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 moderate. The composition analysis of #370-12 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/3H1/4. Additional notes: This image has two possible sets of measurement. The outside frame and inside frame diameters. It appears that the picture was placed on an outside frame so the measurements used are for the inside black outline. The vertical 1/2 accurately aligns to the position of the center of the male figure (A = 2.6). The VL1/3 aligns directly on the line of the male figure's arm. The VRFR supports that alignment and the placement of the woman's left arm on the man's shoulder and his ear. The VRFR aligns to the man's left eye and the woman's face. The VLFR describes the location of the woman's left eye and lower bodyline. The VL1/4 and VR1/4 in general describe the width of the couple in an embrace. The horizontal 1/2 line is in general aligned to the thick black line (5mm). The artist placed three thick black horizontal lines across the picture in approximately the 1/4 sections. Within each section, there are smaller figure images and objects. The upper H 1/4 aligns to the placement of the man's chin and the woman's nose and left cheek. The H lower 1/4 in general aligns to the black line. This is a 2-dimensional image. The artist used black outlines and light and dark areas to create the picture.

**#370-13; *Calendario azteca, Aztec Calendar*, 2003; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

2 black V1/2, H: 1/2  
4 yellow V1/3, H1/3  
Total lines 6

Measurements: length 24.59 cm; height 19.90 cm; ratio = 0.853

V: 1/2, 1/3

H: 1/2, 1/3

1/2 = 12.295

1/2 = 9.95

1/3 = 8.1967, 16.3933

1/4 = 6.633, 13.2667

Total = 3 lines

Total = 3 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 2.4; H upper 1/3 = 1.5,

H lower 1/3 = 1.5; V = 2.4, H = 1.5, A = 1.95

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2 H2	
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.95						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-13; horizontal; length 24.59 cm, height 19.90 cm; ratio = 0.853; vertical lines: 1/2, 1/3; horizontal lines: 1/2, 1/3; accuracy of line placement: A = 1.95; harmonic ratio: 2/3, the fifth, V1/2H1/3; overall composition assessment: HR2/3 moderate. The composition analysis of #370-13 is at the level of a moderate representation of a 2/3, fifth harmonic, HR2/3; V1/2H1/3. Additional notes: The image of the artwork is a circular object with a skeletal face in the center. The placement of the face and concentric circles around the face represent the Mayan calendar. The V1/2 line aligns with the placement of the center of the face and the apex of the triangle on the circle above the face. There are multiple shapes and objects on the circles of the calendar. The H 1/2 line is accurately aligned to the placement of the center of the skeletal eye sockets. The cross of the two lines is exactly at the space in between the two eye sockets. The four Rule of Three lines, V1/3 and H1/3 create a pattern of nine rectangles in the horizontal orientation. The center rectangle contains the information about the skeleton face. The V1/2 line (going through the center of the skeletal face divides the H upper and lower 1/3 lines at the DEMR point of the lines. In effect the artist offset the centering of the skeletal face (5mm distance within the Rule of Three rectangles oriented with the longer side as the horizontal side) to

the asymmetrical position of DEMR. This image is 2-dimensional. The artist used light and dark values and shape and line to create the image.

#370-14; *Leopardo, Leopard*, 2006; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

6 black V1/2, 1/4; H: 1/2, 1/4  
 2 yellow Vna, H1/3  
 Total lines 8

Measurements: length 24.55 cm; height 20.67 cm; ratio = 0.84

V: 1/2, 1/4 H: 1/2, 1/4, 1/3  
 1/2 = 12.275 1/2 = 10.335  
 1/4 = 6.1375, 18.4125 1/4 = 5.167, 15.5025  
 1/3 = 6.89, 13.78  
 Total = 5 Total = 3 lines

Accuracy of lines: HR4/6/9, V1/4H1/9; V L1/4 = 2, V1/2 = 2.6, VR1/4 = 2.8; H 1<sup>st</sup>1/9 = 3.0, H 2<sup>nd</sup> 1/9 = 2.0, H 3<sup>rd</sup>1/9 = 2.5, H 4<sup>th</sup> 1/9 = 1.5, H 5<sup>th</sup> 1/9 = 1, H 6<sup>th</sup> 1/9 = 1.5, H 7<sup>th</sup> 1/9 = 1.5, H8<sup>th</sup> 1/9 = 0.5; V = 2.47, H = 1.6, A = 2.0; HR3/4; V1/4H1/3; V L1/4 = 2, V1/2 = 2.6, V R1/4 = 2.8; H upper = 2.5, H lower

1/3 = 1.5; V = 2.47, H = 2.0, A = 2.35

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				H2	
Moderate						x		
Low								
Inconsistent								
Not Found	x	x		x	x			
Accuracy 0- 3			2.35			2.0		

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-14; horizontal; length 24.55 cm, height 20.67 cm; ratio = 0.84; vertical lines: 1/2, 1/4; horizontal lines: 1/2, 1/4, 1/3; accuracy of line placement: A = 2.37;

harmonic ratio: 3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 strong. The composition analysis of #370-14 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. There is evidence of a 4/6/9, V1/4H1/9 harmonic ratio (A = 2.0) Additional notes: The V1/4H1/9 harmonic ratio 4/6/9 is indicated at a moderate level (A = 2). The V1/2 division is indicated by the placement of the large branch the tiger is standing behind. The top of the branch is placed half way in the picture frame. The VL1/4 describes the placement of the tiger's rear right leg and in general the location of the rear end of the tiger. The VR1/4 accurately aligns to the placement of the left side of the tiger's face, front of the tiger's body and the division at the bottom of the picture of light and dark shapes. The H1/9 lines align in general with the placement of the tiger, tree limbs, and objects in the foreground. However, the 6<sup>th</sup>, 7<sup>th</sup>, and 8<sup>th</sup> 1/9's accurately describe features of the tiger's head and face. The overall accuracy is A = 2.0 a moderate level. The HR3/4; V1/4H1/3 (A = 2.35) is a strong delineation of the composition. The 12 nearly square rectangles that are created from the V1/4H1/3 alignment are arranged horizontally in the picture frame. The upper right rectangle is the shape in which the artist placed the tiger's head. The tiger's face and expression are the main focus of the image so the best harmonic ratio to describe the artwork is the 3/4, the fourth. This is a 3-dimensional image. The artist indicates volume and perspective with the light and dark values that described the tiger in space with a light source from above.

**#370-15; *Caballo egipcio, Egyptian Horse*, 2008; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

5	black	V1/4, H upper 1/4
10	yellow	V1/6, H1/6
3	green	VFR, H lower FR
Total lines 18		

Measurements: length 23.62 cm; height 20.42 cm; ratio = 0.864

V: 1/2, 1/4, 1/6, FR	H: 1/2, upper 1/4 1/6, lower FR
1/2 = 11.81	1/2 = 10.21
1/4 = 5.9, 17.715	upper 1/4 = 5.105
1/6 = 3.936, 7.87, 11.8, 15.746, 19.68	1/6 = 3.4, 6.8, 10.21, 13.6, 17.0
FR = 9.022, 15.597	lower FR = 12.62
Total = 10 lines	Total = 8 lines

Accuracy of lines: HR3/4; V1/4H1/3; VL1/4 = 2.8, V1/2 = 2, V R1/4 = 2; H upper 1/3 = 2.6, H lower 1/3 = 2.5; V = 2.27, H = 2.55, A = 2.41

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V2 H2	V2 H1
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.41					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-15; horizontal; length 23.62 cm, height 20.42 cm; ratio = 0.864; vertical lines: 1/2, 1/4, 1/6, FR; horizontal lines: 1/2, upper 1/4 1/6, lower FR; accuracy of line placement: A = 2.41; harmonic ratio: 3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 strong. The composition analysis of #370-15 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: This image is of a horse pulling a cart with a figure standing in the cart. The VL1/4 accurately describes the placement of the horse's eye (A = 2.8). The VR1/4 divides in general the placement of the horse from the cart and figure. The v1/2 line describes the placement of the horse at the half position of the picture frame and the rear left leg. Both vertical and horizontal dimensions when divided into 1/6's align to the composition of the artist. The H 1<sup>st</sup> 1/6 aligns to the division in the background, the 2<sup>nd</sup> 1/6 describes the placement of under the horse's head and the hand of the figure, the 3<sup>rd</sup> 1/6 (the H1/2) describes the placement of the top of the cart, the 4<sup>th</sup> 1/6 describes the placement of the height of the wheel of the cart, and the 5<sup>th</sup> 1/6 describes the placement of all of the horse's feet. The location is indicated with a dark line going horizontally across the picture. The H lower FR describes the placement of the belly of the horse. The V 1<sup>st</sup> 1/6 delineates the position of the horse's nose. The V 2<sup>nd</sup> 1/6 describes the placement of the hat on the horse. The VLFR aligns with the horse's mane and front right leg. The 4<sup>th</sup> 1/6 is the location of where the horse's tail connects to the horse and the position of the rear right leg. The V 5<sup>th</sup> line describes the placement of the front of the figure's head and the location of the edge of the cart. Overall the HR3/4; V1/4H1/3 describes the placement of the majority of the compositional elements in the picture (A = 2.41). This is a 3- dimensional image. There is an indication of depth perception because the artist used light and dark shading, foreground, middle ground and background techniques along with shape and form.

**#370-16;** La luna, The Moon, 2005; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

2 black V1/2, H1/2  
 4 yellow V1/3, H1/3  
 Total lines 6

Measurements: length 19.91 cm; height 23.77 cm; ratio = 0.8376

V: 1/2, 1/3

H: 1/2, 1/3

1/2 = 9.955

1/2 = 11.885

1/3 = 6.636, 13.272

1/3 = 7.923, 15.846

Total = 3 lines

Total = 3 lines

Accuracy of lines: HR2/3: V1/3H1/2, VL1/3 = 0.7, VR1/3 = 0.7; H 1/2 = 1, V = 0.7, H = 1, A = 0.81

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2 H2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.81						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-16; vertical; length 19.91 cm, height 23.77 cm; ratio = 0.8376; vertical lines: 1/2, 1/3; horizontal lines: 1/2, 1/3; accuracy of line placement: A = 0.81; harmonic ratio: 2/3, the fifth, V1/3H1/2; overall composition assessment: HR2/3 low. The composition analysis of #370-16 is at the level of a low representation of a 2/3, fifth harmonic, HR2/3; V1/3H1/2. Additional notes: The artwork composition is divided in general into thirds vertically and in half horizontally. The artist placed the moon in the center of the upper half of the picture frame. Both sides of the upper half of the picture have stars around the moon. The bottom half of the picture depicts hills, structures and trees. These objects are in general divided also into thirds in the lower half. The VL1/3



and VR1/3 are at a low level ( $A = 0.7$ ). This is a 2-dimensional artwork. The artist used light and dark shapes, foreground, middle and background techniques, and light from the moon appears on the hills and trees. The overall effect is still a rendering of shapes that are planar and which do not have volume.

#370-17; *Toro salvaje, Wild Bull*, 2005; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

6 black V1/2, 1/4; H1/2, 1/4  
Total lines 6

Measurements: length 24.08 cm; height 20.34 cm; ratio = 0.852

V: 1/2, 1/4

H: 1/2, 1/4

1/2 = 12.04

1/2 = 10.17

1/4 = 6.02, 18.06

1/4 = 5.085, 15.225

Total = 3 lines

Total = 3 lines

Accuracy of lines: HR1/2: VnaH1/2; V = na, H 1/2 = 2, V =na, H = 2, A = 2

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low								
Inconsistent	x							
Not Found		x	x	x	x	x		
Accuracy 0- 3	2							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-17; horizontal; length 24.08 cm, height 20.34 cm; ratio = 0.852; vertical lines: na; horizontal lines: 1/2; accuracy of line placement:  $A = 2$ ; harmonic ratio: 1/2, the octave, VnaH1/2; overall composition assessment: HR1/2 inconsistent. The composition analysis of #370-17 is at the level of an inconsistent representation of a 1/2, octave harmonic, HR1/2; VnaH1/2. Additional notes: The artwork is of a wild bull. The H1/2 line aligns to the placement of the head of the bull and along the top of the bull's body. This is not a strong compositional line; there is no clear delineation of the objects around the bull as being in an ordered relationship. Looking at the VL1/4, V1/2 and VR14

locations there is only an in general alignment to the small spheres, clouds and cones in the painting. The H upper 1/4 gives a description of the bottom of the two spheres, however, that is not enough of an alignment to identify a harmonic ratio. The H1/2 moderately delineates the top of the bull but the rest of the artwork does not consistently align to the composition. This is a 2-dimensional image. The artist used white and black shapes. There is a slight indication of light and dark rendering on the small spheres.

#370-18; *Maya*, 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

4 black V1/2; H1/2, 1/4  
Total lines 4

Measurements: length 13.26 cm; height 23.27 cm; ratio = 0.5698

V: 1/2

H: 1/2, 1/4

1/2 = 6.63

1/2 = 11.635

1/4 = 5.8175, 17.452

Total = 1 lines

Total = 3 lines

Accuracy of lines: HR1/2: V1/2H1/4; V1/2 = 2.4, H upper 1/4 = 0.5, H 1/2 = 2.6, H lower 1/4 = 1.5; V = 2.4, H = 1.53, A = 1.965

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate	x							
Low								
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.965							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-18; vertical; length 13.26 cm, height 23.27 cm; ratio = 0.5698; vertical lines: 1/2 ; horizontal lines: 1/2, 1/4; accuracy of line placement: A = 1.965; harmonic ratio: HR1/2, the octave, V1/2H1/4; overall composition assessment: HR1/2 moderate. The composition analysis of #370-18 is at the level of a moderate representation of a 1/2, octave harmonic, HR1/2; V1/2H1/4. Additional notes: This artwork is an image of the

Maya wearing a headdress in profile. The V1/2 aligns to the placement of the headdress at the center of the top of the picture frame and the earring through the neck of the figure (A = 2.4). The H upper 1/4 in general aligns to the composition of background objects. The H1/2 (A = 2.6) indicates the placement of the eye, ear and back of the head in profile view. The H lower 1/4 aligns to the division of the neck from the shoulders and the change in the texture from the foreground to the middle ground. This is a 2-dimensional artwork. The artist used line and shape in black and white to create the image.

#370-19; *El cíclope, Cyclops*, 2005; la litografía, lithograph; assessment grid lines: count /color/ description:

2 black V1/2, H1/2  
 4 yellow V1/3, H1/3  
 4 red Vna, H1/5  
 2 green Vna, HFR  
 Total lines 12

Measurements: length 18.03 cm; height 23.77cm; ratio = 0.733

V: 1/2, 1/3

1/2 = 9.015

1/3 = 6.01, 12.02

H: 1/2, 1/4, 1/3, 1/5, FR

1/2 = 11.885

1/3 = 7.923, 15.8467

1/5 = 4.754, 9.508, 14.262, 19.016

FR = 9.0804, 14.6898

Total = 3 lines

Total = 9 lines

Accuracy of lines: HR3/5: V1/3H1/5; V L1/3 = 1.5, V R1/3 = 1.7; H 1<sup>st</sup> 1/5 = 2.3, H 2<sup>nd</sup> 1/5 = 2.2, H 3<sup>rd</sup> 1/5 = 2, H 4<sup>th</sup> 1/5 = 2.3; V = 1.6, H = 2.2, A = 1.9

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V2 H2	H2
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.9			

### Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-19; vertical; length 18.03 cm, height 23.77 cm; ratio = 0.733; vertical lines: 1/2, 1/3 ; horizontal lines 1/2, 1/4 , 1/3, 1/5, FR; accuracy of line placement: A = 1.9; harmonic ratio: HR3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 moderate. The composition analysis of #370-19 is at the level of a moderate representation of a 3/5, sixth harmonic, HR3/5; V1/3H1/5. Additional notes: There is a general division of the artwork in the vertical orientation of the Rule of Three. The figure is in the center and the V1/2 (A = 2.5) is aligned to the midline of the composition. The VL1/3 follows the shape of the rectangle on the right side of the figure (A = 1.5). The VR1/3 follows the rectangle on the left side (A = 1.7). The composition has a background and a foreground. There is a slight indication of linear perspective due to the angled black and white shapes in the foreground at the feet of the figure. The H 1/5 lines describe the placement of the figure (A = 2.2). The H1st 1/5 describes the eye of the Cyclops. The H 2<sup>nd</sup> 1/5 indicates the placement of the arms. The H 3<sup>rd</sup> 1/5 aligns to the change in checkered square patterns of the background, and the H 4<sup>th</sup> 1/5 identifies the location of the feet. The HFR lines support the 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines. This is a 2-dimensional artwork. The artist used planar shapes of black and white with some light and dark values.

**#370-20; Pirámide de la luz, Pyramid of Light, 2005; grabado sobre acrílico, engraving on acrylic; assessment grid lines: count /color/ description:**

4	black	V1/2, 1/4, H1/2
2	yellow	Vna, H1/3
4	red	V1/5, Hna
2	green	VFR, Hna
Total lines 12		

Measurements: length 8.2 cm; height 10.41cm; ratio = 0.7884

V: 1/2, 1/4, 1/5, FR	H: 1/2, 1/3
1/2 = 4.1	1/2 = 5.2005
1/4 = 2.05, 6.15	1/3 = 3.47, 6.94
1/5 = 1.64, 3.28, 4.92, 6.56	
FR = 3.132, 5.06	
Total = 9 lines	Total = 3 lines

Accuracy of lines: HR3/5: V1/5H1/3; V 1<sup>st</sup> 1/5 = 1.5, V 2<sup>nd</sup> 1/5 = 2.8, V 3<sup>rd</sup> 1/5 = 2.6, V 4<sup>th</sup> 1/5 = 2.6; H upper 1/3 = 2.7, H lower 1/3 = 1.5; V = 2.375, H = 2.1, A = 2.2375

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of</u>	<u>Use of Frame Ratio</u>

							<u>Three lines</u>	
<i>Level of Evidence</i>								
Strong					x		V2	H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.2375			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #370-20; vertical; length 8.2 cm, height 10.41 cm; ratio = 0.7884; vertical lines: 1/2, 1/4, 1/5, FR; horizontal lines 1/2, 1/3; accuracy of line placement: A = 2.2375; harmonic ratio: HR3/5, the sixth, V1/5H1/3; overall composition assessment: HR3/5 strong. The composition analysis of #370-20 is at the level of a strong representation of a 3/5, sixth harmonic, HR3/5; V1/5H1/3. Additional notes: This image shows a figure in the foreground of the picture. The picture has a distinct foreground, middle ground and background. There is an indication of the use of linear perspective. There is a geometric pyramid in the right upper corner. The V1/5 lines divide the figure and background following the placement of the compositional elements. The V1st 1/5 aligns to the right side of the figure, the VFR supports the V 2<sup>nd</sup> 1/5, which accurately describes the placement of the right side of the figure. The V 3<sup>rd</sup> 1/5 describes the placement of the left side of the figure and the right side of the geometric shape (A = 2.6). The VRFR supports this placement. The V 4<sup>th</sup> 1/5 aligns to the left side of the larger base of the figure and the center of the geometric pyramid. The V1/2 describes the center of the figure. The VL1/4 and VR1/4 describe the width of the base of the figure. The H upper 1/3 line accurately aligns with the face of the figure and the bottom of the geometric shape (A = 2.7). The H1/2 line is in general descriptive of the shape of the base of the figure. The H lower 1/3 in general describes the lower section of the base and the horizon line of the picture. The artwork is a 3-dimensional rendering of the subject. The artist used linear perspective within the figure image and base. The foreground, middle ground and background were treated with light and dark values in the correct locations to give a sense of depth to the picture.

**#371, male, 37 years old; 37 years at JLDF; 16 years at the art school; no visual impairments; range of time of artwork used in the study: 1999-2007; socioeconomic status/high**

#371-1; *Paisaje Tahitian, Tahitian Landscape*, 2001; técnica mixta sobre madera, mixed media on wood; assessment grid lines: count /color/ description:

7 black V1/2, 1/4, 1/8; H1/4  
 3 yellow VR1/3; H1/3  
 8 red V1/5, H1/5  
 4 green VFR, HFR  
 Total lines 22

Measurements: length 16.66 cm; height 11.02cm; ratio = 0.661

V: 1/2, 1/4, 1/8, 1/5, R1/3, FR                      H: 1/2, 1/3, 1/5, FR  
 1/2 = 8.33    1/4 = 2.755, 8.265  
 1/4 = 4.165, 12.577                                      1/3 = 3.673, 7.346  
 1/8 = 2.082, 14.577                                      1/5 = 2.204, 4.408, 6.612, 8.816  
 1/5 = 3.334, 6.664, 9.996, 13.328                FR = 4.20, 6.81  
 R1/3 = 11.11  
 FR = 6.368, 10.30  
 Total = 12 lines    Total = 10 lines

Accuracy of lines: HR3/4 (V1/4H1/3) VL1/8 = 2.3, VL1/4 = 2.2, V1/2 = 2, VR1/4 = 2.3, VR1/8 = 2.5; V = 2.26; H upper 1/3 = 1.5, H lower 1/3 = 2.2, H = 1.85, A = 2.055

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V1 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.055					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #371-1; horizontal; length 16.66 cm, height 11.02 cm; ratio = 0.661; vertical lines: 1/2, 1/4, 1/8, 1/5, R1/3, FR; horizontal lines; 1/2, 1/3, 1/5, FR; accuracy of line

placement:  $A = 2.055$ ; harmonic ratio: HR3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 strong. The composition analysis of #371-1 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: The image is eight monolithic vertical shapes that are placed across the picture frame in a horizontal arrangement. The vertical 1/2, 1/4, 1/8 lines support the placement at an accuracy of  $A = 2.26$ . The 1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 7<sup>th</sup> figures are aligned to these lines. The V 2<sup>nd</sup> and 4<sup>th</sup> 1/5's align to the placement of the 3<sup>rd</sup> and 5<sup>th</sup> figures. The width dimensions of the 3<sup>rd</sup> figure are described by the LFR and the V 2<sup>nd</sup> 1/5. The V 4<sup>th</sup> 1/5 divides the 6<sup>th</sup> figure in the center of the shape. The H upper 1/3 at a moderate level aligns to the value change at the top of the figures. This location is supported by the H upper FR and V 2<sup>nd</sup> 1/5. The H lower FR and V 3<sup>rd</sup> 1/5 support at a moderate level the placement of the background of the artwork across the picture frame that is the area of the value change. The H lower 1/3 is aligned to the placement ( $A = 2.2$ ). The lower 1/4 aligns to the bottom of the figure and in general three other figures. This image is 2-dimensional. The artist used shape, light and dark values and a staggered vertical placement to give a slight depth to the image.

**#371-2; Cuchillos, Knives, 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

1	black	Vna; H1/2
2	yellow	Vna; H1/3
2	red	Vna, H (2 <sup>nd</sup> and 3 <sup>rd</sup> ) 1/5
6	orange	V6, Hna
Total lines 11		

Measurements: length 8.3 cm; height 11.64 cm; ratio = 0.713

V: 1/2 <sup>c</sup> 3<sup>rd</sup> 1/5, R 1/4 <sup>c</sup> (length dimension) H: 1/2, 1/3, (2<sup>nd</sup> and 3<sup>rd</sup>)1/5

L 1/8 <sup>c</sup> 1<sup>st</sup> 1/5, 1<sup>st</sup> 1/5 <sup>c</sup> L 1/4, L1/3 <sup>c</sup> 1/2 1/2 = 5.82

2<sup>nd</sup> 1/5 <sup>c</sup> 1/2, 3<sup>rd</sup> 1/5 <sup>c</sup> R1/4 1/3 = 3.88, 7.76

1/2 <sup>c</sup> 3<sup>rd</sup> 1/5 = 4.15 <sup>c</sup> 4.98 (2<sup>nd</sup> and 3<sup>rd</sup>)1/5 = 4.656, 6.984

R 1/4 <sup>c</sup> (length dimension) = 6.0 <sup>c</sup> 8.3

L 1/8 <sup>c</sup> 1<sup>st</sup> 1/5 = 1.0375 <sup>c</sup> 1.66

1<sup>st</sup> 1/5 <sup>c</sup> L 1/4 = 1.66 <sup>c</sup> 2.075

2<sup>nd</sup> 1/5 <sup>c</sup> 1/2 = 4.98 <sup>c</sup> 4.15

Total = 6 lines

Total = 5 lines

Accuracy of lines: HR2/3: V1/2H1/3; V1/2 = 1.5; V = 1.5; H upper 1/3 = 0.5, H lower 1/3 = 0.5; H = 0.5, A = 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					H2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.0						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #371-2; vertical; length 8.3 cm, height 11.64 cm; ratio = 0.713; vertical lines: 6 diagonal; horizontal lines: 1/2, 1/3, (2<sup>nd</sup> and 3<sup>rd</sup>) 1/5; accuracy of line placement: A = 1.0; harmonic ratio: HR2/3, the fifth, V1/2H1/3; overall composition assessment: HR2/3 low. The composition analysis of #371-2 is at the level of a low representation of a 2/3, fifth harmonic, HR2/3; V1/2H1/3. Additional notes: The artwork is an image of two knives and a third object. The items are presented in a vertical orientation. Each object is slanted to the right (looking at the image). There are six diagonal lines that in a general manner align to the object placement. The H upper 1/3 at a low level describes the placement of the upper portion of the object on the right. There is a H1/2 line that aligns to the placement handle of the knives. The H 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines bracket in general the handles of the knives. The H lower 1/3 at a low level divides the lower section of the placement of the knives and object. The artwork is made of shapes, lines, textures primarily in white with areas of black to give definition to the shapes. This is a 2-dimesional image.

**#371-3; *La habitación de van Gogh, Van Gogh's Room*, 2001; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description:**

8	black	V1/2, 1/4, 1/8; H1/2, 1/4, 1/8
4	yellow	V1/3; H1/3
3	red	V (1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> ) 1/5, Hna
2	green	VFR, Hna
Total lines 17		

Measurements: length 24.33 cm; height 19.71 cm; ratio = 0.81  
V: 1/2, 1/4, 1/3, (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>) 1/5, FR      H: 1/2, 1/4, 1/8, 1/3  
1/2 = 12.165      1/2 = 9.855  
1/4 = 6.08, 18.247      1/4 = 4.927, 14.78  
1/3 = 8.11, 16.22      1/8 = 2.463, 17.246



(1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>) 1/5 = 4.866, 9.732, 19.46      1/3 = 6.57, 13.14  
 FR = 9.29, 15.036  
 Total = 10 lines      Total = 7 lines

Accuracy of lines: HR3/4: V1/3H1/4; VL1/3 = 2.8, VL1/3 = 2.8; H upper 1/8 = 0.5,  
 H upper 1/4 = 1.0, H1/2 = 1.5, H lower 1/4 = 2.5, H lower 1/8 = 2.6; V = 2.8, H = 1.8, A = 2.3

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V2 H2	V2
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.3					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #371-3; horizontal; length 24.33 cm, height 19.71 cm; ratio = 0.81; vertical lines: 1/2, 1/4, 1/3, (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>) 1/5, FR; horizontal lines; 1/2, 1/4, 1/8, 1/3; accuracy of line placement: A = 2.3; harmonic ratio: HR3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 strong. The composition analysis of #371-3 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: The artist used the techniques of fore, middle and background along with shapes and lines to create a composition of Van Gogh's bedroom. The technique is correctly done and the image appears 3-dimensional. The face and upper body (neck, shoulders and hands) of the figure appear in the fore ground. The vertical 1/5 lines are used to identify the object placement in the composition. The V 1<sup>st</sup> 1/5 aligns to the right side of the figure's head and the edge of the carpet in the background, which is slightly angled to give the impression of linear perspective. The VL1/4 aligns to the placement of the right ear and of the chair against the bookcase in the background. The VL1/3 (A = 2.8) accurately describes the placement of the center of the right eye. The VLFR accurately aligns to the center of the face of the figure. The V 2<sup>nd</sup> 1/5 accurately aligns to the center of the left eye, outside of the nose and the right side of the painting on the wall in the

background. The V1/2 line aligns to the placement of the left arm, shoulder and left ear. The VRFR supports the VR1/3 aligned to the placement of the right side of the bed. The V 4<sup>th</sup> 1/5 divides the bed in half vertically along the placement of the pillows. The H upper 1/8 moderately aligns to the placement of the items on the back wall. The H upper 1/4 moderately describes the line in the artwork between the floor and wall in the background and at the top of the bed. The H 1/2 line moderately describes the division that the artist makes between the background and the middle ground. The H lower 1/3 in general describes the placement of the bookcase to the right, the forehead of the figure and the baseboard of the bed. The H lower 1/4 accurately (A = 2.5) aligns to the placement of the ears and eyes of the figure. The H lower 1/8 accurately (A = 2.6) aligns to the placement of the mouth, shoulders and left half of the figure. This line is also precisely the line of composition that aligns to the bottom of the bed frame. Overall, the strongest harmonic representation demonstrated in the composition is the HR3/4, V1/3H1/4. This artwork composition is an example of the placement of the grid lines in an asymmetrical manner to describe the facial and bodily features. The V1/3, VFR and V 2<sup>nd</sup> 1/5 are a DEMR alignment in the positioning of the head and face of the figure. This becomes a focal point in the picture. This placement by the artist is in alignment with the vanishing point of the linear perspective. This gives the artwork ideation, spatial depth and dynamic design.

**#371-4; Hermana, Sister, 2005; grabado sobre linóleo, engraving on linoleum;**  
assessment grid lines: count /color/ description:

4	black	V1/2, R1/8; H upper 1/4, upper 1/8
3	yellow	V1/3; H upper 1/3
6	red	V (3 <sup>rd</sup> and 4 <sup>th</sup> ) 1/5, H1/5
3	green	VFR, H upper FR
Total lines 16		

Measurements: length 15.87 cm; height 24.62 cm; ratio = 0.6445

V: 1/2, R1/8, 1/3, (3<sup>rd</sup> and 4<sup>th</sup>) 1/5, FR H: upper 1/4, upper 1/8, upper 1/3, 1/5, upper FR

1/2 = 7.935

upper 1/4 = 6.155

R1/8 = 13.886

upper 1/8 = 3.077

1/3 = 5.29, 10.58

upper 1/3 = 8.206

(3<sup>rd</sup> and 4<sup>th</sup>) 1/5 = 9.522, 12.696

1/5 = 4.924, 9.848, 14.77, 19.696

FR = 6.062, 9.807

upper FR = 9.40

Total = 8 lines

Total = 8 lines

Accuracy of lines: HR3/5(V1/3H1/5) VL1/3 = 1.5, VR1/3 = 2.8; V = 2.15; H 1<sup>st</sup> 1/5 = 2.9, 2<sup>nd</sup> 1/5 = 2.2, 3<sup>rd</sup> 1/5 = 2.6, 4<sup>th</sup> 1/5 = 2.6, H = 2.575; A = 2.3625

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H1	V2 H1
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.3625			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #371-4; vertical; length 15.87 cm, height 24.62 cm; ratio = 0.6445; vertical lines: 1/2, R1/8, 1/3, (3<sup>rd</sup> and 4<sup>th</sup>) 1/5, FR; horizontal lines; upper 1/4, upper 1/8, upper 1/3, 1/5, upper FR; accuracy of line placement: A = 2.3625; harmonic ratio: HR3/5, the fifth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #371-4 is at the level of a strong representation of a 3/5, fifth harmonic, HR3/5; V1/3H1/5. Additional notes: This image is of a girl standing against a background of wide horizontal lines. The top two are thicker and have flowers drawn in the spaces between the lines, which align to the head of the girl. The figure is placed at the compositional line of the V 3<sup>rd</sup> 1/5. This describes the placement of the inside of the right eye, nose, mouth, neckline and line of the right hand (A= 2.8). The VFR describes the placement of the center line of the face and is aligned to the V 3<sup>rd</sup> 1/5 and the VR1/3, which describes the placement of the inner left eye, to the nose, mouth on the left side, left side of the neck and fingers on the right hand. The artist put the girl directly in the vertical DEMR position on the picture frame. The VL1/3 aligns to the placement of the right arm. The VLFR is slightly more accurate in that alignment. The V1/2 line aligns to the placement of the line of the girl's upper torso. The V 4<sup>th</sup> 1/5 aligns to the left side of the head and torso to the extension of the finger of the right hand (A= 2.8). The VR1/8 describes the location of the left arm. The horizontal upper 1/8 (A = 2.9) accurately aligns to the composition of the line of the background and the top of the girl's head. The H upper 1<sup>st</sup> 1/5 aligns accurately (A = 2.9) to the background line and the placement of the eyebrows. The H upper 1/3 aligns to the background line. The H upper FR aligns to the placement of the neck to the shoulders (A = 2.7). The H 2<sup>nd</sup> 1/5 supports this line and aligns to the background line. The H 3<sup>rd</sup> 1/5 aligns (A = 2.6) to the waist of the figure and division of the upper right arm from the forearm. The 4<sup>th</sup> 1/5 accurately describes the placement of the last background line and location of the bottom of the hand. Overall the

HR 3/5 (A = 2.3625) accurately describes the artist's placement of the figure within the picture frame. The three lines 3<sup>rd</sup> 1/5, VRFR, and the VR1/3 delineate the main compositional line of the artwork, which is placed asymmetrically off center at the location of the vertical DEMR. The composition is built by the alternating use of the grid lines. This is a 2-dimensional image. The artist used shape, line and texture to create the artwork. The slanted lines in the skirt pattern give a slight indication of linear perspective. The visual effect is to move the eye from the skirt in the foreground to the face of the figure and the main compositional line of DEMR.

#371-5; *Músicos, Musicians* (diptych), 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

5 black V1/2, 1/4; H1/4  
 4 yellow V1/3; H1/3  
 8 red V1/5, H1/5  
 3 green VFR, H lower FR  
 2 orange V1; H1  
 Total lines 22

Measurements: length 17.67 cm; height 24.67 cm; ratio = 0.716

V: 1/2, 1/4, 1/3, 1/5, FR

H: 1/4, 1/3, 1/5, FR

1/2 = 8.835

1/4 = 6.1675, 18.5

1/4 = 4.41, 13.25

1/3 = 8.223, 16.446

1/3 = 5.89, 11.78

1/5 = 4.934, 9.868, 14.802, 19.736

1/5 = 3.53, 7.06, 10.59, 14.12

lower FR = 9.40

FR = 6.749, 10.92

Diagonal = H 1<sup>st</sup> 1/5 <sup>c</sup> H upper 1/3

2.055 <sup>c</sup> 8.223

Diagonal = V1/2 <sup>c</sup> VL1/4, 8.835 <sup>c</sup> 4.4175

Total = 12 lines

Total = 10 lines

Accuracy of lines: HR3/5: V1/5H1/3; V 1<sup>st</sup> 1/5 = 2.8, 2<sup>nd</sup> 1/5 = 2.6, 3<sup>rd</sup> 1/5 = 2.4, 4<sup>th</sup> 1/5 = 2.0; V = 2.45; H upper 1/3 = 2.5, H lower 1/3 = 2.2, H = 2.35; A = 2.4

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong	x				x		V2 H2	V2 H1
Moderate								

Low								
Inconsistent								
Not Found		x	x	x		x		
Accuracy 0- 3	2.5				2.4			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #371-5; vertical; length 17.67 cm, height 24.67 cm; ratio = 0.716; vertical lines: 1/2, 1/4, 1/3, 1/5, FR; horizontal lines; 1/4, 1/3, 1/5, FR; accuracy of line placement: A = 2.4; harmonic ratio: HR3/5, the fifth, V1/5H1/3; overall composition assessment: HR3/5 strong. The composition analysis of #371-5 is at the level of a strong representation of a 3/5, fifth harmonic, HR3/5; V1/5H1/3. There is evidence of a second harmonic ratio, HR1/2, the octave, V1/2Hna; (A = 2.5). Additional notes: This is a diptych artwork. The concept of the artwork composition is a fundamental vertical division of the two figures. The figure on the left is playing the cello and the figure on the right is playing the accordion. There is a diagonal line in the background that begins on the left side of the first half at the H 1<sup>st</sup> 1/12 measurement and the line slants downward to precisely the H upper 1/3. The diagonal line accuracy is (A = 2.9). This line and the shape the artist creates behind the musicians, to approximately the waistlines of the figures, is the indication of light coming from the light bulb in the background. The compositional effect of this shining light is to connect the two musicians and subdue the V1/2 division. The V1/5 lines align to a placement of the objects and figures in 1/5 divisions. The V 1<sup>st</sup> 1/5 and VL1/4 align to the description of the figure of the cello player's face and body. The VL1/3, VLFR and V 3<sup>rd</sup> 1/5 with the diagonal line V1/2<sup>c</sup> VL1/4 align to the slant and shape of the cello. The V 3<sup>rd</sup> 1/5 line and VRFR align to the accordion and top of the figure's shoes. The VR 1/3 aligns to the description of the accordion player's hands, right knee, and left shoe. The VR1/4 in general aligns to the description of the body of the accordion player. The V 4<sup>th</sup> 1/5 accurately aligns to the description of the face, torso, and legs of the figure placement. The picture frame is divided into 1/3 and 1/5 spacing horizontally. The H 1<sup>st</sup> 1/5 aligns to the head, eye, hand of the cello player and top of the accordion player's head. The H upper 1/4 accurately (A 2.8) aligns to the nose, eye, bottom of the hand of the cello player and nose and head of the accordion player. The H upper 1/3 accurately describes the placement of the shoulders, right arm, and top of the cello. This line is also precisely the location of the diagonal line of light in the background. The upper FR and 2<sup>nd</sup> 1/5 support the composition of the musicians. The H 3<sup>rd</sup> 1/5 and H lower FR indicate the location of the division of the waist to legs of both players. Overall the most accurate and comprehensive description of the placement of the compositional elements of the image is the HR3/5, V1/5H1/3. The HR1/2 is slightly more accurate; however, it does not give the most information about the artwork. This is a 2-dimensional image. The artist used shape, line texture and light and dark values to add depth and interest to the artwork.

#371-6; *Mi amor* (autorretrato), *My Love* (Self-Portrait), 1999; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description:

6 black V1/2, 1/4; H1/2, lower 1/4, upper 1/8  
 4 yellow V1/3; H1/3  
 4 red Vna, H1/5  
 4 green VFR, HFR  
 Total lines 18

Measurements: length 14.95 cm; height 24.42 cm; ratio = 0.6122

V: 1/2, 1/4, 1/3, FR  
 1/2 = 7.475  
 1/4 = 3.737, 11.212  
 1/3 = 4.983, 9.966  
 FR = 5.71, 9.239

H: 1/2, lower 1/4, upper 1/8, 1/3, 1/5, FR  
 1/2 = 12.21  
 lower 1/4 = 18.315  
 upper 1/8 = 3.05  
 1/3 = 8.14, 16.28  
 1/5 = 4.884, 9.768, 14.65, 19.536  
 FR = 9.328, 15.09

Total = 7 lines  
 Total = 11 lines

Accuracy of lines: HR3/5 (V1/3H1/5); VL1/3 = 2.0, VR1/3 = 2.0; V = 2.0; H 1<sup>st</sup> 1/5 = 2.5, 2<sup>nd</sup> 1/5 = 2.3, 3<sup>rd</sup> 1/5 = 1, 4<sup>th</sup> 1/5 = 1, H = 1.7; A = 1.8

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V2 H2	V2 H2
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.85			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #371-6; vertical; length 14.95 cm, height 24.42 cm; ratio = 0.6122; vertical lines 1/2, 1/4, 1/3, FR; horizontal lines: 1/2, lower 1/4, upper 1/8, 1/3, 1/5, FR; accuracy of line placement: A = 1.85; harmonic ratio: HR3/5, the fifth, V1/3H1/5; overall composition assessment: HR3/5 moderate. The composition analysis of #371-6 is at the level of a moderate representation of a 3/5, fifth harmonic, HR3/5; V1/3H1/5. Additional

notes: the overall dimensions of this picture frame are close to the DEMR construct (0.61803...). This mathematical relationship sets up the underlying harmonic ratio of HR3/5. The image is a self-portrait of the artist. The face and head are all that is presented of the individual. The placement of the face and head is in the horizontal upper half of the picture frame. The V1/4 and V1/2 lines directly align to the placement of the eyes. The center of the face, nose and mouth are delineated by the V1/3 and VLFR. The dimensions of the placement of the left side of the head is aligned to the VR1/3 and supported by the VRFR. The horizontal upper 1/8 line aligns to the background line above the head. The H 1<sup>st</sup> 1/5 accurately describes the placement of the top of the head. The H upper 1/3 delineates the cheeks and nose of the face. The H upper FR and 3<sup>rd</sup> 1/5 align to the placement of the mouth. The H1/2 is the division of the head in the upper half of the picture. The remaining H lower lines the 3<sup>rd</sup> 1/5, the lower FR, 1/3 and 1/4, in general, align to the placement of the slanted horizontal objects in the lower half of the picture. The H 4<sup>th</sup> 1/5 aligns to the lower vertical objects. Overall, the HR of V1/3H1/5 is represented in the composition of the artwork. This is a moderate representation. The artist placed the head and face in the optimal compositional position as guided by the Rule of Three. The VL1/4 and V1/2 support the center of the head and face placement VL1/3 and VLFR. The bottom of the face placement aligns to the V1/2, which is the one-half distance between the 2<sup>nd</sup> and 3<sup>rd</sup> 1/5. This is a 2-dimensional image. The artist used shape and line with light and dark values. The placement of the mouth with the light value is in the location of the three points of composition, which draws the attention of the viewer to that location to focus on the face and head of the self-portrait.

**#372, female, 40 years old; 31 years at JLDF; 16years at the art school; no visual impairments; socioeconomic status/very low; range of time of artwork used in the study: NA**

**#372-1; Madre, Mother, 2000; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

5	black	V1/2, 1/4; H1/2, upper 1/4
2	yellow	Vna; H1/3
6	red	V1/5, H (1 <sup>st</sup> , 3 <sup>rd</sup> )1/5
3	green	VFR, H lower FR
Total lines 16		

Measurements: length 12.55 cm; height 16.87 cm; ratio = 0.7439

V: 1/2, 1/4, 1/5, FR	H: 1/2, upper 1/4, 1/3, (1 <sup>st</sup> , 3 <sup>rd</sup> ) 1/5, lower FR
1/2 = 6.275	1/2 = 8.435
1/4 = 3.1375, 9.4125	upper 1/4 = 4.2175
1/5 = 2.51, 5.02, 7.53, 10.04	1/3 = 5.623, 11.246
FR = 4.7941, 7.7559	(1 <sup>st</sup> , 3 <sup>rd</sup> ) 1/5 = 3.374, 10.122
	FR = 10.4256
Total = 9 lines	Total = 7 lines

Accuracy of lines: HR3/4 (V1/4H1/3) VL1/4 = 2.9, V1/2 = 2.9, VR1/4 = 2.2; V = 2.75; H upper 1/3 = 2.4, H lower 1/3 = 3, H = 2.7, A = 2.725  
 HR2/3, V1/2H1/3, V1/2 = 2.9; H upper 1/3 = 2.4, H lower 1/3 = 3; V = 2.9; H = 2.7, A = 2.8; HR3/5: V1/5H1/3, V 1<sup>st</sup> 1/5 = 1, 2<sup>nd</sup> 1/5 = 2.4, 3<sup>rd</sup> 1/5 = 2.7, 4<sup>th</sup> 1/5 = 2.8; H upper 1/3 = 2.4, H lower 1/3 = 3; V = 2.225, H = 2.7; A = 2.46

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				H2	V2 H1
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.725					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #372-1; vertical; length 12.55 cm, height 16.87 cm; ratio = 0.7439; vertical lines: 1/2, 1/4, 1/5, FR; horizontal lines: 1/2, upper 1/4, 1/3, (1<sup>st</sup>, 3<sup>rd</sup>)1/5, lower FR; accuracy of line placement: A = 2.725; harmonic ratio: HR3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 strong. The composition analysis of #372-1 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. There is evidence of two other harmonic ratios, the HR2/3, V1/2H1/3, A = 3, and HR3/5, V1/5H1/3, A = 2.46. Additional notes: This image is of a figure that morphs into a wooden structure. There is a composition line of the figure divided in half vertically, (A = 2.9). Horizontally, the composition is divided into thirds. The H upper 1/3 is just below the wood structure that is the arms of the figure. The H lower 1/3 is precisely the (A = 3) line across the picture frame that the artist made dividing the image in black and white. The white background covers 2/3's of the picture frame. The black background covers the bottom 1/3. The HR2/3 is a high accuracy (A = 2.8). The HR3/5, V1/5H1/3, aligns the V 1<sup>st</sup> 1/5 at a low level, the V 2<sup>nd</sup> 1/5 supports the VLFR and is aligned to the placement of the right side of the head to the right side of the main structure and the right foot. The V 3<sup>rd</sup> 1/5 and VRFR describe the placement of the left side of the head, the left



side of the main wood piece and left foot. The V 4<sup>th</sup> 1/5 accurately describes the left side of the wood post supporting the figure. The overall accuracy is A = 2.46. A third HR3/4, V1/4H1/3, is the fourth harmonic, which is the fundamental HR3/5. The VL1/4 describes the placement of the wood piece on the right side of the figure, A = 2.9. The VR1/4 aligns to the wood post on the left side of the figure (A = 2.2). The horizontal H upper1/4 aligns to the placement of the chin of the figure and arm post. The H lower 1/3 is precisely aligned to the division of black and white background (A = 3). The HR3/4 has an accuracy of A = 2.725 and gives the most information about the image. The vertical lines of the 1/2, 1/4, 1/5 and FR are symmetric in the description of the placement of the elements of the composition. They are not used in an alternating pattern. The horizontal lines 1/2, upper 1/4, 1/3, (1<sup>st</sup>, 3<sup>rd</sup>) 1/5, lower FR are juxtaposing in a pattern of “building” the elements of the composition. This image is 2-dimensional. The artist used line, shape, and, black and white to create the image.

**#373, male, 25 years old; 22 years at JDLF; 5 years at the art school; myopia- wears glasses; socioeconomic status/medium; range of time of artwork used in the study: 2011-2013**

**#373-1; Egipios, Egyptians, 2013; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

6	black	V1/2, 1/4, 1/8; H1/2
3	yellow	V1/3; H upper 1/3
4	red	Vna, H1/5
3	green	VFR, H lower FR
Total lines 16		

Measurements: length 13.35 cm; height 11.28 cm; ratio = 0.8449

V: 1/2, 1/4, 1/8, 1/3, FR	H: 1/2, upper 1/3, 1/5, lower FR
1/2 = 6.675	1/2 = 5.64
1/4 = 3.377, 10.012	upper 1/3 = 3.76
1/8 = 1.668, 11.68	1/5 = 2.256, 4.512, 6.768, 9.024
1/3 = 4.45, 8.9	lower FR = 4.3086
FR = 5.099, 8.250	

Total = 9 lines

Total = 7 lines

Accuracy of lines: HR3/5 (V1/3H1/5) VL1/3 = 2.0, VR1/3 = 2.9; V = 2.45; H 1<sup>st</sup> 1/5 = 2.9, 2<sup>nd</sup> 1/5 = 2.8, 3<sup>rd</sup> 1/5 = 2.0, 4<sup>th</sup> 1/5 = 1.8, H = 2.375; A = 2.4125

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H1	V2 H1
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.4125			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #373-1; horizontal; length 13.35 cm, height 11.28 cm; ratio = 0.8449; vertical lines: 1/2, 1/4, 1/8, 1/3, FR; horizontal lines: 1/2, upper 1/3, 1/5, lower FR; accuracy of line placement: A = 2.4125; harmonic ratio: HR3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #373-1 is at the level of a strong representation of a 3/5, sixth harmonic, HR3/5; V1/3H1/5. Additional notes: This image is of multiple Egyptian figures and animals. They are placed horizontally along the bottom of the picture frame. The height of the figure is approximately 2/3 of the vertical distance of the picture frame, H upper 1/3, (A = 2). At the top of the image is a band across the picture of small figures, the H 1<sup>st</sup> 1/5 accurately (A = 2.9) aligns to the bottom of the band. The H 2<sup>nd</sup> 1/5 aligns to the top of the heads of the main figures. The H1/2 aligns the placement of the figures and the cross beam of a balance. The H 3<sup>rd</sup> 1/5 and H lower FR align to the placement of an animal on the balance. The H 4<sup>th</sup> 1/5 aligns to the placement of the legs of the figures across the picture. Vertically, the VL1/8 and VR1/8 describe the placement of the main figures on each side of the picture. The VL1/3 aligns to the placement of the large figure in the center of the picture that is standing next to the balance beam. The V1/2 line is in alignment with the placement of the base of the balance beam and the exact 1/2 division of the eight small figures in the band at the top of the picture. The VR1/3 and the VRFR precisely align to the width of the balance post. The balance post divides the length of the picture at the VR1/3 (A = 2.9). The artwork composition is strongly divided both vertically and horizontally at the Rule of Three divisions. The balance post precisely delineates the position. The H lower 1/3 is not represented, instead it is the H 3<sup>rd</sup> 1/5 that delineates the 8 cm/5.4 cm rectangle, an approximation of DEMR, in the center of the picture. This is a 2-dimensional image. The artist used shape, line, fore/middle/ back ground and light and dark values to create the artwork.

#373-2; *Diego Rivera*, 2013; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

8 black V1/2, 1/4, 1/8; H1/2, 1/4  
 4 yellow V1/3; H1/3  
 8 red V1/5, H1/5  
 4 green VFR, HFR  
 Total lines 24

Measurements: length 9.72 cm; height 14.27 cm; ratio = 0.681

V: 1/2, 1/4, 1/8, 1/3, 1/5, FR      H: 1/2, 1/4, 1/3, 1/5, FR  
 1/2 = 4.86      1/2 = 7.135  
 1/4 = 2.3, 7.29      1/4 = 3.567, 10.70  
 1/8 = 1.15, 8.57      1/3 = 4.75, 9.513  
 1/3 = 3.24, 6.48      1/5 = 2.854, 5.708, 8.562, 11.416  
 1/5 = 1.94, 3.88, 5.832, 7.77      FR = 5.45, 8.81  
 FR = 3.712, 6.007  
 Total = 13 lines      Total = 11 lines

Accuracy of lines: HR3/5 (V1/3H1/5) V 1<sup>st</sup> 1/5 = 2.8, 2<sup>nd</sup> 1/5 = 2.7, 3<sup>rd</sup> 1/5 = 2.8, 4<sup>th</sup> 1/5 = 2.9; V = 2.8; H upper 1/3 = 3, H lower 1/3 = 2.0, H = 2.5; A = 2.65

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.65			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #373-2; vertical; length 9.72 cm, height 14.27 cm; ratio = 0.681; vertical lines: 1/2, 1/4, 1/8, 1/3, 1/5, FR; horizontal lines: 1/2, 1/4, 1/3, 1/5, FR; accuracy of line placement: A = 2.65; harmonic ratio: HR3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #373-2 is at the level of a strong representation of a 3/5, sixth harmonic, HR3/5; V1/3H1/5. Additional notes: This is an

image of Diego Rivera. The portrait is presented slightly off front view at the right three-quarter (half turn). There is evidence of the use of three harmonic ratios in the artwork. The HR2/3, V1/2H1/3;  $V = 2.7$ ,  $H = 2.5$ ;  $A = 2.6$ , aligns to the placement of the V1/2 delineation of the inside of the right eye, nostril, side of mouth, chin and neck. The H upper 1/3 aligns to the placement of the center of the eyes, and the top of the right ear. The H lower 1/3 aligns to the line of the neck to the shoulders, bottom of the mouth and the protrusion of the mandible. The HR3/4, V1/4H1/3, is the extended divisions of the HR2/3. The V1/8 aligns to the placement of the right ear. The VR1/8 describes the placement of the left side of the head and chin ( $A = 2.425$  for the HR3/4). The HR3/5, V1/5H1/3, represents the vertical division of the 1/5's following the composition of the artwork. The V 1st 1/5 describes the right side of the head and chin along the inside of the ear. The V 2<sup>nd</sup> 1/5 describes the center of the right eye, the 3/4 angle of the portrait, the outside of the mouth and chin box. The V 3<sup>rd</sup> 1/5 is the center of the portrait. The V 4<sup>th</sup> 1/5 line aligns to the placement of the center of the left eye, outside of the eye socket, zygomatics and lower mandible. The VR1/3 describes the line of composition of the inside corner of the left eye, left nostril, mouth and chin. The VLFR describes the line of composition that supports the V2<sup>nd</sup> 1/5 line. The VRFR supports the V 3<sup>rd</sup> 1/5 that describes the center of the face. The VR1/4 aligns to the placement of the left eyeball, nose, mouth and chin placement. The connections of the grid lines are not a symmetric pattern. The relationship of each line is the "built" pattern of composition that creates the portrait image. The composition of this portrait demonstrates the use of a DEMR relation asymmetric juxtaposition of the facial elements. The image is 2-dimensional. The artist used thick white lines and a background of black to create this artwork. This is an excellent artistic portrait rendering that can be used as a teaching example.

**#373, male, 25 years old; 22 years at JDLF; 5 years at the art school; myopia- wears glasses; socioeconomic status/medium; range of time of artwork used in the study: 2011-2013**

**#373-3; *Mujer joven, Young Woman*, 2011; pirograbado en madera, pyrograph in wood; assessment grid lines: count /color/ description:**

3	black	V1/2; H1/2, upper 1/4
4	yellow	V1/3; H1/3
4	red	Vna, H1/5
Total lines 11		

Measurements: length 10.01 cm; height 13.67 cm; ratio = 0.732	
V: 1/2, 1/3	H: 1/2, upper 1/4, 1/3, 1/5
1/2 = 5.005	1/2 = 6.835
1/3 = 3.336, 6.67	upper 1/4 = 3.417
	1/3 = 4.556, 9.113

Total = 3 lines

1/5 = 2.734, 5.468, 8.202, 10.936  
Total = 8 lines

Accuracy of lines: HR2/3 (V1/2H1/3) V1/2 = 1.7; V = 1.7; H upper 1/3 = 1.5, H lower 1/3 = 1.5, H = 1.5; A = 1.6

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2 H2	
Moderate		x						
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.6						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #373-3; vertical; length 10.01 cm, height 13.67 cm; ratio = 0.732; vertical lines: 1/2, 1/3; horizontal lines: 1/2, upper 1/4, 1/3, 1/5; accuracy of line placement: A = 1.6; harmonic ratio: HR2/3, the fifth, V1/2H1/3; overall composition assessment: HR2/3 moderate. The composition analysis of #373-3 is at the level of a moderate representation of a 2/3, fifth harmonic, HR3/5; V1/2H1/3. Additional notes: This artwork is an image of a figure that is placed in the center of the picture frame. The V1/2 line aligns to that placement slightly off of center (A = 1.7). The H upper 1/3 aligns to the division in general of the upper part of the figure. The H lower 1/3 aligns to the placement of the knees of the figure. The horizontal spacing of the composition aligns with the 1/5 divisions. The H 1<sup>st</sup> 1/5 aligns to the placement of the nose of the figure. The H 2<sup>nd</sup> 1/5 aligns to the placement of the belly button of the figure. The H 3<sup>rd</sup> 1/5 aligns to the placement in general of the figure's legs. The H 4<sup>th</sup> 1/5 describes the location of the feet. The H upper 1/4 describes the placement of the chin and the H 1/2 aligns to the placement of the pelvis. Overall, the V1/2 division is evident and the horizontal composition is a juxtaposition of the grid lines aligned to the parts of the figure asymmetrically 1/2, upper 1/4, 1/3, 1/5. The image is 2-dimensional. The artist used black and white texture marks to create the image.

**#374, male, 32 years old; 20 years at JLDF; unknown years at art school; keratoconus- wears glasses; socioeconomic status/low; range of time of artwork used in the study: 2002-2015**

#374-1; Pájaro tropical, Tropical parrot, 2015; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

4 black V1/2; H1/2, 1/8  
 2 yellow Vna; H1/3  
 4 red V1/5, Hna  
 3 green VFR, H upper FR  
 1 orange diagonal  
 Total lines 14

Measurements: length 13.21 cm; height 15.52 cm; ratio = 0.851

V: 1/2, 1/5, FR

1/2 = 6.6

1/5 = 2.64, 5.28, 7.926, 10.568

FR = 5.045, 8.164

H: 1/2, 1/8, 1/3, upper FR

1/2 = 7.76

1/8 = 1.94, 13.58

1/3 = 5.17, 10.346

upper FR = 5.93

diagonal (right side) H lower 1/8<sup>c</sup> (left

side)

H upper 1/8 = 0, 13.21

Total = 7 lines

Total = 7 lines

Accuracy of lines: HR3/5: V1/5H1/3, V 1<sup>st</sup> 1/5 = 1.5, 2<sup>nd</sup> 1/5 = 2.2, 3<sup>rd</sup> 1/5 = 1.0, 4<sup>th</sup> 1/5 = 1.5; H upper 1/3 = 1.0, H lower 1/3 = 1.0; V = 1.5, H = 1.0; A = 1.25

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V2	H2
Low								
Inconsistent								
Not Found	x	x	x	x	x	x		
Accuracy 0- 3					1.25			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-1; vertical; length 13.21 cm, height 15.52 cm; ratio = 0.851; vertical lines: 1/2, 1/5, FR; horizontal lines: 1/2, 1/8, 1/3, upper FR; accuracy of line placement: A =

1.25; harmonic ratio: HR3/5, the sixth, V1/5H1/3; overall composition assessment: HR3/5 moderate. The composition analysis of #374-1 is at the level of a moderate representation of a 3/5, sixth harmonic, HR3/5; V1/5H1/3. Additional notes: this image is of multiple objects and shapes. The main object is a parrot. The arrangement of the objects can be described as a vertical division of the 1/5' spacing and a horizontal 1/3's spacing. The V 2<sup>nd</sup> 1/5 aligns moderately to the flower object in the center location aligned to the diagonal across the picture frame from left to right starting at the H upper 1/8. The H upper FR accurately aligns to the exact location of the point of the flower. The intersection of the V1/2 and the H 1/2 describes the placement of the head of the parrot. This area is the focus of the composition and is supported by the alignment of the diagonal line, which follows the artist's intention. This is a 2-dimensional image. The artist used light and dark with shapes to create this artwork.

#374-2; Libros, Books, 2004; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description:

8 black V1/2, 1/4, 1/8; H1/2, 1/4, 1/5, FR  
 2 yellow V1/3; Hna  
 8 red V1/5, H1/5  
 4 green VFR, HFR  
 Total lines 22

Measurements: length 10.36 cm; height 11.94 cm; ratio = 0.867

V: 1/2, 1/4, 1/8, 1/3, 1/5, FR

H: 1/2, 1/4, 1/5, FR

1/2 = 5.18

1/2 = 5.97

1/4 = 2.59, 7.77

1/4 = 2.985, 8.955

1/8 = 1.295, 9.065

1/5 = 2.388, 4.776, 7.164, 9.55

1/3 = 3.45, 6.90

FR = 4.56, 7.379

1/5 = 2.07, 4.144, 6.216, 8.288

FR = 3.957, 6.4

Total = 13 lines

Total = 9 lines

Accuracy of lines: HR3/4: V1/3H1/4, VL1/3 = 2.5, VR1/3 = 2.2;

H upper 1/4 = 2.2, H1/2 = 2.0, H lower 1/4 = 2.1; V = 2.35, H = 2.1;

A = 2.225; HR3/5, V1/3H1/5; V1/3H1/4, VL1/3 = 2.5, VR1/3 = 2.2;

H 1<sup>st</sup> 1/5 = 2.9, 2<sup>nd</sup> 1/5 = 2.8, 3<sup>rd</sup> 1/5 = 2.0, 4<sup>th</sup> 1/5 = 1.8; V = 2.35,

H = 2.275; A = 2.3125

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>

<i>Level of Evidence</i>								
Strong			x		x		V2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x		x		x		
Accuracy 0- 3			2.225		2.3125			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-2; vertical; length 10.36 cm, height 11.94 cm; ratio = 0.867; vertical lines: 1/2, 1/4, 1/8, 1/3, 1/5, FR; horizontal lines: 1/2, 1/4, 1/5, FR; accuracy of line placement: A = 2.3125; harmonic ratio: HR3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #374-2 is at the level of a strong representation of a 3/5, sixth harmonic, HR3/5; V1/3H1/5. There is evidence of a second harmonic ratio, HR3/4, the fourth, V1/3H1/4, A = 2.225. Additional notes: This is an image of a woman sitting at a table. Her left elbow is resting on the table. Her left hand is against her cheek. The V1/2 line accurately describes the placement of the center of the left eye. (Portrait artists' set-up the picture composition around the central vertical line going through the center of one of the subject's eyes. This image is an example of that art principle.) The V 1<sup>st</sup> 1/5 describes the placement of the right side of the head. The VL1/3 line accurately aligns to the right eye and blouse. The V 2<sup>nd</sup> 1/5 aligns to the placement of the nose and mouth at a moderate level. The V 3<sup>rd</sup> 1/5 is aligned to the placement of the left side of the face and hand. The V 4<sup>th</sup> 1/5 describes the sleeve of the blouse on the left arm and the placement of the outside of the left arm. The vertical diagonal of the table on the left side of the picture starts at the V1st 1/16 and follows the angle line of the table, scarf line, the left eye to the VR1/3 at the top of the picture. The H upper 1/8 delineates the placement of the woman's eyebrows. The H 1<sup>st</sup> 1/5 delineates the lines under the eye's and the top of the left ear. The H upper 1/4 describes the placement of the mouth and left hand on the cheek. The H upper FR and the H 2<sup>nd</sup> 1/5 delineate the background divisions the artist presented and at the wrist and coat sleeve. The H 1/2 aligns to the placement of the shape of the scarf. The H lower 3<sup>rd</sup> 1/5 and H lower FR align to the right shoulder of the coat and the bottom of the scarf. The H lower 1/4 is moderately aligned to the horizontal edge of the table. The H lower 4<sup>th</sup> 1/5 follows an existing horizontal line on the table of an object. Overall, the HR3/4 (A = 2.225) is less accurate than the HR3/5. The HR3/4 is the base harmonic of the HR3/5. More information about the composition is provided in the HR3/5. Both harmonic ratios together explain the picture composition; both represent crucial aspects of the placement of the compositional elements. The vertical delineation of grid lines is asymmetric and based on the V1/2 crossing the center of one of the eyes. The pattern of V1/3, VFR and V 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines is offset by 1 cm from the center. This is the preferred composition. The angle of the table gives the impression of depth. The line also leads the viewer into the face of the woman. This is a



3-dimensional image. The artist used white and black shapes with gray outlines, light and dark values, and fore/middle/ back ground techniques to create the artwork.

#374-3; *El gallo, The Rooster*, 2002; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description:

5 black V1/2; H1/2, 1/4, lower 1/8  
 4 yellow V 1<sup>st</sup>, 5<sup>th</sup> 1/6; H1/3  
 4 green VFR, HFR  
 Total lines 13

Measurements: length 10.26 cm; height 12.64 cm; ratio = 0.8117

V: 1/2, 1/6, FR

1/2 = 5.13

(1<sup>st</sup>, 5<sup>th</sup>) 1/6 = 1.71, 8.55

FR = 3.92, 6.34

H: 1/2, 1/4, lower 1/8, 1/3, FR

1/2 = 6.32

1/4 = 23.16, 9.48

lower 1/8 = 11.06

1/3 = 4.21, 8.426

FR = 4.828, 7.812

Total = 5 lines

Total = 8 lines

Accuracy of lines: HR3/4: V1/3H1/4, VL1/3 = 1.7, VR1/3 = 1.2;

H upper 1/4 = 1.5, H1/2 = 2.7, H lower 1/4 = 1.2; V = 1.45, H = 1.8;

A = 1.6

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							H2	V2 H2
Moderate			x					
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.6					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-3; vertical; length 10.26 cm, height 12.64 cm; ratio = 0.8117; vertical lines: 1/2, 1/6, FR; horizontal lines: 1/2, 1/4, lower 1/8, 1/3, FR; accuracy of line placement: A = 1.6; harmonic ratio: HR3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 moderate. The composition analysis of #374-3 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/3H1/4. Additional notes:

This image is of a rooster. The artist divided the horizontal composition into fourths. The upper H 1/4 moderately aligns to the placement of the clouds. The H1/2 accurately describes the placement of the line the artist made to divide the middle ground from the background. The H lower 1/4 in general aligns to the placement of the rooster's feet and the smaller chicken. The H lower 1/4 goes through the eye of the smaller chicken. The vertical divisions were the sixths. The V 1<sup>st</sup> 1/6 delineates the accurate placement of the rooster's eye (A =2.8). The V 5<sup>th</sup> 1/6 in general aligns to the placement of the position of the second smaller chicken. The H lower 1/8 accurately describes the placement of the edge of a cliff the second chicken is looking over. This is a 2-dimensional image. The artist used shape, line, light and dark values and some fore/middle and background techniques.

**#374-4; *Las llaves del palacio, The Keys to the Palace*, 2006; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

6	black	V1/2 VR1/8; H1/2, 1/4, upper 1/8
2	yellow	V1/3; Hna
4	red	Vna, H1/5
2	green	VRFR, H lower FR
Total lines 14		

Measurements: length 8.08 cm; height 12.04 cm; ratio = 0.671

V: 1/2, R1/8, 1/3, 1/5, RFR	H: 1/2, 1/4, lower 1/8, lower FR
1/2 = 4.04	1/2 = 6.02
R1/8 = 7.07	1/4 = 3.01, 9.03
1/3 = 2.69, 5.386	upper 1/8 = 1.5
1/5 = 1.616, 3.232, 4.848, 6.464	lower FR = 7.44
RFR = 4.99	
Total = 9 lines	Total = 5 lines

Accuracy of lines: HR3/4: V1/3H1/4, VL1/3 = 1.5, VR1/3 = 2.0;  
H upper 1/4 = 1.5, H1/2 = 1.5, H lower 1/4 = 1.5; V = 1.75, H = 1.5;  
A = 1.625

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2	V1 H1
Moderate			x					
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.625					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-4; vertical; length 8.08 cm, height 12.04 cm; ratio = 0.671; vertical lines: 1/2, R1/8, 1/3, 1/5, RFR; horizontal lines: 1/2, 1/4, lower 1/8, lower FR; accuracy of line placement: A = 1.625; harmonic ratio: HR3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 moderate. The composition analysis of #374-4 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/3H1/4. Additional notes:

This image depicts a large object that is figure-like on the top of a three post box of ornate decoration. The object is placed in an asymmetrical position vertically. The composition is divided horizontally by the H lower FR. Underlying the Rule of Three vertical divisions are the 1/5 divisions. The V 1<sup>st</sup> 1/5 accurately aligns to the placement of the left side of the box structure. The V L1/3 aligns to the placement of the post on the right side. The V 2<sup>nd</sup> 1/5 in general describes the inside position of the center post. The V 3<sup>rd</sup> 1/5 aligns closely to the VRFR and accurately aligns to the center of the head shape of the image. The VR1/3 describes accurately the position of the figure object. The V 4<sup>th</sup> 1/5 aligns in general to the placement of the box and figure in the picture frame on the right side. The horizontal lines accurately describe the figure, H upper 1/8, the head, H upper 1/4 the neck and shoulders, H1/2 the division of the box and figure, and the H lower 1/4, the bottom of the box. The H lower FR accurately describes the background division. Overall, the HR3/4; V1/3H1/4, aligns to the composition of the image with asymmetrical juxtaposition of the grid lines. The image is 2-dimensional. The artist used black and white shape and outline to create the artwork.

**#374-5;** *Sopa de figuras, Soup of Figures*, 2010; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

5 yellow V1/6; Hna

4 red Vna, H1/5  
Total lines 9

Measurements: length 13.03 cm; height 15.73 cm; ratio = 0.828

V: 1/6

H: 1/5

1/6 = 2.17, 4.34, 6.51, 8.68, 10.85

1/5 = 3.146, 6.292, 9.438, 12.584

Total = 5 lines

Total = 4 lines

Accuracy of lines: HR3/5, V1/3H1/5; V1/3H1/4, VL1/3 = 1.3, VR1/3 = 1.0;  
H 1<sup>st</sup> 1/5 = 1.5, 2<sup>nd</sup> 1/5 = 1.5, 3<sup>rd</sup> 1/5 = 1.0, 4<sup>th</sup> 1/5 = 1.0; V = 1.15,  
H = 1.25; A = 1.2

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V2	
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.2			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-5; vertical; length 13.03 cm, height 15.73 cm; ratio = 0.828; vertical lines: 1/6; horizontal lines: 1/5; accuracy of line placement: A = 1.2; harmonic ratio: HR3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 moderate. The composition analysis of #374-5 is at the level of a moderate representation of a 3/5, sixth harmonic, HR3/5; V1/3H1/5. Additional notes: This image is of many whimsical items arranged in general as a V1/3 H1/5 composition. The objects are presented in an overall horizontal alignment even though the picture orientation is vertical. The vertical 1/3 lines show alignment to the placement of the figures or their interactions. The horizontal 1/5 lines align to the separation of the object and the white open spacing. The objects are asymmetrical to one another and are distinctly different from the open spaces. The image is 2-dimentional. The artist used black and white shapes and light and dark values to create the artwork.

#374-6; Sueños rojos, Red Dreams, 2006; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

2 yellow V1/3; Hna  
 4 red Vna; H1/5  
 Total lines 6

Measurements: length 24.33 cm; height 19.86 cm; ratio = 0.8162

V: 1/3

H: 1/5

1/3 = 8.11, 16.22

1/5 = 3.97, 7.944, 11.9, 15.88

Total = 2 lines

Total = 4 lines

Accuracy of lines: HR3/5, V1/3H1/5; V1/3H1/4, VL1/3 = 1.3, VR1/3 = 1.5;  
 H 1<sup>st</sup> 1/5 = 1.0, 2<sup>nd</sup> 1/5 = 1.0, 3<sup>rd</sup> 1/5 = 1.0, 4<sup>th</sup> 1/5 = 1.5; V = 1.4,  
 H = 1.125; A = 1.26

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V2	
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.26			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-6; horizontal; length 24.33 cm, height 19.86 cm; ratio = 0.828; vertical lines: 1/3; horizontal lines: 1/5; accuracy of line placement: A = 1.26; harmonic ratio: HR3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 moderate. The composition analysis of #374-5 is at the level of a moderate representation of a 3/5, sixth harmonic, HR3/5; V1/3H1/5. Additional notes: This image is of multiple objects of light and dark values that are in general aligned vertically in thirds and horizontally in fifths. The VL1/3 aligns to the division in the artwork of the objects. Two sections of the object do not divide completely into thirds. The VR1/3 line aligns to the artist's spacing of the objects; all of the

object placement indicates a third division. The artwork composition is more vertical than horizontal. The artwork in 2-dimensional. The artist used shape with light and dark values to create the image.

#374-7; *La playa, The Beach*, 2002; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description:

9 black V1/2, 1/4, 1/8; H1/2, lower 1/4, 1/8  
 4 yellow V1/3; H1/3  
 4 red Vna, H1/5  
 2 green VFR, Hna  
 4 orange V4; Hna  
 Total lines 23

Measurements: length 24.38 cm; height 20.17 cm; ratio = 0.8273

V: 1/2, 1/4, 1/8, 1/3, FR

H: 1/2, lower 1/4, 1/8, 1/3, 1/5

1/2 = 12.19

1/2 = 10.45

1/4 = 6.09, 18.285

lower 1/4 = 15.675

1/8 = 3.04, 21.335

1/8 = 2.611, 18.29

1/3 = 8.126, 16.25

1/3 = 6.96, 13.93

FR = 9.312, 15.067

1/5 = 4.18, 8.36, 12.54, 16.72

Diagonal: V 3<sup>rd</sup> ° VR1/8 = 14.628 ° 21.335

VR1/3 ° VL1/3 = 16.25 ° 8.126

H lower 1/4 ° VR1/3 = 15.675 ° 16.25

VL1/3 ° VLFR = 13.44 ° 9.312

Total = 13 lines

Total = 10 lines

Accuracy of lines: HR3/5, V1/3H1/5; V1/3H1/4, VL1/3 = 2.7, VR1/3 = 2.8;

H 1<sup>st</sup> 1/5 = 2.5, 2<sup>nd</sup> 1/5 = 2.7, 3<sup>rd</sup> 1/5 = 2.4, 4<sup>th</sup> 1/5 = 2.7; V = 2.75,

H = 2.575; A = 2.66

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H2	V2

Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.66			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-7; horizontal; length 24.38 cm, height 20.17 cm; ratio = 0.8273; vertical lines: 1/2, 1/4, 1/8, 1/3, FR; horizontal lines: 1/2, lower 1/4, 1/8, 1/3, 1/5; accuracy of line placement: A = 2.66; harmonic ratio: HR3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #374-7 is at the level of a strong representation of a 3/5, sixth harmonic, HR3/5; V1/3H1/5. Additional notes: This image is of three bathers near two palm trees at the beach with the ocean in the background. The V1/3 accurately aligns to the placement of the bather on the left side of the artwork and to the diagonal palm tree. The VR1/3 accurately describes the placement of the bather on the right side of the picture. The V1/2 aligns to the center of the bather in the center. The V1/4 and 1/8 lines describe the tree positions and the bather information. There are four diagonal lines of the composition. One of the lines follows the placement of the central palm tree. Two lines represent the arm positions of the central bather. The fourth diagonal line follows the arm position of the bather on the right side. The H upper 1/8 line describes the top of the head of the central bather. The H 1<sup>st</sup> 1/5 line describes the top of the head of the bather on the right, the eyes of the central bather and the neck and shoulders of the bather on the left. The H 2<sup>nd</sup> 1/5 aligns to the placement of the swimsuits of the bathers. The H 1/2 describes in general the waist area of the bathers. The H lower 1/4 describes the location of the horizon line of the ocean. This is a 3-dimensional image. The artist used light and dark values to place the shapes and lines in the fore/middle/back ground positions. This created a depth perception within the composition.

**#374-8; *Faraón egipcio, Egyptian Pharaoh*, 2008; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

10	black	V1/2, 1/4, 1/8; H1/2, 1/4, 1/8
16	yellow	V1/9; H1/9
4	green	VFR, HFR
1	blue dotted line	Vna; H1

Total lines 31

Measurements: length 19.74 cm; height 24.25 cm; ratio = 0.814

V: 1/2, 1/4, 1/8, 1/9, FR	H: 1/2, 1/4, 1/8, 1/9, FR
1/2 = 9.87	1/2 = 12.1

1/4 = 4.935, 14.8  
 1/8 = 2.467, 17.27  
 1/9 = 2.193, 4.386, 6.579, 8.77,  
 10.964, 13.157, 15.35, 17.54  
 FR = 7.54, 12.199

1/4 = 6.06, 18.187  
 1/8 = 3.03, 21.22  
 1/9 = 2.694, 5.388, 8.082, 10.776,  
 13.47, 16.16, 18.858, 21.55  
 FR = 9.26, 14.987  
 Blue dotted line: 3.08555

Total = 15 lines

Total = 16 lines

VR1/4  
 H 5<sup>th</sup>  
 =  
 Accuracy of lines: HR4/6/9, V1/4H1/9; VL1/8= 2.7, VL1/4 = 2.3, V1/2 = 3,  
 = 2.2, VR1/8= 2.4; H 1<sup>st</sup>1/9 = 2.4, H 2<sup>nd</sup> 1/9 = 2.0, H 3<sup>rd</sup>1/9 = 2.7, H 4<sup>th</sup> 1/9 = 3,  
 1/9 = 2.8, H 6<sup>th</sup> 1/9 = 2.8, H 7<sup>th</sup> 1/9 = 2.4, H8<sup>th</sup> 1/9 = 2.5; V = 2.52, H = 2.575, A  
 =  
 2.5475

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong						x	V2 H2	V2 V2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x	x	x		
Accuracy 0- 3						2.5475		

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-8; vertical; length 19.74 cm, height 24.25 cm; ratio = 0.814; vertical lines: 1/2, 1/4, 1/8, 1/9, FR; horizontal lines: 1/2, 1/4, 1/8, 1/9, FR, dotted blue line; accuracy of line placement: A = 2.5475; harmonic ratio: HR4/6/9, the double fifth, V1/4H1/9; overall composition assessment: HR4/6/9 strong. The composition analysis of #374-8 is at the level of a strong representation of a 4/6/9, double fifth harmonic, HR4/6/9; V1/4H1/9. Additional notes: This is an image of a Pharaoh's mask. The mask is surrounded by an Egyptian headdress. The composition of the elements of the artwork align to a vertical and horizontal division of 1/9, the VFR and HFR. The H 1<sup>st</sup> and 8<sup>th</sup> 1/9's describe the height of



the mask and headdress. The V 1<sup>st</sup> and 8<sup>th</sup> 1/9's describe the width. The VL1/8 and VR18 are very close to the outside 1/9's. The V1/2 is precisely the centerline of the artwork and that is the center of the right eye of the mask. The length of the mask is 8.3 cm and width is 5.8 cm. This is a DEMR rectangle, H upper 1/3 and H lower 1/3, VLFR and VR1/3. The upper DEMR horizontal line of the internal rectangle is precisely the center of the eyes. The H 4<sup>th</sup> 1/9 is the top line at the eyes and slightly above the center. The blue line precisely crosses the V1/2 at the center of the right eye. This is the major focal point of the artwork. Overall, the correct harmonic ratio is the HR4/6/9, V1/4H1/9. There was evidence of some of the V1/9 divisions. This is a 2-dimensional image. The artist used shape, line, and dark and light values to create the artwork. This image is symmetrical.

**#374-9; Morelos, 2009; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

28	black	V1/16; H1/12
14	yellow	V1/9; H1/9
2	red	V 2 <sup>nd</sup> and 3 <sup>rd</sup> ; Hna
4	green	VFR, HFR
2	blue dotted line	V1; H1
Total lines 50		

Measurements: length 15.84 cm; height 24.25 cm; ratio = 0.744

V: 1/16, 1/9, (2 <sup>nd</sup> , 3 <sup>rd</sup> ) 1/5, FR	H: 1/12, 1/9, FR
1/16 = 0.99, 1.98, 2.97, 3.96, 4.95, 5.94	1/12 = 1.77, 3.548, 5.322, 7.096, 8.87
6.93, 7.92, 8.91, 9.9, 10.89, 11.88, 12.87	10.64, 12.42, 14.19, 15.96, 17.74,
13.86, 14.85	19.5
1/9 = 1.76, 3.52, 5.28, 7.04, 8.8,	1/9 = 2.365, 4.73, 7.095, 9.46, 11.825,
10.56, 12.32, 14.08	14.19, 16.55, 18.92
(2 <sup>nd</sup> , 3 <sup>rd</sup> ) 1/5 = 6.336, 9.504	FR = 8.132, 13.157
FR = 6.05, 9.789	Diagonal: H 5 <sup>th</sup> 1/12 <sup>c</sup> H 4 <sup>th</sup> 1/12
Diagonal: V1/2 <sup>c</sup> V 4 <sup>th</sup> 1/9	8.87 <sup>c</sup> 7.096
7.92 <sup>c</sup> 7.04	

Total = 28 lines

Total = 22 lines

Accuracy of lines: HR9/12/16, V1/16H1/12; V 1<sup>st</sup> 1/16 = 1.0, V 2<sup>nd</sup> 1/16 = 2.4, V 3<sup>rd</sup> 1/16 = 2.0, V 4<sup>th</sup> 1/16 = 2.4, V 5<sup>th</sup> 1/16 = 2.5, V 6<sup>th</sup> 1/16 = 2.8, V 7<sup>th</sup> 1/16 = 2.8, V 8<sup>th</sup> 1/16 = 2.8, V 9<sup>th</sup> 1/16 = 2.8, V 10<sup>th</sup> 1/16 = 2.5, V 11<sup>th</sup> 1/16 = 2.4, V 12<sup>th</sup> 1/16 = 2.4, V 13<sup>th</sup> 1/16 = 2.2, V 14<sup>th</sup> 1/16 = 2.2, V 15<sup>th</sup> 1/16 = 1.0; H 1<sup>st</sup> 1/12 = 2.7, H 2<sup>nd</sup> 1/12 = 1.5, H 3<sup>rd</sup> 1/12 = 2.7, H 4<sup>th</sup> 1/12 = 2.5, H 5<sup>th</sup> 1/12 = 2.7, H 6<sup>th</sup> 1/12 = 2.6, H 7<sup>th</sup> 1/12 = 2.2, H 8<sup>th</sup> 1/12 = 2.5, H 9<sup>th</sup> 1/12 = 2.4, H 10<sup>th</sup> 1/12 = 1.5, H 11<sup>th</sup> 1/12 = 1.5; V = 2.28, H = 2.2545; A = 2.267

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong				x			V2 H2	V2 V2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy 0- 3				2.267				

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-9; vertical; length 15.84 cm, height 21.29 cm; ratio = 0.744; vertical lines: 1/16, 1/9, (2<sup>nd</sup>, 3<sup>rd</sup>) 1/5, FR; horizontal lines: 1/12, 1/9, FR; accuracy of line placement: A = 2.267; harmonic ratio: HR9/12/16, the fifth and the fourth, V1/16H1/12; overall composition assessment: HR9/12/16 strong. The composition analysis of #374-8 is at the level of a strong representation of a 9/12/16, the fifth and fourth harmonic, HR9/12/16; V1/16H1/12. Additional notes: This image is the portrait of Morales. The horizontal divisions for the compositions were aligned to the placement of the picture elements at the measurement of vertical 1/16's and horizontal 1/12's. The range of accuracy for the H1/12's is 1.5 to 2.7. The closer to the face at the center of the image the higher the accuracy of the placement of the eyes, nose and mouth. There are two blue dotted lines of compositional significance. The first is across the center of the eyes at a slant, H 5<sup>th</sup> 1/12 <sup>c</sup> H 4<sup>th</sup> 1/12. The vertical blue dotted line is perpendicular to this line, V1/2 <sup>c</sup> V 4<sup>th</sup> 1/9.. The vertical compositional elements can be described following the placements of the elements in spacing aligned to a detailed 1/16's measurement. The range of accuracy is 1.0 to 2.8 and the accuracy increases the closer the lines are to the center of the portrait. The width of the nose is described between the V 7<sup>th</sup> 1/16 and the V 4<sup>th</sup> 1/9. There is a slight shift of the head and face off of a frontal view. The perpendicular blue dotted lines identify this shift. The shapes and spacing of the facial, head and body are correctly aligned in portrait relationship per artist principles. This is a 3-dimensional image. The artist used black and white lines in correct proportionality with implied linear perspective to create this artwork.

#374-10; Cuauhtémoc, 2009; grabado sobre linóleo, engraving on linoleum;  
assessment grid lines: count /color/ description:

17	black	V1/16; H1/4
10	yellow	V1/3; H1/9
4	green	VFR, HFR
Total lines 31		

Measurements: length 16.76 cm; height 16.43 cm; ratio = 0.6819

V: 1/16, 1/3, FR	H: 1/4, 1/9, FR
1/16 = 1.0475, 2.095, 3.1425, 4.19	1/4 = 2.857, 8.57
5.2375, 6.285, 7.33, 8.38, 9.4225	1/9 = 1.27, 2.54, 3.81, 5.08, 6.35,
10.475, 11.52, 12.57, 13.617	8.89, 10.16
14.66, 15.712	FR = 8.132, 13.157
1/3 = 5.586, 11.17	
FR = 6.4, 10.358	
Total = 19 lines	Total = 12 lines

7.62

Accuracy of lines: HR9/12/16, V1/16H1/12; V 1<sup>st</sup> 1/16 = 1.0, V 2<sup>nd</sup> 1/16 = 1.0, V 3<sup>rd</sup> 1/16 = 1.5, V 4<sup>th</sup> 1/16 = 1.5, V 5<sup>th</sup> 1/16 = 2.2, V 6<sup>th</sup> 1/16 = 2.6, V 7<sup>th</sup> 1/16 = 2.6, V 8<sup>th</sup> 1/16 = 2.6, V 9<sup>th</sup> 1/16 = 2.9, V 10<sup>th</sup> 1/16 = 2.9, V 11<sup>th</sup> 1/16 = 2.8, V 12<sup>th</sup> 1/16 = 2.7, V 13<sup>th</sup> 1/16 = 2.8, V 14<sup>th</sup> 1/16 = 2.4, V 15<sup>th</sup> 1/16 = 2.0; H 1<sup>st</sup> 1/9 = 2.2, H 2<sup>nd</sup> 1/9 = 2.7, H 3<sup>rd</sup> 1/9 = 3.0, H 4<sup>th</sup> 1/9 = 3.0, H 5<sup>th</sup> 1/9 = 3.0, H 6<sup>th</sup> 1/9 = 2.7, H 7<sup>th</sup> 1/9 = 2.5, H 8<sup>th</sup> 1/9 = 2.0; V = 2.233, H = 2.6825; A = 2.46

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong				x			V2 H2	V2 V2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy				2.46				

0-3								
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Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-10; horizontal; length 16.76 cm, height 11.43 cm; ratio = 0.6819; vertical lines: 1/16, 1/3, FR; horizontal lines: 1/4, 1/9, FR; accuracy of line placement: A = 2.46; harmonic ratio: HR9/12/16, the fifth and the fourth, V1/16H1/9; overall composition assessment: HR9/12/16 strong. The composition analysis of #374-8 is at the level of a strong representation of a 9/12/16, fifth and fourth harmonic, HR9/12/16; V1/16H1/9. Additional notes: This image is of the Aztec Cuauhtémoc. The portrait is in a profile orientation and this aligns with the horizontal format. The V 1/16 lines follow the placement of the portrait elements of the image. The range of accuracy is 1 to 2.9. The accuracy of the lines increases to the right side of the artwork as the face is described. The V1/3's support the V 5<sup>th</sup> 1/16 the helmet location and V 11<sup>th</sup> 1/16, the eye. The VLFR is very close to the 6<sup>th</sup> 1/16 and follows the alignment to the helmet. The VRFR is nearly the same number as the 10<sup>th</sup> 1/16. The V 11<sup>th</sup>, 12<sup>th</sup>, 13<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> 1/12 lines accurately describe the placement of the forehead, nose, nose tip, mouth, chin, thumb and fingers of the hand. The horizontal 1/9 lines align to the placement of the composition elements (A = 2.6825). Each of the 9 lines describes with accuracy a major element of the portrait image. The H lower FR accurately delineates the position of the thumb. This is a 2-dimensional image. The artist used shape, line and light and dark values to create the artwork. The artist used the Rule of Three to set up the composition. This divides the image into thirds; however, there is no evidence of the use of the grid measurements asymmetrically to build an image with depth.

**#374-11; *Leopardo, Leopard*, 2004; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

14	black	V1/12; H1/2, 1/4
8	yellow	Vna; H1/9
3	green	VFR, H upper FR
Total lines 25		

Measurements: length 16.51 cm; height 10.01 cm; ratio = 0.606

V: 1/12, FR

1/12 = 1.3758, 2.75, 4.127, 5.5

6.879, 8.25, 9.63, 11.0, 12.38

13.75, 15.13

FR = 6.3, 10.20

Total = 13 lines

H: 1/2, 1/4, 1/9, upper FR

1/2 = 5.05

1/4 = 2.525, 7.575

1/9 = 1.122, 2.244, 3.366, 4.488, 5.61,

7.854, 8.976

Upper FR = 3.8579

Total = 12 lines

6.73,

Accuracy of lines: HR3/4; V1/4H1/3, VL1/4 = 2.6, V1/2 = 2.3, VR1/4 = 2.8; H upper

1/3 = 2.6, H lower 1/3 = 2.8; V = 2.566, H = 2.7, A = 2.633

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V2 H2	V2 H1
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.633					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #374-11; horizontal; length 16.51 cm, height 10.01 cm; ratio = 0.606; vertical lines: 1/2, R1/8, 1/3, 1/5, RFR; horizontal lines: 1/2, 1/4, lower 1/8, lower FR; accuracy of line placement: A = 2.633; harmonic ratio: HR3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 strong. The composition analysis of #374-11 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: This image is of a leopard lying down in the grass. The artist composed the work with the vertical divisions of the 1/12's (A = 1.636). The V1/4, V1/2, and VR1/4 accurately describe the rear end, middle and front of the leopard (A = 2.566). The horizontal divisions of the 1/9's describe the elements of the composition but with less accuracy (A = 1.875). The H upper 1/3 aligns to the face of the leopard at the nose and the blades of grass in the background. The H lower 1/3 is the placement of the tail and legs of the body. Overall there is evidence of a HR4/6/9, V1/4H1/9, harmonic ratio (A = 2.22). The HRV1/4H1/3, A = 2.633 describes the key elements of the image and has a significantly higher accuracy. This is a 2-dimensional image. The artist used black and white line with texture to create the artwork. There is a slight indication of linear perspective. The picture frame dimensions are close to DEMR.

**#375, female, 30 years old, 30 years at the JLDF; 6 years at the art school; myopia; socioeconomic status/medium; range of time period of artwork used in the study: 2009-2014**

#375-1; *Tecolote, Owl*, 2011; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

3 black V1/2, R1/4; H upper 1/4  
 4 yellow V1/3; H1/3  
 2 green VRFR, H upper FR  
 Total lines 9

Measurements: length 9.8 cm; height 13.67 cm; ratio = 0.71689  
 V: 1/2, R1/4, 1/3, RFR H: upper 1/4, 1/3, upper FR  
 1/2 = 4.9 upper 1/4 = 3.4175  
 R1/4 = 7.35 1/3 = 4.556, 9.113  
 1/3 = 3.266, 6.533 upper FR = 5.23  
 RFR = 6.056  
 Total = 5 lines Total = 4 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 0.7; H upper  
 1/3 = 2, H lower 1/3 = 0.5; V = 0.7, H = 1.25, A = 0.975

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2 H2	V1 H1
Moderate								
Low		x						
Inconsistent								
Not Found	x			x	x	x		
Accuracy 0- 3		0.975						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #375-1; vertical; length 9.8 cm, height 13.67 cm; ratio = 0.71689; vertical lines: 1/2, R1/4, 1/3, RFR; horizontal lines: upper 1/4, 1/3, upper FR; accuracy of line placement: A = 0.975; harmonic ratio: HR2/3, the fifth, V1/2H1/3; overall composition assessment: HR2/3 low. The composition analysis of #375-1 is at the level of a strong representation of a 2/3, fifth harmonic, HR2/3; V1/2H1/3. Additional notes: This image is of a large owl in flight. The artist placed the owl face and eyes at one of the rectangular corners indicating the Rule

of Three. This is the traditional object placement in a picture frame. Of the eight lines that were used to represent the placement of the artist's composition, four are the Rule of Three lines. There are three horizontal lines and the lines described the placement of the owl's eyes, the VR1/3, VRFR and H upper 1/3. The H lower 1/3 and V1/2 in general describe the position of the owl. The HR2/3 is at a low representation, there is not enough visual information for more accuracy. This is a 2-dimensional image. The artist used primarily black and white line and texture to create the artwork.

#375-2; *Pirámide maya, Mayan Pyramid*, 2009; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

7 black V1/2, 1/4; H1/2, 1/4, upper 1/8  
 2 yellow Vna; H1/3  
 2 green Vna, HFR  
 Total lines 11

Measurements: length 10.46 cm; height 7.871 cm; ratio = 0.7523

V: 1/2, 1/4

1/2 = 5.23

1/4 = 2.615, 7.845

H: 1/2, 1/4, upper 1/8, 1/3, FR

1/2 = 5.05

1/4 = 1.967, 5.90

upper 1/8 = 0.9837

1/3 = 2.623, 5.2467

FR = 3.006, 4.864

Total = 3 lines

Total = 8 lines

Accuracy of lines: HR3/4, V1/4H1/3, VL1/4 = 1.5, V1/2 = 2.0, VR1/4 = 1.0; H upper

1/3 = 1.0, H lower 1/3 = 1.5; V = 1.5, H = 1.25, A = 1.375

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				H2	H2
Low								
Inconsistent								
Not Found	x	x		x	x	x		

Accuracy 0- 3			1.375					
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Harmonic ratio with Rule of Three Analysis per Image

Analysis #375-2; horizontal; length 10.46 cm, height 7.87 cm; ratio = 0.7523; vertical lines: 1/2, 1/4; horizontal lines: 1/2, 1/4, upper 1/8, 1/3, FR; accuracy of line placement: A = 1.375; harmonic ratio: HR3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 moderate. The composition analysis of #375-2 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: This is an image of a Mayan pyramid. The location of the main steps leading to the top of the pyramid in the front are accurately described by the V1/2 line. The V L1/4 describes the trees in the background and moon on the left side of the picture. The VR1/4 describes the branches of the tree on the right side of the picture. The horizontal composition is in general a 1/3 division, the top of the pyramid, the main area of the pyramid and the bottom of the pyramid. The H 1/3 and HFR lines follow this alignment. This is a 2-dimensional image. The artist used black and white lines to create the image. There is a slight indication of linear perspective from the slanted lines of the steps on the right side of the picture. The artist used a symmetrical alignment, which is off of center about 0.5 cm. This is not an asymmetrical alignment.

#375-3; Bolsa de café, Bag of Coffee, 2010; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:

10	black	VR1/4, 1/8; H1/2, 1/4, 1/8, (1 <sup>st</sup> , 15 <sup>th</sup> ) 1/16
2	yellow	V1/3; Hna
8	red	V1/5; H1/5
2	green	VLFR; H lower FR
Total lines 22		

Measurements: length 12.08 cm; height 15.54 cm; ratio = 0.777

V: R1/4, 1/8, 1/3, 1/5, LFR      H: 1/2, 1/4, 1/8, (1<sup>st</sup>, 15<sup>th</sup>) 1/16, 1/5, lower

FR

R1/4 = 9.06	1/2 = 7.77
1/8 = 1.51, 10.57	1/4 = 3.885, 11.655
1/3 = 4.0267, 8.053	1/8 = 1.94, 13.59
1/5 = 2.416, 4.832, 7.248, 9.664	(1 <sup>st</sup> , 15 <sup>th</sup> )1/16 = 0.97, 14.57
LFR = 4.614	1/5 = 3.108, 6.216, 9.324, 12.432
	lower FR = 9.604
Total = 10 lines	Total = 12 lines

Accuracy of lines: HR3/5, V1/3H1/5, VL1/3 = 2, VR1/3 = 2.4; H 1<sup>st</sup> 1/5 = 2.3, 2<sup>nd</sup> 1/5 =



2.7, 3<sup>rd</sup> 1/5 = 2.4, 4<sup>th</sup> 1/5 = 2.7; V = 2.2, H = 2.6, A = 2.4

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2	V1 H1
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.4			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #375-3; vertical; length 10.46 cm, height 15.54 cm; ratio = 0.777; vertical lines: R1/4, 1/8, 1/3, 1/5, LFR; horizontal lines: 1/2, 1/4, 1/8, (1<sup>st</sup>, 15<sup>th</sup>) 1/16, 1/5, lower FR; accuracy of line placement: A = 2.4; harmonic ratio: HR3/5, the sixth, V1/3H1/5; overall composition assessment: HR3/5 strong. The composition analysis of #375-3 is at the level of a strong representation of a 3/5, sixth harmonic, HR3/5; V1/3H1/5. Additional notes: This image is of a container of coffee. The object fills the majority of the space of the picture. There is an underlying vertical 1/5's division. The VL1/8 aligns to the placement of the left handle (looking at the image). The V 1<sup>st</sup> 1/5 describes the placement of the left side of the container (A = 2.8). The VL1/3 moderately describes the location of the front label and the circular product name and logo are accurately described. The LFR and V 2<sup>nd</sup> 1/5 accurately aligns to the label on the left side. The V 3<sup>rd</sup> 1/5 accurately aligns to the placement of the right side of the product logo. The VR1/3 (A = 2.4) accurately aligns to the description of the right side of the label. The VR1/4 accurately aligns to the placement of the top lid on the right side. The V 4<sup>th</sup> 1/5 describes the placement of the right side of the container. The VR1/8 aligns to the placement of the right handle of the container. The horizontal divisions of the composition at the top of the image is the H upper 1/16, which delineates the top of the left handle. The H upper 1/8 delineates the curl of the handle. The H 1<sup>st</sup> 1/5 accurately aligns to the placement of the top of the container. The H upper 1/4 describes the edge of the top of the container. The H 2<sup>nd</sup> 1/5 aligns to the placement of the top of the label on the container. The H1/2

aligns to the smaller handle on the right side. The H 3<sup>rd</sup> 1/5 and H lower FR describe the placement of the sides of the handles of the container. The H lower 1/4 align to the bottom of the label. The H lower 1/8 aligns to the bottom of the container. The H lower 1/16 aligns to the logo on the container. The artist placed the composition in an asymmetrical pattern; the various grid lines describe alternating elements in that pattern. The image is 2-dimensional. The artist used black and white shapes with line to create the artwork.

**#375-4; *Las guitarras, The Guitars*, 2009; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count /color/ description:**

3 black V1/2, L1/4; H upper 1/4  
 7 yellow V (4<sup>th</sup>, 5<sup>th</sup>) 1/6; H 1/6  
 3 green VRFR; HFR  
 2 diagonal Vna, H2  
 Total lines 15

Measurements: length 9.75 cm; height 12.64 cm; ratio = 0.771

V: 1/2, L1/4, (4<sup>th</sup>, 5<sup>th</sup>) 1/6, RFR

1/2 = 4.875

L1/4 = 2.437

(4<sup>th</sup>, 5<sup>th</sup>) 1/6 = 6.5, 8.125

RFR = 6.0258

H: upper 1/4, 1/6, FR

upper 1/4 = 3.16

1/6 = 2.106, 4.213, 6.32, 8.427, 10.53

FR = 4.828, 7.819

H upper FR <sup>c</sup> H 1<sup>st</sup> 1/6 = 4.828 <sup>c</sup>

2.1067

H upper 1/4 <sup>c</sup> H 5<sup>th</sup> 1/6 = 3.16 <sup>c</sup>

10.533

Total = 5 lines

Total = 10 lines

Accuracy of lines: HR2/3, V1/2H1/3, V1/2 = 2.4; H 3<sup>rd</sup> 1/6 = 1.2, H 4<sup>th</sup> 1/6; V = 2.4, H = 1.066, A = 1.733

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V1 H2	V1 H2
Moderate		x						

Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.733						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #375-4; vertical; length 9.75 cm, height 12.64 cm; ratio = 0.771; vertical lines: 1/2, L1/4, (4<sup>th</sup>, 5<sup>th</sup>)1/6, RFR; horizontal lines: upper 1/4, 1/6, FR; accuracy of line placement: A = 1.733; harmonic ratio: HR2/3, the fifth, V1/2H1/3; overall composition assessment: HR2/3 moderate. The composition analysis of #375-4 is at the level of a moderate representation of a 2/3, fifth harmonic, HR2/3; V1/2H1/3.

Additional notes: This image is of four guitars standing in a road. The guitars are in an upright position and grouped three together on the right side of the artwork (looking at the work), one guitar is on the left side. A diagonal line depicting a road is behind the guitars. The V1/2 accurately aligns to the center guitar placement. The V1/4 in general aligns to the guitar on the left side of the picture. The composition of the three guitars on the right side align to the LFR, VL1/3, VL1/6 lines in a general manner. Horizontally, the picture can be divided into 1/6's. The H 1<sup>st</sup> 1/6 aligns to the change of texture in the background to the base of the guitar. The H 5<sup>th</sup> 1/6 aligns to the line in the foreground. This is a 2-dimentional image. The artist used shape and line with texture to create the image.

**#375-5; *China poblana, Country Girl*, 2014; óleo sobre tela, oil on canvas;**  
assessment grid lines: count /color/ description:

8	black	V1/2, 1/4; H1/2, 1/4, 1/8
2	yellow	V1/3; Hna
4	red	V1/5; Hna
Total lines 14		

Measurements: length 13.26 cm; height 15.95 cm; ratio = 0.831

V: 1/2, 1/4, 1/3, 1/5, FR	H: 1/2, 1/4, 1/8, 1/5
1/2 = 6.63	1/2 = 7.975
1/4 = 3.315, 9.945	1/4 = 3.987, 11.96
1/3 = 4.42, 8.84	1/8 = 1.99, 13.956
1/5 = 2.65, 5.3, 7.956, 10.6	
Total = 9 lines	Total = 5 lines

Accuracy of lines: HR3/4, V1/3H1/4, VL1/3 = 1.5, VR1/3 = 1.2; H upper 1/4 = 2.6

H 1/2 = 2.8, H lower 1/4 = 1; V = 1.35, H = 2.133, A = 1.74

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2	
Moderate			x					
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.74					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #375-5; vertical; length 13.26 cm, height 15.98 cm; ratio = 0.831; vertical lines: 1/2, 1/4, 1/3, 1/5, FR; horizontal lines: 1/2, 1/4, 1/8, 1/5; accuracy of line placement: A = 1.74; harmonic ratio: HR3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 moderate. The composition analysis of #375-5 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/3H1/4. Additional notes: This image is of a country girl in traditional dress. She is standing in a field with mountain behind her. The V1/3 lines describe the placement of the girl in the center of the picture. The V 1/5 lines in general align to the background placement of the objects in the picture. The V 2<sup>nd</sup>, 3<sup>rd</sup> 1/5 lines align in general to the shoulders, face, and arms of the figure. The horizontal 1/2 accurately describes the alignment to the distinction of the background from the field of flowers in the middle and fore ground. The H upper 1/4 aligns to the placement of the eyes of the figure and the structures in the background. The H upper 1/8 aligns to the background objects. The H lower 1/4 in general aligns to the pattern and images on the dress. The H lower 1/8 accurately aligns to the dress pattern at the bottom of the dress. This is a 3-dimensional image. The artist used shape, line, texture, light and dark values and fore, middle and background techniques to create the artwork.

#375-6; *Las jirafas, The Giraffes*, 2013; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

14 black VL1/4; H1/16 (not 11<sup>th</sup>, 13<sup>th</sup>, 15<sup>th</sup>)  
 9 yellow V1/9; H upper 1/3  
 4 green VFR; HFR  
 Total lines 27

Measurements: length 13.4 cm; height 15.38 cm; ratio = 0.87

V: 1/4, V1/9 (not 2<sup>nd</sup>, 5<sup>th</sup>), FR H: 1/16 (not 11<sup>th</sup>, 13<sup>th</sup>, 15<sup>th</sup>), upper 1/3,

FR

1/4 = 3.35, 10.05 1/16 (not 11<sup>th</sup>, 13<sup>th</sup>, 15<sup>th</sup>) = 0.96125,  
 1.9225, V1/9 = 1.489, 2.9778, 4.465, 5.95, 2.883, 3.845, 4.806, 5.767, 6.728, 7.69,  
 8.65, 7.439, 8.93, 10.41, 11.9 9.61, 11.535, 13.4575  
 FR = 5.118, 8.28 upper 1/3 = 5.126  
 FR = 5.874, 9.505  
 Total = 12 lines Total = 15 lines

Accuracy of lines: HR9/12/16, V1/9H1/16; V 1<sup>st</sup> 1/9 = 2.4, V 2<sup>nd</sup> 1/9 = 0.5, V  
 3<sup>rd</sup> 1/9 =  
 1.5, V 4<sup>th</sup> 1/9 = 2.7, V 5<sup>th</sup> 1/9 = 0.5, V 6<sup>th</sup> 1/9 = 2.6, V 7<sup>th</sup> 1/9 = 2.7, V 8<sup>th</sup> 1/9 =  
 2.5; H 1<sup>st</sup>  
 1/16 = 2.5, H 2<sup>nd</sup> 1/16 = 2.6, H 3<sup>rd</sup> 1/16 = 2.5, H 4<sup>th</sup> 1/16 = 2.2, H 5<sup>th</sup> 1/16 = 2.0,  
 H 6<sup>th</sup>  
 1/16 = 2.4, H 7<sup>th</sup> 1/16 = 2.0, H 8<sup>th</sup> 1/16 = 2.4, H 9<sup>th</sup> 1/16 = 1.0, H 10<sup>th</sup> 1/16 = 2.0,  
 V 12<sup>th</sup>  
 1/16 = 1.0, V 14<sup>th</sup> 1/16 = 1.0; V = 2.0375, H = 2.175; A = 2.106

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong				x			V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		

Accuracy				2.106				
0- 3								

Harmonic ratio with Rule of Three Analysis per Image

Analysis #375-6; vertical; length 13.4 cm, height 15.38 cm; ratio = 0.87; vertical lines: 1/4, V1/9 (not 2<sup>nd</sup>, 5<sup>th</sup>), FR; horizontal lines: 1/16 (not 11<sup>th</sup>, 13<sup>th</sup>, 15<sup>th</sup>), upper 1/3, FR; accuracy of line placement: A = 2.106; harmonic ratio: HR9/12/16, the fifth and the fourth, V1/9H1/16; overall composition assessment: HR9/12/16 strong. The composition analysis of #375-6 is at the level of a strong representation of a 9/12/16, the fifth and fourth harmonic, HR9/12/16, V1/9H1/16. Additional notes: This image is of four giraffes in the savanna. The placement of the four giraffes in the picture frame reveals a detailed composition horizontally and vertically. The horizontal divisions align to the various picture elements that are delineated by the 1/16<sup>th</sup> measurements. The bottom of the picture is in dark shadows and there are numerous vertical plant structures that do not have a horizontal alignment so the 1/16 (not 11<sup>th</sup>, 13<sup>th</sup>, 15<sup>th</sup>) lines are not used. The H upper 1/3 aligns to the placement of the location of the eye and nose of the giraffe in the fore ground. The lower FR aligns to the foliage placement in the foreground. The three giraffes on the right side are bracketed by the 3<sup>rd</sup> and 4<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> 1/9 lines. The V 1<sup>st</sup> 1/9 line aligns to the center of the giraffe on the left side. This is a 3-dimensional image. The artist used shape, form, line and light and dark shading with fore, middle and background techniques to create the artwork.

**#376, male, 39 years old; 26 years at JLDF; 26 years at the art school; astigmatism –wears glasses; socioeconomic status/very low; range of time of artwork used in the study: 1995-2008**

**#376-1; *Manos y cara, Hands and Face*, 2006; técnica mixta sobre madera, mixed media on wood; assessment grid lines: count /color/ description:**

5	black	V1/2, 1/4; H1/2, upper 1/4
4	yellow	V1/3; H1/3
8	red	V1/5; H1/5
3	green	VFR, lower FR

Total lines 20

Measurements: length 13.67 cm; height 19.56 cm; ratio = 0.698

V: 1/2, 1/4, 1/3, 1/5, FR

1/2 = 6.835

1/4 = 3.42, 10.25

1/3 = 4.5567, 9.11

1/5 = 2.734, 5.468, 8.2, 10.936

FR = 5.22, 8.448

Total = 11 lines

H: 1/2, upper 1/4, 1/3, 1/5, lower FR

1/2 = 9.78

upper 1/4 = 4.89

1/3 = 6.52, 13.04

1/5 = 3.9, 7.8, 11.7, 15.648

lower FR = 12.088

Total = 9 lines

Accuracy of lines: HR3/5, V1/5H1/3, V 1<sup>st</sup> 1/5 = 0.5, V 2<sup>nd</sup> 1/5 = 2.2, V 3<sup>rd</sup> 1/5 = 2.7,  
V 4<sup>th</sup> 1/5 = 1.5; H upper 1/3 = 1.8, H lower 1/3 = 2.0; V = 1.725, H = 1.9, A = 1.8125

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V2 H2	V2 H1
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.8125			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-1; vertical; length 13.67 cm, height 19.56 cm; ratio = 0.698; vertical lines: 1/2, 1/4, 1/3, 1/5, FR; horizontal lines: 1/2, upper 1/4, 1/3, 1/5, lower FR; accuracy of line placement: A = 1.8125; harmonic ratio: HR3/5, the fifth, V1/5H1/3; overall composition assessment: HR3/5 moderate. The composition analysis of #376-1 is at the level of a moderate representation of a 3/5, fifth harmonic, HR3/5; V1/5H1/3. Additional notes: This image is of a figure standing in front of a wall. The center of the figure is placed asymmetrically at the V 3<sup>rd</sup> 1/5 and VRFR (A = 2.7). The VR1/3 accurately aligns to the left side of the figure's face, neck and inside of the left leg. The VL1/4, VL1/3, and 2<sup>nd</sup> 1/5 each identifies an aspect of the placement of right arm, leg and hand. The V1/2 aligns to the placement of the right side of the body and right leg. The V 1<sup>st</sup>, and 5<sup>th</sup> 1/5 in general align to the placement of the hands. The horizontal 1<sup>st</sup> 1/5 (A = 2.8) accurately describes the location of the eyes. The H upper 1/4 aligns to the mouth and ears. The H upper 1/3 aligns to the bow tie and shoulders. The H 1/2 aligns in general to the half division of the figure. This is a 2-dimensional image. The artist used shape, line and light and dark values to create the artwork.

**#376-2;** *Yo, Omar, I, Omar*, 2005; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

1 black V1/2; Hna  
 2 yellow Vna; H1/3  
 Total lines 3

Measurements: length 16.11 cm; height 19.64 cm; ratio = 0.82

V: 1/2 H: 1/3  
 1/2 = 8.055 1/3 = 6.5467, 13.09  
 Total = 1 line Total = 2 lines

Accuracy of lines: HR2/3, V1/2H1/3, V1/2 = 1.2; H upper 1/3 = 1.0, H lower 1/3 = 1.0; V = 1.2, H = 1.0, A = 1.1

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low								
Inconsistent		x					H2	
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.1						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-2; vertical; length 16.11 cm, height 19.64 cm; ratio = 0.82; vertical lines: 1/2; horizontal lines: 1/3; accuracy of line placement: A = 1.1; harmonic ratio: HR2/3, the fifth, V1/2H1/3; overall composition assessment: HR2/3 inconsistent. The composition analysis of #376-2 is at the level of an inconsistent representation of a 2/3, fifth harmonic, HR2/3; V1/2H1/3. Additional notes: This is an image of a collage of photos and drawn pictures. In a general sense, the composition is divided in half vertically as there is a repetition of a second face in the upper half. The other printed images are of hands and they are placed in general in a thirds horizontal division. There is not enough visual information to provide evidence of a consistent harmonic ratio.

**#376-3; Fuego, Fire, 1999; acrílico sobre tela, acrylic on canvas; assessment grid lines: count /color/ description:**

8 black V1/2, 1/8; H1/2, lower 1/4, 1/8



3 yellow V (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>) 1/6; Hna  
 7 red V1/5; H (2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>) 1/5  
 4 green VFR; HFR  
 1 diagonal blue dotted line Vna; H1  
 Total lines 23

Measurements: length 9.3 cm; height 11.84 cm; ratio = 0.785  
 V: 1/4, 1/8, (2<sup>nd</sup>, 4<sup>th</sup>, 5<sup>th</sup>) 1/6, 1/5, FR H: 1/2, lower 1/4, 1/8, (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>) 1/5, FR  
 1/4 = 2.325, 6.975 1/2 = 5.92  
 1/8 = 1.163, 8.14 lower 1/4 = 8.88  
 (2<sup>nd</sup>, 4<sup>th</sup>, 5<sup>th</sup>) 1/6 = 3.1, 6.2, 7.75, 1/8 = 1.48, 10.36  
 1/5 = 1.86, 3.72, 5.58, 7.44 (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>) 1/5 = 2.368, 4.736, 7.1  
 FR = 3.55, 5.747 FR = 4.52, 7.3  
 diagonal blue dotted line = 4.939  
 Total = 13 lines Total = 10 lines

Accuracy of lines: HR3/4, V1/3H1/4, VL1/3 = 1.0, VR1/3 = 1.0; H upper 1/8 = 1.0, H upper 1/4 = 1.5, H 1/2 = 1.5, H lower 1/4 = 1.5, H lower 1/8 = 2.2; V = 1.0, H = 1.54, A = 1.27

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2	V2 H2
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.27					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376- 3; vertical; length 9.3 cm, height 11.84 cm; ratio = 0.785; vertical lines: 1/4, 1/8, (2<sup>nd</sup>, 4<sup>th</sup>, 5<sup>th</sup>) 1/6, 1/5, FR; horizontal lines: 1/2, lower 1/4, 1/8, (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>) 1/5, FR; accuracy of line placement: A = 1.27; harmonic ratio: HR3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 moderate. The

composition analysis of #376-3 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/3H1/4. Additional notes: This is an image of a rectangle that has lost and found edges with areas of light and dark values. In general, the image vertical boundaries are aligned to the V1st and V 5<sup>th</sup> 1/6 lines. The horizontal boundaries are the H 1<sup>st</sup> 1/5 and lower 1/8. There is a blue line that delineates the placement of a horizontal line at H = 4.939, which is the point of DEMR in the rectangle H 1<sup>st</sup> 1/5 to H lower 1/8 ( $H \ 2.368 - 10.36 = 7.992 * .61803 = 4.939$ ). This is a 2-dimensional image. The artist used light and dark values with texture to create the artwork.

#376-4; *Dolor, Pain*, 1998; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

3 black V1/2; Hna  
 2 yellow Vna; H1/3  
 Total lines 5

Measurements: length 16.81 cm; height 12.27 cm; ratio = 0.7299

V: 1/2, 1/4  
 1/2 = 8.405  
 1/4 = 4.2, 12.6  
 Total = 3 lines

H: 1/3  
 1/3 = 4.09, 8.18  
 Total = 2 lines

Accuracy of lines: HR3/4, V1/4H1/3, VL1/4 = 0.5, V1/2 = 1.0, VR1/4 = .5; H upper  
 1/3 = 1.0, H lower 1/3 = 1.0; V = 0.66, H = 1.0, A = 0.83

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low								
Inconsistent			x				H2	
Not Found	x	x		x	x	x		
Accuracy 0- 3		0.83						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-4; horizontal; length 16.81 cm, height 12.27 cm; ratio = 0.7299; vertical lines: 1/2, 1/4; horizontal lines: 1/3; accuracy of line placement: A = 0.83; harmonic ratio: HR3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 inconsistent. The composition analysis of #376-4 is at the level of an inconsistent representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: This is an image of shapes of light and dark. In general, the picture has a vertical 1/2 division. The H 1/4's do not show a clear alignment to the objects. The horizontal 1/3 divisions align in general to the spacing of the objects in the picture. However, there is not enough visual evidence to demonstrate a consistent use of the relationship. This is a 2-dimensional image. The artist used light and dark shapes to create the artwork.

**#376-5; *Cubos en agua, Cubes in Water*, 1998; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

2 black Vna; H1/4  
 6 yellow V1/3; H (1<sup>st</sup> 3<sup>rd</sup> 6<sup>th</sup> 8<sup>th</sup>) 1/9  
 4 red V1/5; Hna  
 4 green VFR; HFR  
 Total lines 16

Measurements: length 16.47 cm; height 20.28 cm; ratio = 0.812  
 V: 1/3, 1/5, FR H: 1/4, (1<sup>st</sup> 3<sup>rd</sup> 6<sup>th</sup> 8<sup>th</sup>) 1/9, lower FR  
 1/3 = 5.49, 10.98 1/4 = 5.07, 15.21  
 1/5 = 3.294, 6.588, 9.882, 13.176 (1<sup>st</sup> 3<sup>rd</sup> 6<sup>th</sup> 8<sup>th</sup>) 1/9 = 2.25, 6.76, 13.52, 18  
 FR = 6.29, 10.18 FR = 7.74, 12.53  
 Total = 8 lines Total = 8 lines

Accuracy of lines: HR3/5, V1/5H1/3, V 1<sup>st</sup> 1/5 = 2.0, V 2<sup>nd</sup> 1/5 = 1.0, V 3<sup>rd</sup> 1/5 = 1.2,  
 V 4<sup>th</sup> 1/5 = 2.5; H 1<sup>st</sup> 1/9 = 3.0, H 3<sup>rd</sup> 1/9 = 1.0, H 6<sup>th</sup> 1/9 = 1.0, H 8<sup>th</sup> 1/9 = 3.0;  
 V =  
 1.675, H = 2.0, A = 1.8375

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
<b>Strong</b>								

Moderate					x		V2 H2	V2 H2
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.8375			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-5; vertical; length 16.47 cm, height 20.28 cm; ratio = 0.812; vertical lines: 1/3, 1/5, FR; horizontal lines: 1/4, (1<sup>st</sup> 3<sup>rd</sup> 6<sup>th</sup> 8<sup>th</sup>) 1/9, lower FR; accuracy of line placement: A = 1.8375; harmonic ratio: HR3/5, the sixth, V1/5H1/3; overall composition assessment: HR3/5 moderate. The composition analysis of #376-5 is at the level of a moderate representation of a 3/5, sixth harmonic, HR3/5; V1/5H1/3. Additional notes: This is an abstract painting of a rectangular shape in a vertical orientation. There are multiple light and dark values within the rectangle. The vertical borders of the rectangle are aligned to the V 1<sup>st</sup> and 4<sup>th</sup> 1/5 lines. The horizontal 1<sup>st</sup> and 8<sup>th</sup> 1/9's accurately describe the placement of the length of the rectangle. Within the geometric shape there are areas that in general are described by the V1/3 and the VFR with the 2<sup>nd</sup> and 3<sup>rd</sup> 1/5. The horizontal lines of the H 1/3 and HFR in general align to the internal shapes. This is a 2-dimensional image. The artist used light and dark shading to create the artwork.

**#376-6; *Máscara, Mascara*, 2007; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

10	black	V1/2, 1/4, 1/8; H1/2, 1/4, 1/8
4	yellow	V1/3; H1/3
4	red	Vna; H1/5
4	green	VFR; HFR
Total lines 22		

Measurements: length 10.36 cm; height 11.48 cm; ratio = 0.902

V: 1/2, 1/4, 1/8 1/3, FR

1/2 = 5.18

1/4 = 2.59, 7.77

1/8 = 1.295, 9.065

1/3 = 3.45, 6.90

FR = 6.29, 10.18

Total = 9 lines

H: 1/2, 1/4, 1/3, 1/5, FR

1/2 = 5.74

1/4 = 2.87, 8.61

1/8 = 1.435, 10.05

1/3 = 3.827, 7.65

1/5 = 2.296, 4.592, 6.888, 9.684

FR = 7.74, 12.53

Total = 13 lines

Accuracy of lines: HR3/4; V1/4H1/3; VL1/4 = 2.4, V1/2 = 2.8, VR1/4 = 2.4;  
H upper 1/3 = 1.8, H lower 1/3 = 1.0; V = 1.4, H = 2.53; A = 1.965

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2 H2	V2 H2
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.965					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-6; vertical; length 10.36 cm, height 11.48 cm; ratio = 0.902; vertical lines: 1/2, 1/4, 1/8 1/3, FR; horizontal lines: 1/2, 1/4, 1/3, 1/5, FR; accuracy of line placement: A = 1.965; harmonic ratio: HR3/4, the fourth, V1/4H1/3; overall composition assessment: HR3/4 moderate. The composition analysis of #376-6 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: This image is of a face made of small shapes and thick outlines in black. The VL1/4 and V R1/4 align accurately to the lines of the face. The VLFR and VRFR align to the width of the eyes. The H upper 1/3 aligns to the placement of the center of the eyes. The H lower 1/3 aligns to the bottom of the right ear. The H 1/5 lines describe the placement of the eyebrows, top of the right ear and nose, mouth. This is a 2-dimensional image and the lines of the composition are symmetric. The artist used shapes and thick black outlines with light and dark values to create the artwork.

**#376-7;** Mujer, Woman, 1995; técnica mixta sobre papel, mixed media on paper; assessment grid lines: count /color/ description:

5 black V1/2; H1/2, 1/4 , 1/8  
6 yellow V1/6; H lower 1/3  
2 green VFR, Hna  
Total lines 13

Measurements: length 8.64 cm; height 12.7 cm; ratio = 0.680  
 V: 1/6, FR H: 1/2, 1/4, 1/8, lower 1/3  
 1/6 = 1.44, 2.88, 4.32, 5.76, 7.2 1/2 = 6.35  
 FR = 3.3, 5.339 1/4 = 3.175, 9.525  
 1/8 = 1.5875, 11.11  
 lower 1/3 = 8.467  
 Total = 7 lines Total = 6 lines

Accuracy of lines: HR3/4, V1/3H1/4, V 2<sup>nd</sup> 1/6 = 2.4, V 4<sup>th</sup> 1/6 = 2.4;  
 H upper 1/8 = 2.4, H upper 1/4 = 2.6, H1/2 = 1.0, H lower 1/4 = 0.5, H  
 lower 1/8 = 0.5; V = 2.4, H = 1.166; A = 1.78

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2	V2
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.78					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-7; vertical; length 8.64 cm, height 12.7 cm; ratio = 0.68; vertical lines: 1/6, FR; horizontal lines: 1/2, 1/4, 1/8, lower 1/3; accuracy of line placement: A = 1.78; harmonic ratio: HR3/4, the fourth, V1/3H1/4; overall composition assessment: HR3/4 moderate. The composition analysis of #376-7 is at the level of a moderate representation of a 3/4, fourth harmonic, HR3/4; V1/3H1/4. Additional notes: This is an abstract image of a face. There are four circles, two represent the eyes, one is the nose and one is the mouth. The vertical lines of the 1/6's accurately describe the placement of the center of the eyes. The H upper 1/4 accurately describes the location of the bottom of the circle of the eyes. The H 1/2 in general describes the top of the circle for the nose. The H lower 1/3 describes the location of the bottom of the circle of the nose. The H lower 1/4 and 1/8 in general represent the location of the circle of the mouth. This is a 2-dimensional image. The artist used shape, line with light and dark values to create the artwork.

#376-8; Ventanas, Windows, 1995; técnica mixta sobre papel, mixed media on paper; assessment grid lines: count /color/ description:

1 black Vna; H1/2  
 4 yellow V1/3; H1/3  
 Total lines 5

Measurements: length 23.67 cm; height 16.74 cm; ratio = 0.707

V: 1/3 H: 1/2, 1/3  
 1/3 = 7.89, 15.78 1/2 = 8.37  
 1/3 = 5.58, 11.16  
 Total = 2 lines Total = 3 lines

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 1.0, VR1/3 = 0.7; H1/2 = 0.8  
 V = 0.85, H = 0.8; A = 0.825

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2 H2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.825						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-8; horizontal; length 23.67 cm, height 16.74 cm; ratio = 0.707; vertical lines: 1/3; horizontal lines: 1/2, 1/3; accuracy of line placement: A = 0.825; harmonic ratio: HR2/3, the fifth; overall composition assessment: HR2/3 low. The composition analysis of #376-8 is at the level of a low representation of a 2/3, fifth harmonic, HR2/3; V1/3H1/2. Additional notes: This image is an abstract artwork with multiple squares and circle images. In general, a division can be identified of a horizontal 1/2 by the placement of a large rectangle. The vertical VL 1/3 line aligns in general to a large circle space and the VR1/3 placement aligns to the black and white background of the right side of the

artwork. This is a 2-dimensional image. The artist used black outline, shape with light and dark values to create the artwork.

#376-9; *Mi ciudad, My City*, 1995; técnica mixta sobre papel, mixed media on paper; assessment grid lines: count /color/ description:

3 black Vna; H1/2, 1/4  
 5 yellow V1/6; Hna  
 Total lines 8

Measurements: length 20.97 cm; height 24.63 cm; ratio = 0.85  
 V: 1/6 H: 1/2, 1/4  
 1/6 = 3.495, 6.99, 10.485, 13.98, 17.475 1/2 = 8.37  
 1/4 = 6.1575, 18.47  
 Total = 5 lines Total = 3 lines

Accuracy of lines: HR2/3, V1/3H1/2; V 2<sup>nd</sup> 1/6 = 1.5, V 4<sup>th</sup> 1/6 = 0.7;  
 H1/2 = 1.8; V = 1.1, H = 1.8; A = 1.45

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2	
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.45						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-9; vertical; length 20.97 cm, height 24.63 cm; ratio = 0.85; vertical lines: 1/6; horizontal lines: 1/2, 1/4; accuracy of line placement: A = 1.45; harmonic ratio: HR2/3, the fifth; overall composition assessment: HR2/3 moderate. The composition analysis of #376-9 is at the level of a moderate representation of a 2/3, fifth harmonic, HR2/3; V1/3H1/2. Additional notes: This is an image of two figures and multiple shapes with light and dark areas. The vertical 1/6's align to the placement of the figures on the left side of the picture



and the vertical lines in the center of the picture. The horizontal upper 1/4 describes the placement of the face of the small figure on the right and aligns to the objects on the left of the picture. The H lower 1/4 describes the placement of the eyes on the face of the lower figure. The H1/2 is the delineation of the foreground to the background. This is a 2-dimensional image. The artist used shapes and lines with light and dark values to create the artwork.

**#376-10**; La contaminación, Pollution, 1995; acuarela y pastel sobre papel, watercolor and pastel on paper; assessment grid lines: count /color/ description:

- 1 black Vna; H1/2
- 2 yellow V1/3; Hna
- Total lines 3

Measurements: length 24.48 cm; height 20.77 cm; ratio = 0.848  
 V: 1/3 H: 1/2  
 1/3 = 8.16, 16.32 1/2 = 10.385  
 Total = 2 lines Total = 1 line

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 0.7, VR1/3 = 0.5;  
 H1/2 = 1.5; V = 0.6, H = 1.3; A = 0.95

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.95						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-10; horizontal; length 24.48 cm, height 20.77 cm; ratio = 0.848; vertical lines: 1/3; horizontal lines: 1/2; accuracy of line placement: A = 0.95; harmonic ratio: HR2/3, the fifth; overall composition assessment: HR2/3 low. The

composition analysis of #376-10 is at the level of a low representation of a 2/3, fifth harmonic, HR2/3; V1/3H1/2. Additional notes: This is an abstract image of multiple shapes. The vertical 1/3' in general align to the division of the objects in the picture. The H 1/2 line aligns to the bottom of the white circle at the location of the Rule of Three and the smaller square on the right side of the picture. This is a 2-dimensional image. The artist used shapes and lines with light and dark values to create the artwork.

**#376-11; *La cárcel, Jail*, 1995; óleo sobre cartón, oil on cardboard; assessment grid lines: count /color/ description:**

4 black V1/2; H1/2, 1/4  
 4 yellow V1/3; H1/3  
 Total lines 8

Measurements: horizontal; length 24.08 cm; height 19.46 cm; ratio = 0.808

V: 1/2, 1/3

H: 1/2, 1/4, 1/3

1/2 = 12.04

1/2 = 9.73

1/3 = 8.02, 16.05

1/4 = 4.865, 14.595

1/3 = 6.48, 12.97

Total = 3 lines

Total = 5 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 0.5; H upper 1/3 = 0.8, H lower 1/3 = 0.8; V = 0.5, H = 0.8; A = 0.65

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2 H2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.65						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-11; horizontal; length 24.08 cm, height 19.46 cm; ratio = 0.808; vertical lines: 1/2, 1/3; horizontal lines: 1/2, 1/4, 1/3; accuracy of line placement: A = 0.65; harmonic ratio: HR2/3, the fifth; overall composition assessment: HR2/3 low. The composition analysis of #376-11 is at the level of a low representation of a 2/3, fifth harmonic, HR2/3; V1/2H1/3. Additional notes: This image is of squares with perpendicular lines drawn inside the squares. In general, the artist divided the picture in to horizontal thirds and a vertical 1/2 line. The image appears to flow in and out of focus. This is a 2-dimensional image. The artist used black background with white lines to create the artwork.

**#376-12; *El muerto, Dead*, 2005; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

4 black V1/2, 1/4; H1/2  
 4 yellow V1/3; H1/3  
 Total lines 8

Measurements: length 19.3 cm; height 23.79 cm; ratio = 0.811  
 V: 1/2, 1/4, 1/3 H: 1/2, 1/3  
 1/2 = 9.65 1/2 = 11.895  
 1/4 = 4.825, 14.475 1/3 = 7.93, 15.86  
 1/3 = 6.43, 12.86  
 Total = 5 lines Total = 3 lines

Accuracy of lines: HR3/4, V1/4H1/3, V L1/4 = 0.5, V1/2 = 1.0, VR1/4 = 1.0;  
 H upper 1/3 = 0.7, H lower 1/3 = 0.5; V = 0.833, H = 0.6; A = 0.7165

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low			x				V2 H2	
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			0.7165					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #376-12; vertical; length 19.3 cm, height 23.79 cm; ratio = 0.811; vertical lines: 1/2, 1/4, 1/3; horizontal lines: 1/2, 1/3; accuracy of line placement: A = 0.7165; harmonic ratio: HR3/4, the fourth; overall composition assessment: HR3/4 low. The composition analysis of #376-12 is at the level of a low representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: This image is of a large geometric shape that represents a coffin. There are multiple images of drawings and photograph inside and outside of the image. In general, the center of the vertical shape is the vertical 1/2 line. The VL1/4 in general describes the right side of the coffin and the VR1/4 describes the left side of the shape. The horizontal lower 1/3 in general follows the line of the composition. The H lower 1/3 in general is the division of the lower 1/3 of the image. This is a 2-dimensional image. The artist used line with black and white shading and photographs to create the artwork.

**#377, male, 26 years old; 5 years at JLDF; 4 years at the art school; unknown visual information; socioeconomic status: medium; range of time of artwork used in the study: NA**

**#377-1; *La puerta, The Door*, 2014; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:**

6 black V1/2, 1/4; H1/2, 1/4  
Total lines 6

Measurements: vertical; length 12.09 cm; height 14.48 cm; ratio = 0.8349  
V: 1/2, 1/4 H: 1/2, 1/4  
1/2 = 6.045 1/2 = 7.24  
1/3 = 3.02, 9.0675 1/4 = 3.62, 10.86  
Total = 3 lines Total = 3 lines

Accuracy of lines: HR1/2, VnaH1/2; Vna; H1/2 = 0.8; Vna, H = 0.8; A = 0.8

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low	x							
Inconsistent								
Not Found		x	x	x	x	x		

Accuracy 0- 3	0.8							
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Harmonic ratio with Rule of Three Analysis per Image

Analysis #377-1; vertical; length 12.09 cm, height 14.48 cm; ratio = 0.8349; vertical lines: 1/2, 1/4; horizontal lines: 1/2, 1/4; accuracy of line placement: A = 0.8; harmonic ratio: HR1/2, the octave; overall composition assessment: HR1/2 low. The composition analysis of #377-1 is at the level of a low representation of a 1/2, octave harmonic, HR1/2; VnaH1/2. Additional notes: This image is of multiple objects made with black lines. The artist made two circular objects that align vertically (one on top of the other) in the center area of the image. There is a large rectangular shape in the top half of the picture and a semi-circular shape in the bottom half. In general, the H1/2 aligns to a horizontal 1/2 division of the shapes between the top half and bottom half. This is a 2-dimensional image. The artist used black line and white background to create the artwork.

**#378, male, 46 years old; 30 years at the JLDF; 26 years at the art school; myopia and astigmatism; socioeconomic status/medium to high; range of time of artwork used in the study: 1997-2004**

**#378-1; *La selva, The Jungle*, 1995; acuarela sobre papel, watercolor on paper; assessment grid lines: count /color/ description:**

1 black V1/2; Hna  
Total lines 1

Measurements: length 17.09 cm; height 9.49 cm; ratio = 0.555

V: 1/2 H: na

1/2 = 8.545

Total = 1 lines Total = 0 lines

Accuracy of lines: HR1/2, V1/2Hna; V1/2 = 1.0, Hna; V = 1.0, Hna; A = 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low								
Inconsistent	x							
Not Found		x	x	x	x	x		

Accuracy 0- 3	1.0						
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Harmonic ratio with Rule of Three Analysis per Image

Analysis #378-1; horizontal; length 17.09 cm, height 9.49 cm; ratio = 0.555; vertical lines: 1/2; horizontal lines: na; accuracy of line placement: A = 1.0; harmonic ratio: HR1/2, the octave; overall composition assessment: HR1/2 inconsistent. The composition analysis of #378-1 is at the level of an inconsistent representation of a 1/2, octave harmonic, HR1/2; V1/2Hna. Additional notes: This image is of an animal in the jungle. The artist put a mountain in the background on the left side. A moon and palm trees in the background are on the right side. In the foreground, this vertical 1/2 division is reinforced with a group of leaves on the right side and similarly a group of leaves on the left side aligned to the palm trees. The animal is placed across the length of the picture frame. The V1/2 aligns between the two front legs. The animal is placed off center but not aligned to a harmonic ratio or Rule of Three. Therefore, the underlying HRV1/2 is inconsistent to the placement of the animal. This is a 2-dimensional image. The artist used black and white shapes to create the artwork.

**#378-2; *Las jirafas, Giraffes*, 1995; técnica mixta sobre papel, mixed media on paper;**

assessment grid lines: count /color/ description:

3 black Vna; H1/2, 1/4

2 yellow Vna; H1/3

4 red V1/5; Hna

Total lines 9

Measurements: vertical; length 13.12 cm; height 15.03 cm; ratio = 0.8729

V: 1/5

H: 1/2, 1/4, 1/3

1/5 = 2.624, 5.248, 7.872, 10.496

1/2 = 7.515

1/4 = 3.757, 11.27

1/3 = 5.01, 10.02

Total = 4 lines

Total = 5 lines

Accuracy of lines: HR3/5, V1/5H1/3, V 1<sup>st</sup> 1/5 = 1.0, V 2<sup>nd</sup> 1/5 = 2.5, V 3<sup>rd</sup> 1/5 = 1.0,

V 4<sup>th</sup> 1/5 = 1.2; H upper 1/3 = 1.5, H lower 1/3 = 1.5; V = 1.425, H = 1.5, A = 1.4625

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V2	
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.4625			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #378-2; vertical; length 13.12 cm, height 15.03 cm; ratio = 0.8729; vertical lines: 1/5; horizontal lines: 1/2, 1/4, 1/3; accuracy of line placement: A = 1.4625; harmonic ratio: HR3/5, the sixth; overall composition assessment: HR3/5 moderate. The composition analysis of #378-2 is at the level of a moderate representation of a 3/5, sixth harmonic, HR3/5; V1/5H1/3. Additional notes: This is an image of two giraffes. The H1/2 line aligns accurately to the placement of the eyes of the smaller giraffe on the left side of the picture frame. The H upper 1/3 aligns to the placement of the eye of the larger giraffe at a moderate level. The V1st 1/5 describes the placement of the front legs of the smaller giraffe and the clouds at the top of the picture. The V 2<sup>nd</sup> 1/5 describes the placement of the rear legs of the smaller giraffe. The V 3<sup>rd</sup> 1/5 aligns to the location of the eye of the larger giraffe and the V 4<sup>th</sup> 1/5 aligns to the placement of the front legs of the larger giraffe. This is a 2-dimensional image. The artist used shape, line with light and dark shading to create the artwork.

**#378-3; Tigre, Tiger, 1997; óleo y encaústico sobre tela, oil and encaustic on canvas; assessment grid lines: count /color/ description:**

1 black V1/2; Hna  
2 yellow Vna; H1/3  
4 red V1/5; Hna  
Total lines 7

Measurements: length 23.93 cm; height 20.4 cm; ratio = 0.852

V: 1/2, 1/5

H: 1/3

1/2 = 11.965

1/3 = 6.8, 13.6

1/5 = 4.786, 9.572, 14.358, 19.144

Total = 5 lines

Total = 2 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 2.0; H upper 1/3 = 2.0,  
H lower 1/3 = 1.0; V = 2.0, H = 1.5; A = 1.75

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					H2	
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.75						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #378-3; horizontal; length 23.93 cm, height 20.4 cm; ratio = 0.852; vertical lines: 1/2, 1/5; horizontal lines: 1/3; accuracy of line placement: A = 1.75; harmonic ratio: HR2/3, the fifth; overall composition assessment: HR2/3 moderate. The composition analysis of #378-3 is at the level of a moderate representation of a 2/3, fifth harmonic, HR2/3; V1/2H1/3. Additional notes: This is an image of two tigers. The V1/2 line accurately aligns to the right eye of the larger tiger. The horizontal upper 1/3 aligns to the placement of the eyes of the tiger. The H lower 1/3 delineates the separation of the larger tiger from the smaller tiger. There is an indication that the V1/5 lines describe the placement of the object in the picture. This is a 2 dimensional image. The artist used shape with light and dark values to create the artwork.

**#378-4; *La momia, the Mummy*, 2001; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description:**

1 black V1/2; Hna  
4 yellow V1/3; H1/3  
Total lines 5

Measurements: length 19.35 cm; height 24.67 cm; ratio = 0.784  
V: 1/2, 1/3 H: 1/3  
1/2 = 9.675 1/3 = 8.22, 16.446  
1/3 = 6.45, 12.9  
Total = 3 lines Total = 2 lines



Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 1.0; H upper 1/3 = .8,  
H lower 1/3 = 0.5; V = 1.0, H = 0.65; A = 0.825

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2 H2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.825						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #378-4; vertical; length 19.35 cm, height 24.67 cm; ratio = 0.784; vertical lines: 1/2, 1/3; horizontal lines: 1/3; accuracy of line placement: A = 0.825; harmonic ratio: HR2/3, the fifth; overall composition assessment: HR2/3 low. The composition analysis of #378-4 is at the level of a low representation of a 2/3, fifth harmonic, HR2/3; V1/2H1/3. Additional notes: The image is of three figures, which are standing above three objects. The V1/2 aligns to the central figure in the top 2/3 of the picture. The 1/3 section of the picture does not have a V1/2 alignment. This arrangement of objects is deliberate by the artist. The H 1/3 lines in general align to the thirds division of the artwork composition. This is a 2-dimensional image. The artist used shape with light and dark values to create the artwork.

#378-5; *La Mona Lisa* (la cara), *Mona Lisa* (a face), 2004; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count /color/ description:

15 black Vna; H1/16  
10 yellow V1/9; H upper 1/3  
4 green VFR; HFR  
Total lines 29

Measurements: length 19.23 cm; height 24.5 cm; ratio = 0.784  
V: 1/9, FR H: 1/16, 1/3, FR

<p>9.18, 19.89</p> <p>FR = 7.345, 11.889</p> <p>Total = 10 lines</p>	<p>V1/9 = 2.136, 4.27, 6.408, 8.54 10.68, 12.81, 14.95, 17.08</p> <p>21.42, 22.95 1/3 = 8.166, 16.33 FR = 9.358, 15.14</p> <p>Total = 19 lines</p>	<p>1/16 = 1.53, 3.06, 4.59, 6.12, 7.65, 10.7, 12.24, 13.77, 15.3, 16.83, 18.36,</p>
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Accuracy of lines: HR9/12/16, V1/9H1/16; V 1<sup>st</sup> 1/9 = 1.0, V 2<sup>nd</sup> 1/9 = 1.2, V 3<sup>rd</sup> 1/9 = 2.4, V 4<sup>th</sup> 1/9 = 2.0, V 5<sup>th</sup> 1/9 = 1.8, V 6<sup>th</sup> 1/9 = 2.0, V 7<sup>th</sup> 1/9 = 0.5, V 8<sup>th</sup> 1/9 = 0.5; H 1<sup>st</sup> 1/16 = 1.8, H 2<sup>nd</sup> 1/16 = 2.0, H 3<sup>rd</sup> 1/16 = 0.5, H 4<sup>th</sup> 1/16 = 1.0, H 5<sup>th</sup> 1/16 = 2.6, H 6<sup>th</sup> 1/16 = 1.5, H 7<sup>th</sup> 1/16 = 2.0, H 8<sup>th</sup> 1/16 = 1.0, H 9<sup>th</sup> 1/16 = 0.5, H 10<sup>th</sup> 1/16 = 0.5, V 11<sup>th</sup> 1/16 = 1.0, V 12<sup>th</sup> 1/16 = 1.0, V 13<sup>th</sup> 1/16 = 0.5, V 14<sup>th</sup> 1/16 = 0.7, V 15<sup>th</sup> 1/16 = 1.0; V = 1.3, H = 1.1733; A = 1.23

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate				x			V2 H2	
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy 0- 3				1.23				

Harmonic ratio with Rule of Three Analysis per Image

Analysis #378-5; vertical; length 19.23 cm, height 24.5 cm; ratio = 0.784; vertical lines: 1/9, FR; horizontal lines: 1/16, 1/3, FR; accuracy of line placement: A = 1.23; harmonic ratio: HR9/12/16, the fifth and the fourth, V1/9H1/16; overall composition assessment: HR9/12/16 moderate. The composition analysis of #378-5 is at the level of a moderate representation of a 9/12/16, the fifth and the fourth



Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.158					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-1; horizontal; length 15.39 cm, height 12.8 cm; ratio = 0.83; vertical lines: 1/2, 1/4, FR; horizontal lines: 1/2, 1/3, FR; accuracy of line placement: A = 2.158; harmonic ratio: HR3/4, the fourth; overall composition assessment: HR3/4 strong. The composition analysis of #379-1 is at the level of a strong representation of a 3/4, fourth harmonic, HR3/4; V1/4H1/3. Additional notes: This is a profile image of an elephant. The image encompasses the entire picture frame. The V1/2 aligns to the placement of the front legs. The VL1/4 aligns to the placement of the rear left leg, the VR1/4 aligns accurately to the elephant's eye and head. The H2 accurately describes the torso placement, the tail and tusk. The elephant's legs are elongated in the composition and reach the bottom of the picture frame. The H lower 1/3 describes the line in the picture delineating the background from the fore and middle ground. This is a 2-dimensional image. The artist used shapes and black outlines with light and dark shading to create the artwork.

**#379-2; *La ballena de colores*, The Whale's Colors, 2005; óleo sobre madera, oil on wood; assessment grid lines: count /color/ description:**

1 black V1/2; H1/2  
3 yellow V1/3; H lower 1/3  
2 green VLFR; H lower FR  
Total lines 7

Measurements: length 15.9 cm; height 13.06 cm; ratio = 0.848

V: 1/2, 1/3, LFR

1/2 = 7.695

1/3 = 5.13, 10.26

LFR = 5.878

Total = 4 lines

H: 1/2, upper 1/3, lower FR

1/2 = 6.53

upper 1/3 = 4.33

lower FR = 8.07

Total = 3 line

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 0.5, VR1/3 = 0.5;

H1/2 = 0.7; V = 0.5, H = 0.7; A = 0.6

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2 H1	V1 H1
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.6						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-2; horizontal; length 15.39 cm, height 13.06 cm; ratio = 0.848; vertical lines: 1/2, 1/3, LFR; horizontal lines: 1/2, upper 1/3, lower FR; accuracy of line placement: A = 0.6; harmonic ratio: HR2/3, the fifth; overall composition assessment: HR2/3 low. The composition analysis of #379-2 is at the level of a low representation of a 2/3, fifth harmonic, HR2/3; V1/3H1/2. Additional notes: This image is a collection of many shapes. The focus of the artwork is a large aquatic animal shape. This shape is placed in the upper H1/2 division of the picture. The VL1/3 describes in general the placement of the head of the animal. The VR1/3 describes the placement of the fins and tail of the animal. This is a 2-dimensional image. The artist used shape and line with light and dark values to create the artwork.

**#379-3**; Perfil, Profile, 2005; óleo sobre tela, oil on canvas; assessment grid lines: count /color/ description:

6 black V1/2, 1/4; H1/2, 1/4

1 green Vna; H upper FR

Total lines 7

Measurements: length 15.8 cm; height 19.24 cm; ratio = 0.821

V: 1/2, 1/4

1/2 = 7.9

1/4 = 3.95, 11.85

Total = 3 lines

H: 1/2, 1/4, upper FR

1/2 = 9.62

1/4 = 4.81, 14.43

upper FR = 7.349

Total = 4 line

Accuracy of lines: HR1/2, V1/2Hna; V1/2 = 1.8;  
Hna; V = 1.8, Hna; A = 1.8

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate	x							H1
Low								
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.8							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-3; vertical; length 15.8 cm, height 19.24 cm; ratio = 0.821; vertical lines: 1/2, 1/4; horizontal lines: 1/2, 1/4, upper FR; accuracy of line placement: A = 1.8; harmonic ratio: HR1/2, the octave; overall composition assessment: HR1/2 moderate. The composition analysis of #379-3 is at the level of a moderate representation of a 1/2, octave harmonic, V1/2Hna. Additional notes: This is image of two figures. One is in the foreground and the other is in the background. The artist placed the figures in a vertical division. The V1/2 aligns to the placement. The H upper 1/4 aligns to the eyes of the larger figure. The H 1/2 and the H1/4 are in general aligned to the placement of the figures. The composition is a focus on the vertical relationship of the figures. This is a 2-dimensional image. The artist used shape and line with light and dark values to create the artwork.

**#379-4;** Brilla el amor, sol sube, Loves Shines, Sun Raises, 1998; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:

1 black Vna; H1/2  
4 yellow V1/3; H1/3  
Total lines 5

Measurements: length 23.9 cm; height 20.26 cm; ratio = 0.8476  
V: 1/3 H: 1/2, 1/3  
1/3 = 7.966, 15.93 1/2 = 10.13  
1/3 = 6.753, 13.50

Total = 2 lines

Total = 3 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 1.2, VR1/3 = 1.2;  
H1/2 = 1.5; V = 1.2, H = 1.5; A = 1.35

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2 H2	
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.35						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-4; horizontal; length 23.9 cm, height 20.26 cm; ratio = 0.8476; vertical lines: 1/3; horizontal lines: 1/2, 1/3; accuracy of line placement: A = 1.35; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #379-4 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of a bowl of fruit and vegetables. The center of the oval shaped bowl aligns precisely to the Rule of Three principle of art design in the composition. There are additional items of food around the bowl on a tablecloth. The H1/2 describes and divides the space of the bowl and the V1/3 and H1/3 lines describe this Rule of Three arrangement. This is a 2-dimensional image. The artist used shapes with light and dark values to create the artwork.

**#379-5; *Las frutas, Fruits*, 1998; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:**

- 1 black V1/2; Hna
  - 4 yellow V1/3; H1/3
  - 4 red Vna; H1/5
- Total lines 9

Measurements: length 19.13 cm; height 24.32 cm; ratio = 0.78659

V: 1/2, 1/3

H: 1/3, 1/5

1/2 = 9.565

1/3 = 8.10, 16.21

1/3 = 6.375, 12.75

1/5 = 4.864, 9.728, 14.59, 19.45

Total = 3 lines

Total = 6 lines

Accuracy of lines: HR3/5, V1/3H1/5; VL1/3 = 2.0, VR1/3 = 2.4;

H 1<sup>st</sup> 1/5 = 2.7, H2<sup>nd</sup> = 2.2, H 3<sup>rd</sup> 1/5 = 1.5, H 4<sup>th</sup> 1/5 = 2.4; V = 2.2,

H = 2.2; A = 2.2

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H2	
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.2			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-5; vertical; length 19.13 cm, height 24.32 cm; ratio = 0.78659; vertical lines: 1/2, 1/3; horizontal lines: 1/3, 1/5; accuracy of line placement: A = 2.2; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, strong. The composition analysis of #379-5 is at the level of a strong representation of a 3/5, the sixth harmonic, V1/3H1/5. Additional notes: This is an image of fruit stacked on a table. The stacked arrangement of the fruit is in a thirds pattern. There is a piece of fruit that extends into the foreground. The majority of the fruit is placed in the middle ground of the picture and in the background where the artist placed the tallest items. This composition gives the image of depth. The V1/5 lines align to this 3-dimensional placement. The V 1<sup>st</sup> 1/5 aligns to the fruits on the top of the stack in the back. The V 2<sup>nd</sup> 1/5 describes the area just below the tallest fruit near the table and the V 4<sup>th</sup> 1/5 aligns accurately to the fruit in the foreground and on the table. Parts of the individual fruit are drawn with the indication of linear perspective, which helps to give the overall sense of the depth



in the artwork. The artist used the fore, middle and back ground technique along with shapes and light and dark values to create the artwork.

**#379-6; Florero con flores, Vase with Flowers, 2007; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:**

3 black V1/2; H1/2, lower 1/4  
 3 yellow V1/3; H upper 1/3  
 4 red Vna; H1/5  
 Total lines 10

Measurements: length 19.13 cm; height 24.3 cm; ratio = 0.796

V: 1/2, 1/3

1/2 = 9.675

1/3 = 6.45, 12.9

H:1/2, lower 1/4, upper 1/3, 1/5

1/2 = 12.15

lower 1/4 = 18.225

upper 1/3 = 8.1

1/5 = 4.86, 9.72, 14.58, 19.44

Total = 3 lines

Total = 7 lines

Accuracy of lines: HR3/5, V1/3H1/5; VL1/3 = 2.4, VR1/3 = 2.5;

H1st 1/5 = 1.0, H2<sup>nd</sup> = 2.4, H 3<sup>rd</sup> 1/5 = 2.6, H 4<sup>th</sup> 1/5 = 1.0; V= 2.45,

H = 1.75; A = 2.1;

V1/3H1/2; VL1/3 = 2.4, VR1/3 = 2.5; H1/2 = 1.5, V = 2.45, H = 1.5; A = 1.975

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H1	
Moderate		x						
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.975			2.1			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-6; vertical; length 19.35 cm, height 24.3 cm; ratio = 0.796; vertical lines: 1/2, 1/3; horizontal lines: 1/2, lower 1/4, upper 1/3, 1/5; accuracy of line placement: A = 2.1; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, strong. The composition analysis of #379-6 is at the level of a strong representation of a 3/5, the sixth harmonic, V1/3H1/5. There was evidence of the use of the harmonic ratio HR2/3; V1/3H1/2, A = 1.975. Additional notes: This is an image of a vase of flowers on a table. The artist placed the vase of flowers directly in the foreground. The flowers in the vase cover the entire top half of the picture frame. The HR 2/3 represents the H1/2 division aligned to the line of the table dividing the placement in general of the top portion of the vase and the background flower location. The VR1/3 delineates the center of the vase, with the flowers of the lightest value. The H upper 1/3 describes the location of the back lip of the vase and area of dark gray in the lower background. The V 1<sup>st</sup> 1/5 is in general aligned to the section of flowers with the lightest values. The V 2<sup>nd</sup> 1/5 accurately describes the front lip of the top of the vase and handle. The V 3<sup>rd</sup> 1/5 accurately describes the upper and lower parts of the vase. The V 4<sup>th</sup> 1/5 in general describes the lower portion of the vase and is aligned to the top of the small figure on the left side in the fore ground. The HR3/5 gives the strongest accuracy and more information about the composition. This is a 2-dimensional image. The author used shapes and lines with light and dark values to create the artwork.

**#379-7; *La television, The Television*, 1995; pastel sobre papel, pastel on paper; assessment grid lines: count/color/ description:**

3	black	V1/2, 1/4; Hna
2	yellow	Vna; H1/3
Total lines 5		

Measurements: length 24.12 cm; height 20.78 cm; ratio = 0.86	
V: 1/2, 1/4	H: 1/3
1/2 = 12.06	1/3 = 6.926, 13.85
1/4 = 6.03, 18.09	
Total = 3 lines	Total = 2 lines

Accuracy of lines: HR3/4, V1/4H1/3; VL1/4 = 3, V1/2 = 1.0, VR1/4 = 2.5; H upper 1/3 = 3.0, H lower 1/3 = 1.2; V = 2.166, H = 2.1; A = 2.133

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x					H2
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.133					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-7; horizontal; length 24.12 cm, height 20.78 cm; ratio = 0.86; vertical lines: 1/2, 1/4; horizontal lines: 1/3; accuracy of line placement: A = 2.133; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, strong. The composition analysis of #379-7 is at the level of a strong representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This is an abstract image. Primarily, there is a black background with an area of dark gray. There are two objects in the image, a white ball and its shadow and a white squiggly shape. Both objects are placed on the V1/4 lines. The ball is precisely on the edge of VL1/4. The squiggly shape is precisely on the VR1/4. The V1/2 is aligned to the dark gray area at the top of the picture. The H upper 1/3 is precisely aligned to the shadow of the white ball. The H lower 1/3 in general aligns to the squiggly shape. The placement of the two objects is in the opposite corners of the Rule of Three rectangle that is made with the V1/4H1/3 geometric relationship. The placement of the two objects is on the outside edge of the rectangle and this alignment places the two objects in perfect symmetry to one another. This is a 2-dimensional image. The artist used black and white with shape and line to create the artwork.

**#379-8;** *Las Sandías, Watermelons*, 1995; pastel sobre amate papel, pastel on amate paper; assessment grid lines: count/color/ description:

- 1 black Vna; H1/2
- 2 yellow V1/3; Hna
- Total lines 3

Measurements: length 24.99 cm; height 16.81 cm; ratio = 0.672  
 V: 1/3 H: 1/2  
 1/3 = 8.33, 16.6 1/2 = 8.405  
 Total = 2 lines Total = 1 line

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 1.2, VR1/3 = 1.8;  
 H 1/2 = 0.5; V= 1.5, H = 0.5; A = 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.0						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-8; horizontal; length 24.99 cm, height 16.81 cm; ratio = 0.672; vertical lines: 1/3; horizontal lines: 1/2; accuracy of line placement: A = 1.0; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, low. The composition analysis of #379-8 is at the level of a low representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of watermelon. The watermelon is represented by dark shapes and white lines with dots. In general, the grouping of the shapes aligns to a vertical thirds division. In general, the horizontal 1/2 divides the fruit along a line of dots. This is a 2-dimensional image. The artist used black shapes and white line with light and dark shading to create the artwork.

**#379-9; *El professor Daniel, Professor Daniel*, 2000; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:**

1 black Vna; H1/2  
 4 yellow V1/3; H1/3  
 Total lines 5

Measurements: length 19.75 cm; height 24.49 cm; ratio = 0.806

V: 1/3

H: 1/2

1/3 = 6.583, 13.167

1/2 = 12.245

1/3 = 8.16, 16.326

Total = 2 lines

Total = 3 lines

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 2.0, VR1/3 = 2.2;

H 1/2 = 1.5; V = 2.1, H = 1.5; A = 1.8

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2 H2	
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.8						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #379-9; vertical; length 19.75 cm, height 24.49 cm; ratio = 0.806; vertical lines: 1/3; horizontal lines: 1/2, 1/3; accuracy of line placement: A = 1.8; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #379-9 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of a standing figure with elongated legs on the left side of the picture (looking at the picture), a face in the center third area and books on a stand on the right side. The V1/3 aligns with the elongated figure and the VR1/3 aligns precisely to the center section placement and at a moderate level of accuracy for the placement of the face. The H1/2 lines describe the placement of some of the smaller objects in the picture. This is a 2-dimensional image and the main objects are aligned to the geometric rectangles of the V1/3H1/2 divisions of the picture frame. The artist used shapes and lines with light and dark areas to create the artwork.

**#380, male, 36 years old; 36 years at the JLDF; 17 years at the art school; myopia and astigmatism; socioeconomic status/medium; range of time of artwork used in the study: 2000-2008**

#380-1; *Elviscente, Elvis*, 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

1 black Vna; H 11<sup>th</sup> 1/12  
 1 yellow V 1<sup>st</sup> 1/9; Hna  
 22 diagonal lines V11; H 11  
 Total lines 24

Measurements: length 12.24 cm; height 21.74 cm; ratio = 0.563

V: 1<sup>st</sup> 1/9, L1/8<sup>c</sup> LFR, L1/8<sup>c</sup> V1/2, H: 1<sup>st</sup> 1/12<sup>c</sup> 2<sup>nd</sup> 1/12, 2<sup>nd</sup> 1/12<sup>c</sup>  
 3<sup>rd</sup> 1/12, L1/4<sup>c</sup> 5<sup>th</sup> 1/9, L1/3<sup>c</sup> RFR, LFR<sup>c</sup> R1/3, 3<sup>rd</sup> 1/12<sup>c</sup> 4<sup>th</sup> 1/12, 4<sup>th</sup>  
 1/12<sup>c</sup> 5<sup>th</sup> 1/12,  
 4<sup>th</sup> 1/9<sup>c</sup> R1/4, 5<sup>th</sup> 1/9<sup>c</sup> 2<sup>nd</sup> 1/9, 5<sup>th</sup> 1/9 5<sup>th</sup> 1/12<sup>c</sup> 6<sup>th</sup> 1/12, 6<sup>th</sup> 1/12<sup>c</sup>  
 7<sup>th</sup> 1/12,  
 7<sup>th</sup> 1/9, R1/3<sup>c</sup> L1/3, 6<sup>th</sup> 1/9<sup>c</sup> 8<sup>th</sup> 1/9, 7<sup>th</sup> 1/12<sup>c</sup> 8<sup>th</sup> 1/12, 8<sup>th</sup> 1/12<sup>c</sup>  
 9<sup>th</sup> 1/12,  
 7<sup>th</sup> 1/9 12.24 9<sup>th</sup> 1/12<sup>c</sup> 10<sup>th</sup> 1/12, 10<sup>th</sup> 1/12<sup>c</sup>  
 11<sup>th</sup>  
 1/12, 11<sup>th</sup> 1/12  
 1/2 = 6.12, 1/4 = 3.06, 9.18, 1/8 = 1.5, 13.74 1/112 = 1.8116, 3.62, 5.43,  
 7.246, 9.058,  
 1/9 = 1.36, 2.72, 4.08, 5.44, 6.8, 8.16, 9.52 10.869, 12.68, 14.49, 16.30,  
 18.4, 19.92  
 10.88, FR= 4.675, 7.56  
 Total = 13 lines Total = 11 lines

Accuracy of lines: HR3/4, V1/3H1/4; VL1/3 = 2.8, VR1/3 = 2.4; H upper 1/4 = 2.4,  
 H 1/2 = 1.0, H lower 1/4 = 2.6; V= 2.6, H = 2.0; A = 2.3

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V2	
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		

Accuracy 0- 3			2.3					
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Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-1; vertical; length 12.24 cm, height 21.74 cm; ratio = 0.563; vertical lines: see above; horizontal lines: same; accuracy of line placement: A = 2.3; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, strong. The composition analysis of #380-1 is at the level of a strong representation of a 3/4, the fourth harmonic, V1/3H1/4. Additional notes: This is an image of Elvis. The artist slanted the figure vertically to the right. The vertical lines of the 1/9's aligned to the placement of the figure, face, head, arms, and objects in the front of Elvis. The VL1/3 line describes accurately the placement of the figures' right eye. The VR1/3 describes accurately the hair, left ear, coat, left hand and object placement. The horizontal 1/12 lines align to the placement of the figure, hair, eyes, ears, mouth, chin, jacket, shoulders, arms, hands, and object in front on the table. The H upper 1/4 describes the placement of the lower right ear, mouth and center of the left ear. The H 1/2 aligns in general to the arms and jacket. The H lower 1/4 describes the placement of the hands, coat sleeves and object in the front. This is a 3-dimensional image. The artist used black and white lines with shapes. The image was created at an angle, which gives the indication of depth. There is a distinct fore, middle and background.

#380-2; *Tigre, Tiger*, 2002; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

7	black	V1/4; H1/2, 1/4, 1/8
4	yellow	V1/3; H1/3
4	red	V1/5; Hna
4	green	VFR; HFR
1	diagonal	V1; Hna
Total lines 20		

Measurements: length 12.28 cm; height 18.02 cm; ratio = 0.68

V: 1/4, 1/3, 1/5, FR, 3<sup>rd</sup> 1/5 <sup>c</sup> 2<sup>nd</sup> 1/5    H: 1/2 1/4, 1/8, 1/3, FR

1/4 = 3.07, 9.21

1/2 = 9.01

1/3 = 4.09, 8.186

1/4 = 4.5, 13.5

1/5 = 2.456, 4.9, 7.368, 9.8

1/8 = 2.25, 15.77

FR = 4.69, 7.589

1/3 = 8.16, 16.326

Diagonal = 7.368 <sup>c</sup> 4.9

FR = 6.88, 11.136

Total = 11 lines

Total = 9 lines

Accuracy of lines: HR3/5, V1/5H1/3; V 1<sup>st</sup> 1/5 = 2.4, 2<sup>nd</sup> 1/5 = 1.2, 3<sup>rd</sup> 1/5 = 2.7  
 4<sup>th</sup> 1/5 = 1.4; H upper 1/3 = 2.4, H lower 1/3 = 2.0; V= 1.925, H = 2.2; A = 2.0625

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V2 H2	
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.0625			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-2; vertical; length 12.28 cm, height 18.02 cm; ratio = 0.68; vertical lines: 1/4, 1/3, 1/5, FR, 3<sup>rd</sup> 1/5 c 2<sup>nd</sup> 1/5; horizontal lines: 1/2 1/4, 1/8, 1/3, FR; accuracy of line placement: A = 2.0625; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, moderate. The composition analysis of #380-2 is at the level of a moderate representation of a 3/5, the sixth harmonic, V1/5H1/3. Additional notes: This is an image of the head of a tiger. The image takes up the entire picture frame. The artist placed the centerline of the face of the tiger slanted to the left. This is indicated by the tiger stripes on the forehead, line of the nose, mouth and the front leaf in the foreground. The V 1<sup>st</sup> 1/5 lines aligns to the placement of the tiger's right ear, corner of the right eye and edge of the mouth. The V 2<sup>nd</sup> 1/5 aligns to the top of the head, right nostril, teeth and leaf in front. The V 3<sup>rd</sup> 1/5 aligns to the pupil of the left eye, edge of the mouth and leaf in front. The VFR's support both the V 2<sup>nd</sup> 1/5 and V 3<sup>rd</sup> 1/5 lines. The V 4<sup>th</sup> 1/5 line accurately describes the left side of the face, and leaf in front. The H upper 1/3 aligns to the bottom of the eyes. The H lower 1/3 aligns to the bottom of the mouth. This is an example of an asymmetrical centering of the portrait image. The VFR, V 2<sup>nd</sup> 1/5 and top of the diagonal line that gives the slanted center line form the top point of the convergence of these three lines to the bottom of the picture, the convergence of the V 3<sup>rd</sup> 1/5 and VRFR. In addition, the artist "built" the structure of the tiger's head and face by using all of the grid geometric lines primarily vertically and to a lesser degree horizontally. The V 1<sup>st</sup> 1/5 aligns to the inside of the right ear, outside of the eye and cheek. The V1/4 aligns to the pupil



of the right eye and jaw. The VLFR and V 2<sup>nd</sup> 1/5 align to the description of the top of the right nostril, teeth, and lower part of the mouth. The V 3<sup>rd</sup> 1/5 and VRFR describe the center of the left eye, cheek, mouth and teeth. The V 4<sup>th</sup> 1/5 describes the outside of the left ear. The VR1/4 aligns to the left ear and outline of the face. Looking at the image the line on the right side of the tiger's head is the VL1/8, on the right side is the V 1<sup>st</sup> 1/5, on the left side it is the VR1/4. The next line on the right side is the VL1/4, on the left side it is the VR1/3, (both lines describe the same position for the respective eye). The next line on the left is the VL1/3, on the left side it is the VLFR and the V 2<sup>nd</sup> 1/5 the lines describe the placement of the inside of the eye. The next lines on the right are the VRFR and the V 3<sup>rd</sup> 1/5, the corresponding line is the diagonal line that connects the two groups of VLFR and V 2<sup>nd</sup> 1/5 to the VRFR and V 3<sup>rd</sup> 1/5 from the top to the bottom. This is an asymmetrical alignment and arrangement of the composition to the HR3/5; V1/5H1/3. This is a 2-dimensional image. The artist used black and white lines with shapes to create the artwork.

**#380-3; *El árbol de los deseos, The Tree of Desires*, 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

- 2 black V1/4; Hna
  - 13 yellow V1/6; H1/9
  - 1 green Vna; H lower FR
  - 1 dotted blue line V1; Hna
- Total lines 17

Measurements: length 17.11 cm; height 13.0 cm; ratio = 0.789

V: 1/4, 1/6, FR, dotted blue line      H: 1/9, lower FR  
 1/4 = 4.277, 12.8      1/9 = 1.45, 2.9, 4.35, 5.8, 7.25, 8.7  
 1/6 = 2.85, 5.7, 8.55, 11.40, 14.25      10.15, 11.6  
 Dotted blue line = 9.1      lower FR = 8.52

Total = 8 lines

Total = 9 lines

Accuracy of lines: HR3/4, V1/4H1/3; VL1/4 = 1.5, V1/2 = 2.5, VR1/4 = 1.5;  
 H upper 1/3 = 1.5, H lower 1/3 = 2.2; V = 1.83, H = 1.85; A = 1.841

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
<b>Strong</b>								

Moderate			x				V2 H2	H1
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.841					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-3; horizontal; length 17.11 cm, height 13.05 cm; ratio = 0.789; vertical lines: 1/4, 1/6, FR, dotted blue line; horizontal lines: 1/9, lower FR; accuracy of line placement: A = 1.841; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, moderate. The composition analysis of #380-3 is at the level of a moderate representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This image is an abstract drawing of a tree, leaves and foreground. The tree is divided into five parts with a design of three vertical swirl patterns in the center of the trunk of the tree. The VL1/4 and VR1/4 in general describe the placement of the leaves. The V1/2 aligns to one of the tree parts and the right edge of the swirl patterns. The V 1/3 lines in general align to the placement of the tree. Horizontally, the top of the tree, bends in the tree trunks, alignment to the leaf patterns of the background and each swirl patterns align to the H 1/9 lines. The highest swirl is delineated by the 6<sup>th</sup> 1/9 (H lower 1/3) and is supported by the H lower Fr. The 3<sup>rd</sup> 1/9 (H upper 1/3) aligns to the bend in three of the tree trunks and the top of the tree parts on the right (looking at the picture). There is a major composition line that is indicated in the image design. The vertical line 9.1 cm delineates the center of the swirl patterns and the space between the second and third tree trunk. This line divides the picture frame into two vertical rectangles. The one on the left has the dimension of length 9.1 and height 13.05, ratio = 0.697; the rectangle on the right is length 8.0 and height 13.0, ratio = 0.61538. This composition line is placed precisely as a vertical line through the center of the swirl patterns and describes a DEMR rectangle relationship within the dimensions of the picture frame. This is a 2-dimensional image. The artist used black and white lines with shapes to create the artwork.

**#380-4; *Tres Mujeres, Three Women*, 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

- 1 yellow V1/3; Hna
- 4 red Vna; H1/5
- 2 green VRFR; H upper FR
- Total lines 8

Measurements: length 8.03 cm; height 10.26 cm; ratio = 0.782  
V: 1/3, RFR H: 1/5, upper FR

1/3 = 2.676, 5.353  
RFR = 4.96

1/5 = 2.052, 4.104, 6.156, 8.208  
upper FR = 3.919

Total = 3 lines

Total = 5 lines

Accuracy of lines: HR3/5, V1/3H1/5; VL1/3 = 1.5, VR1/3 = 2.0;  
H 1<sup>st</sup> 1/5 = 2.0, 2<sup>nd</sup> 1/5 = 2.4, 3<sup>rd</sup> 1/5 = 1.0, 4<sup>th</sup> 1/5 = 2.6; V= 1.75, H = 2.0;  
A = 1.875

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		V1	V1 H1
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.875			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-4; vertical; length 8.03 cm, height 10.26 cm; ratio = 0.782; vertical lines: 1/3, RFR; horizontal lines: 1/5, upper FR; accuracy of line placement: A = 1.875; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, moderate. The composition analysis of #380-4 is at the level of a moderate representation of a 3/5, the sixth harmonic, V1/3H1/5. Additional notes: This is an image of three women. The placement of the three figures can be described by the horizontal 1/5 divisions. The H 1<sup>st</sup> 1/5 aligns to the heads of the figures. The H 2<sup>nd</sup> 1/5 aligns to the hand positions of the women and the dress designs. The H 3<sup>rd</sup> 1/5 aligns in general to the dresses and lower arm of the sitting figure. The artist placed the three figures such that each is in a 1/3 section of the vertical picture frame. This is a 2-dimensional image. The artist used black and white lines with shapes to create the artwork.

**#380-5; *El estudiante, The student*, 2001; óleo sobre tela, oil on canvas;**  
assessment grid lines: count/color/ description:

13 yellow V1/6; H1/9  
1 green VLFR; Hna

Total lines 14

Measurements: length 17.72 cm; height 22.39 cm; ratio = 0.79

V: 1/6, VLFR

H: 1/9

1/6 = 2.953, 5.9, 8.859, 11.81, 14.765

1/9 = 2.4877, 4.975, 7.463, 9.95,

12.438,

LFRR = 6.7685

14.926, 17.41, 19.9

Total = 6 lines

Total = 8 lines

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 2.9, VR1/3 = 2.8;

H1/2 = 2.4; V = 1.75, H = 2.0; V = 2.85, H = 2.4; A = 2.625

V1/3H1/4; VL1/3 = 2.9, VR1/3 = 2.8; H upper 1/4 = 2.3, H1/2 = 2.4, H lower

1/4 = 1.8; V = 2.85, H = 2.166; A = 2.508

4/6/9; V1/6H1/9; V 1<sup>st</sup> 1/6 = 1.5, 2<sup>nd</sup> 1/6 = 2.9, 3<sup>rd</sup> 1/6 = 2.2, 4<sup>th</sup> 1/6 = 2.8, 5<sup>th</sup>

1/6 = 2.4; H 1<sup>st</sup> 1/9 = 2.5, 2<sup>nd</sup> 1/9 = 2.7, 3<sup>rd</sup> 1/9 = 1.0, 4<sup>th</sup> 1/9 = 1.0, 5<sup>th</sup>

1/9 = 2.4, 6<sup>th</sup> 1/9 = 1.7, 7<sup>th</sup> 1/9 = 2.3, 8<sup>th</sup> 1/9 = 2.0; V = 2.36, H = 1.8625; A =

2.11

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x	x			x	V2 H2	V1
Moderate								
Low								
Inconsistent								
Not Found	x			x	x			
Accuracy 0- 3		2.625	2.508			2.11		

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-5; vertical; length 17.72 cm, height 22.39 cm; ratio = 0.79; vertical lines: 1/6, VLFR; horizontal lines: 1/9; accuracy of line placement: A = 2.625; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of #380-5 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of a figure standing in a room. He is standing next to a table on his right side. There is a light hanging on his left from the ceiling of the room. The light from the lamp is directed in diagonals into the space in the room. There are vertical shelves full of

items on the left side of the room. The focus of the artwork is the light in the room. The figure is standing half way in the shadow of the light. The V 4<sup>th</sup> 1/6 accurately describes the location of the lamp. The V 2<sup>nd</sup> 1/6 accurately describes the figure's position and the artist leaned the upper part of the body to the figure's left and the VLFR precisely aligns to the center of the figure's face. The H1/2 aligns to the items on the table, the bottom of the jacket and the line of the shelf location. The HR3/4, the fourth harmonic is slightly less accurate, A= 2.508. The H 1/4 lines are not as informative as the 1/9's. In particular, the H 1<sup>st</sup>, 2<sup>nd</sup>, 5<sup>th</sup> and 8<sup>th</sup> 1/9 lines. The H 3<sup>rd</sup>, 4<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> 1/9 lines in general describe a compositional placement, the HR 4/6/9 is not as strong a representation overall as the HR 2/3. The 4/6/9 is the extension of the 2/3 in both the vertical and horizontal dimensions. The 3/4 is the extension of the 2/3 in one dimension. There is evidence of the use of linear perspective, the angle of the table top, the shadow on the floor and the table and the three dimensional shape of the shelves. This picture is a complex demonstration of the artistic principle Rule of Three. The image is 3-dimensional. The artist used shapes, lines dark and light shading and fore, middle and back ground techniques with linear perspective to create this artwork.

#380-6; *El mundo, The Globe*, 2000; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:

- 1 black V1/2; Hna
- 2 yellow Vna; H1/3
- Total lines 3

Measurements: length 18.44 cm; height 22.56 cm; ratio = 0.817

V: 1/2 H: 1/3  
 1/2 = 9.22 1/3 = 7.52, 15.04

Total = 1 line Total = 2 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 1.0; H upper 1/3 = 1.0, H lower 1/3; V= 1.0, H = 1.0; A = 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
<b>Strong</b>								

Moderate								
Low		x					H2	
Inconsistent								
Not Found	x		x	x		x		
Accuracy 0- 3		1.0						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-6; vertical; length 18.44 cm, height 22.56 cm; ratio = 0.817; vertical lines: 1/2; horizontal lines: 1/3; accuracy of line placement: A = 1.0; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, low. The composition analysis of #380-6 is at the level of a low representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a large central object. In general, the picture is divided into thirds horizontally by the placement of the fore ground of children playing near the large object. The middle ground is represented by the houses on either side of the large object. The background is the sky and mountains. In general, the H 1/3 lines align to this division. The V1/2 line aligns in general to the lines on the large object. This is a 2-dimensional image. The artist used shape with light and dark values with the fore, middle and background technique to create the artwork.

#380-7; *La calle, The Street*, 2005; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:

2 black V1/2; H1/2  
Total lines 2

Measurements: length 23.87 cm; height 20.48 cm; ratio = 0.857

V: 1/2

H: 1/2

1/2 = 11.935

1/2 = 10.24

Total = 1 line

Total = 1 line

Accuracy of lines: HR1/2, VnaH1/2; Vna; H1/2 = 2.6; V= na, H = 2.6;

A = 2.6

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong	x							

Moderate								
Low								
Inconsistent								
Not Found		x	x	x		x		
Accuracy 0- 3	2.6							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-7; horizontal; length 23.87 cm, height 20.48 cm; ratio = 0.857; vertical lines: 1/2; horizontal lines: 1/2; accuracy of line placement: A = 2.6; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, strong. The composition analysis of #380-7 is at the level of a strong representation of a 1/2, the octave harmonic, VnaH1/2. Additional notes: This is an image of a railroad station. Primarily, the artist divided the horizontal middle of the scene at the railroad station. In the fore ground, the artist placed the people, animals, carts and trains. In the exact center of the picture frame is a railroad crossing sign and a figure. The background is the buildings of the town. The H1/2 aligns to this division A= 2.6. The V1/2 aligns accurately to the background building tower at the center point. In the foreground, the V1/2 line aligns to the placement of the central figure and the post of the railroad sign. The H1/2 and V1/2 divisions create four separate pictures that can be considered stand-alone images. Each smaller image has a fore, middle and background. This is a 2 –dimensional image. The artist used shape with light and dark values with fore, middle and background technique to create the artwork.

**#380-8;** *Gato salvaje, Wild Cat*, 2004; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:

- 1 black V1/2; Hna
- 2 yellow Vna; H1/3
- Total lines 3

Measurements: length 17.93 cm; height 22.2 cm; ratio = 0.80

V: 1/2 H: 1/3  
 1/2 = 8.965 1/3 = 7.4, 14.8

Total = 1 line Total = 2 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 2.6; H upper 1/3 = 2.0,  
 H lower 1/3 = 0.8; V= 2.6, H = 1.4; A = 2.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					H2	
Low								
Inconsistent								
Not Found	x		x	x		x		
Accuracy 0- 3		2.0						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-8; vertical; length 17.93 cm, height 22.2 cm; ratio = 0.80; vertical lines: 1/2; horizontal lines: 1/3; accuracy of line placement: A = 2.0; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #380-8 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a cat outside. A tree is on the right side (looking at the picture) and a flower is on the left. The sun is in the background along with clouds and a rainbow. The H upper 1/3 moderately aligns to the placement of the top of the tree, the top of the cat's head and near the top of the background hill. The H lower 1/3 aligns to the placement of the large flower. The V1/2 line accurately aligns to the center of the right eye of the cat and front right leg. The composition of the picture aligns to a HR2/3 and is very close to a strong representation. The H lower 1/3 is not accurate enough for a strong level. This is a 2-dimensional image. The artist used shape with light and dark values with fore, middle and background technique to create the artwork.

**#380-9; *El Castillo, Castle*, 2005; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

- 1 black V1/2; Hna
- 2 yellow Vna; H1/3
- Total lines 3

Measurements: length 24.25 cm; height 18.25 cm; ratio = 0.75

V: 1/2

H: 1/3

1/2 = 12.125

1/3 = 6.08, 12.16



Total = 1 line

Total = 2 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 2.2; H upper 1/3 = 1.0,  
H lower 1/3 = 1.2; V = 2.2, H = 1.1; A = 1.65

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					H2	
Low								
Inconsistent								
Not Found	x		x	x		x		
Accuracy 0- 3		1.65						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-9; horizontal; length 24.25 cm, height 18.25 cm; ratio = 0.75; vertical lines: 1/2; horizontal lines: 1/3; accuracy of line placement: A = 1.65; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #380-9 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a large building. In general, the building sections are divided into thirds. The H upper 1/3 aligns to the top of the building on the right and the shorter section of building on the left (looking at the picture). The H lower 1/3 aligns to the top of the windows on the left. This is a 3-dimensional image. The artist used black and white lines with shapes to create the artwork.

**#380-10**; *El loco y locas mujeres, The Madman and Madwomen*, 2006; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

1 black Vna; H1/2  
2 yellow V1/3; Hna  
Total lines 3

Measurements: length 17.32 cm; height 11.58 cm; ratio = 0.668

V: 1/3 H: 1/2  
1/3 = 5.773, 11.5 1/2 = 5.79

Total = 2 lines

Total = 1 line

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 0.5, VR1/3 = 1.5; H1/2 = 0.5, V= 1.0, H = 0.5; A = 0.75

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate							V2	
Low		x						
Inconsistent								
Not Found	x		x	x		x		
Accuracy 0- 3		0.75						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-10; horizontal; length 17.32 cm, height 11.58 cm; ratio = 0.668; vertical lines: 1/3; horizontal lines: 1/2; accuracy of line placement: A = 0.75; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, low. The composition analysis of #380-10 is at the level of a low representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of three figures. The artist placed the figures in general in a vertical thirds placement. The H 1/2 line in general aligns to the waist position of each of the figures. This is a 2-dimensional image. The artist used black and white lines with small shapes to create the artwork.

**#380-11**; *Vicente y Maynca, Vincent and Maynca*, 2008; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

1 black V1/2; Hna

Total lines 1

Measurements: length 17.27 cm; height 11.55 cm; ratio = 0.668

V: 1/2 H: na

1/2 = 8.635

Total = 1 line

Total = 0 lines

Accuracy of lines: HR1/2, V1/2Hna; V1/2 = 2.7; Hna, V = 2.7, Hna; A = 2.7

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong	x							
Moderate								
Low								
Inconsistent								
Not Found		x	x	x		x		
Accuracy 0- 3	2.7							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-11; horizontal; length 17.27 cm, height 11.55 cm; ratio = 0.668; vertical lines: 1/2; horizontal lines: na; accuracy of line placement: A = 2.7; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, strong. The composition analysis of #380-11 is at the level of a strong representation of a 1/2, the octave harmonic, V1/2Hna. Additional notes: This is a picture of Vincente and Maynca. The artist has combined their portraits into one face. The V1/2 aligns accurately to the placement of the two faces together. The relationship between the two people is the focus of the artwork and the main compositional focus. This is a 2-dimensional image. The artist used black and white lines with shapes to create the artwork.

**#380-12;** *Guitara de Elvis, Elvis's Guitar*, 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

1 black V1/2; Hna

Total lines 1

Measurements: length 24.05 cm; height 14.96 cm; ratio = 0.622

V: 1/2

H: na

1/2 = 12.025

Total = 1 line

Total = 0 lines

Accuracy of lines: HR1/2, V1/2Hna; V1/2 = 1.0; Hna,  
V = 1.0, Hna; A = 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low	x							
Inconsistent								
Not Found		x	x	x		x		
Accuracy 0- 3	1.0							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-12; horizontal; length 24.05 cm, height 14.96 cm; ratio = 0.622; vertical lines: 1/2; horizontal lines: na; accuracy of line placement: A = 1.0; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, low. The composition analysis of #380-12 is at the level of a low representation of a 1/2, the octave harmonic, V1/2Hna. Additional notes: This is an image of two guitars. The artist placed the guitars in a V1/2 position one on each side of the horizontal picture frame. One of the guitars has an outline of the portrait of Elvis placed on the front of the instrument. The other guitar is the color of black. This is a 2-dimensional image. The artist used black and white lines with shapes to create the image.

**#380-13; *Mujeres gordas, Fat Women*, 2005; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

2 yellow Vna; H (1<sup>st</sup>, 8<sup>th</sup>)1/9  
3 diagonal V1; H2  
Total lines 5

Measurements: length 15.2 cm; height 24.67 cm; ratio = 0.61613

V: R1/3 ° L1/3

10.13 ° 5.06

H: (1<sup>st</sup>, 8<sup>th</sup>)1/9, 2<sup>nd</sup> 1/9 ° 1<sup>st</sup> 1/9,

5<sup>th</sup> 1/9 ° 4<sup>th</sup> 1/9;

1<sup>st</sup> 1/9 = 2.74; 8<sup>th</sup> 1/9 = 21.92

5.48 ° 2.74; 13.70 ° 10.96

Total = 1 line

Total = 4 lines

Accuracy of lines: HR1/2, V1/2Hna; V1/2 = 2.5; Hna,  
V= 2.5, Hna; A = 2.5

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong	x						V2	
Moderate								
Low								
Inconsistent								
Not Found		x	x	x		x		
Accuracy 0- 3	2.5							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-13; vertical; length 15.2 cm, height 24.67 cm; ratio = 0.61613;  
vertical lines: R1/3 ° L1/3; horizontal lines: (1<sup>st</sup>, 8<sup>th</sup>)1/9, 2<sup>nd</sup> 1/9 ° 1<sup>st</sup> 1/9, 5<sup>th</sup> 1/9 °  
4<sup>th</sup> 1/9; accuracy of line placement: A = 2.5; harmonic ratio: 1/2, the octave;  
overall composition assessment: HR1/2, strong. The composition analysis of  
#380-13 is at the level of a strong representation of a 1/2, the octave harmonic,  
V1/2Hna. Additional notes: This image is of two women standing side by side.  
The artist placed them at a slant to the left (looking at the picture). The delineation  
between them is a diagonal line that starts at the VL1/3 at the top of the picture  
frame and goes to the VR1/3 at the bottom of the picture frame. The placement of  
the figures delineates the diagonal line as the precise center between the figures.  
The horizontal 1<sup>st</sup> 1/9 accurately aligns to the faces of the two figures. The 2<sup>nd</sup>  
1/9 ° 1<sup>st</sup> 1/9 diagonal accurately describes the division of the shoulders of the  
figures. The diagonal 5<sup>th</sup> 1/9 ° 4<sup>th</sup> 1/9 accurately describes the placement of the  
waists of the figures. The 8<sup>th</sup> 1/9 aligns in general to the feet of the figures. The  
overall dimensions of the picture frame is very close to the DEMR construct. This  
is a 2-dimensional image. The artist used black and white lines with shapes to  
create the artwork.

#380-14; *La jirafa, Giraffe*, 2001; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

26 black V1/12; H1/16  
 4 yellow Vna; H(1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 5<sup>th</sup>) 1/6

Total lines 30

Measurements: length 15.24 cm; height 23.72 cm; ratio = 0.642

V: 1/12

H: 1/16

1/12 = 1.27, 2.54, 3.81, 5.08, 6.35, 7.62, 8.89, 10.16, 11.43, 12.7, 13.97  
 1/16 = 1.482, 2.964, 4.446, 5.928, 7.41, 8.892, 10.374, 11.856, 13.338, 14.82, 16.317.78, 19.266, 20.748, 22.23  
 (1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 5<sup>th</sup>) 1/6 = 3.95, 7.9, na, 15.8, 19.7

Total = 11 lines

Total = 19 lines

Accuracy of lines: HR9/12/16; V1/12H1/16; V 1<sup>st</sup> 1/12 = 2.3, 2<sup>nd</sup> 1/12 = 2.6, 3<sup>rd</sup> 1/12 = 2.1, 4<sup>th</sup> 1/12 = 2.3, 5<sup>th</sup> 1/12 = 2.2, 6<sup>th</sup> 1/12 = 2.5, 7<sup>th</sup> 1/12 = 1.5, 8<sup>th</sup> 1/12 = 2.6, 9<sup>th</sup> 1/12 = 1.5, 10<sup>th</sup> 1/12 = 1.0, 11<sup>th</sup> 1/12 = 2.4; H 1<sup>st</sup> 1/16 = 2.3, 2<sup>nd</sup> 1/16 = 2.4, 3<sup>rd</sup> 1/16 = 1.2, 4<sup>th</sup> 1/16 = 2.2, 5<sup>th</sup> 1/16 = 2.8, 6<sup>th</sup> 1/16 = 2.0, 7<sup>th</sup> 1/16 = 2.6, 8<sup>th</sup> 1/16 = 2.2, 9<sup>th</sup> 1/16 = 2.5, 10<sup>th</sup> 1/16 = 1.5, 11<sup>th</sup> 1/16 = 2.7, 12<sup>th</sup> 1/16 = 1.2, 13<sup>th</sup> 1/16 = 2.2, 14<sup>th</sup> 1/16 = 1.5, 15<sup>th</sup> 1/16 = 2.4; V = 2.09, H = 2.113; A = 2.10

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong				x				
Moderate								
Low								
Inconsistent								
Not Found	x	x	x			x		
Accuracy 0- 3				2.10				

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-14; vertical; length 15.24 cm, height 23.72 cm; ratio = 0.642; vertical lines: 1/12; horizontal lines: 1/16; accuracy of line placement: A = 2.10; harmonic ratio: 9/12/16, the fourth and the fifth; overall composition assessment: HR9/12/16, strong. The composition analysis of #380-14 is at the level of a strong representation of a 9/12/16, the fourth and the fifth harmonic, V1/12H1/16.

Additional notes: This is an image of a giraffe standing over trees with clouds and objects above the giraffe. These objects are inverted cones of varying sizes and there are 12 objects. The artist placed the composition of the giraffe such that there are 12 divisions of the space across the picture frame aligning to the various parts of the giraffe and trees. The horizontal 1/16 lines accurately delineate the placement of the clouds and cones. The horizontal lines (4<sup>th</sup>, 5<sup>th</sup>, 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup>) 1/16 accurately align to the giraffe's position. The horizontal 1/6 lines support the (3<sup>rd</sup>, 5<sup>th</sup>, 8<sup>th</sup>, 11<sup>th</sup> and 13<sup>th</sup>) 1/16 lines. The position of the giraffe gives the indication of a 3/4 angle, which implies depth. This picture has a strong fore, middle and back ground composition. This is a 3-dimensional image. The artist used black and white shapes with line and the fore, middle and back ground technique to create the artwork.

**#380-15; *El león Lion*, 2002; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

8 black V1/2, 1/4, 1/8; H1/2, 1/4  
 2 yellow V1/3; Hna

Total lines 10

Measurements: length 15.88 cm; height 23.99 cm; ratio = 0.66

V: 1/2, 1/4, 1/8 H: 1/2, 1/4  
 1/2 = 7.94 1/2 = 11.995  
 1/4 = 3.97, 11.91 1/4 = 5.9975, 17.99  
 1/8 = 1.985, 13.895  
 1/3 = 5.29, 10.5866  
 Total = 7 lines Total = 3 lines

Accuracy of lines: HR3/4, V1/3H1/4; VL1/3 = 2.3, VR1/3 = 1.8; H upper 1/4 = 2.4, H1/2 = 2.2, H lower 1/4 = 1.5; V = 2.05, H = 2.03; A = 2.04  
 HR1/2; V1/4H1/2; VL1/4 = 2.4, V1/2 = 2.1, VR1/4 = 0.5; H1/2 = 2.2; V = 1.66, H = 2.2; A = 1.93

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>

<i>Level of Evidence</i>								
Strong								
Moderate	x		x				V2	
Low								
Inconsistent								
Not Found		x		x		x		
Accuracy 0- 3	1.93		2.04					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-15; vertical; length 15.88 cm, height 23.99 cm; ratio = 0.66; vertical lines: 1/2, 1/4, 1/8; horizontal lines: 1/2, 1/4; accuracy of line placement: A = 2.04; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, moderate. The composition analysis of #380-15 is at the level of a moderate representation of a 3/4, the fourth harmonic, V1/3H1/4. There is evidence of a second harmonic ratio HR1/2; V1/4H1/2; VL1/4 = 2.4, V1/2 = 2.1, VR1/4 = 0.5; H1/2 = 2.2; V = 1.66, H = 2.2; A = 1.93.m Additional notes: This is an image of a lion. The horizontal upper 1/4 aligns to the top of the lion's head. The H1/2 line aligns to the placement of the bottom of the lion's eyes. The H lower 1/4 in general aligns to the bottom of the lion's head. The VL1/8 in general aligns to the right side of the lion's head; the VL1/4 accurately describes the center of the lion's face. The VL1/3 accurately aligns to the left eye of the lion, the front right leg and in general the placement of the cloud directly above the lion's head. The V1/2 aligns to the left side of the lion's head and the front left leg and the cloud at the top of the picture. The VR1/3 describes the left front leg of the lion. The VR1/8 in general aligns to the rear leg of the lion. There are more significant composition lines, such as, the VL1/4, the placement of the center of the lion's face and the V1/2, the delineation of the lion's head from the other half of the picture frame, with the HR3/4. This is a 2-dimensional image. The artist used black and white lines with shapes to create the artwork.

**#380-16; *El rinoceroceros, Rhinoceros*, 2002; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

2	black	V1/4; Hna
10	yellow	V1/3; H1/9
2	green	VFR; Hna

Total lines 14

Measurements: length 15.74 cm; height 23.94 cm; ratio = 0.657  
V: 1/4, 1/3, FR H: 1/9



1/4 = 3.95, 11.79  
 1/3 = 5.246, 10.49  
 FR = 6.01, 9.727

1/9 = 2.66, 5.32, 7.98, 10.64, 13.3, 15.96,  
 18.62, 21.28

Total = 6 lines

Total = 8 lines

Accuracy of lines: HR3/4, V1/4H1/3; VL1/4 = 2.4, V1/2 = 1.5, VR1/4 = 2.2;  
 H upper 1/3 = 2.5, H lower 1/3 = 2.7; V = 2.03, H = 2.6; A = 2.315

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V2 H2	V2
Moderate								
Low								
Inconsistent								
Not Found	x	x		x		x		
Accuracy 0- 3			2.315					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-16; vertical; length 15.74 cm, height 23.94 cm; ratio = 0.657; vertical lines: 1/4, 1/3, FR; horizontal lines: 1/9; accuracy of line placement: A = 2.315; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, strong. The composition analysis of #380-16 is at the level of a strong representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This is an image of a rhinoceros. The hump of the rhinoceros is centered at the VRFR line and supported by the VL1/3. The composition of the picture of the rhinoceros is an underlying vertical 1/4 divisions. The horizontal 1/9 lines describe the background clouds and plants in general. The H upper 1/3 precisely aligns to the placement of the hump of the rhinoceros. The H lower 1/3 accurately aligns to the underbelly, chin and horn. The H 4<sup>th</sup>, 5<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> 1/9 lines describe the placement of the ears, eyes, horn, and the four leg positions. The 3/4 angle of the position of the rhinoceros suggests depth, the artist aligned the VR1/3, VR1/4 and VRFR, which is the combination of the 1/4 and 1/3 lines plus the FR (harmonic ratio and Rule of Three). This is a 3-dimensional image. The artist used black and white shapes with line to create a dynamic DEMR posture of the animal as if it is in movement for the artwork.

#380-17; *El borracho, The Drunk*, 2005; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

- 1 black V1/2; Hna
- 7 yellow V1/3; H1/6
- 2 green Vna; HFR

Total lines 10

Measurements: length 7.32 cm; height 27.33 cm; ratio = 0.2678

V: 1/2, 1/3

H: 1/6, FR

1/2 = 3.66

1/6 = 4.555, 9.11, 13.665, 18.22, 22.775

1/3 = 2.44, 2.88

FR = 10.439, 16.89

Total = 3 lines

Total = 7 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 2.4; H upper 1/3 = 0.8, H lower 1/3 = 1.4; V = 2.4, H = 1.1; A = 1.75

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2 H2	H2
Moderate		x						
Low								
Inconsistent								
Not Found	x		x	x		x		
Accuracy 0- 3		1.75						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #380-17; vertical; length 7.32 cm, height 27.33 cm; ratio = 0.2678; vertical lines: 1/2, 1/3, FR; horizontal lines: 1/6, FR; accuracy of line placement: A = 1.75; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #380-17 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a man sitting. This is an elongated figure composition and the focus is on the vertical alignment of the picture frame. The V1/2 lines accurately describes

the left eye of the figure as well as the nose, chin, center of the neck, center of the shirt, the belt, pants, and part of the hand. The horizontal H1/3 lines describe the placement of the neck and shoulders and the waist of the figure. The horizontal FR lines support this 1/3 division of the picture frame. This is a 2-dimensional image. The artist used black and white lines with shapes to create the artwork.

**#381, female, 40 years old; 38 years at JLDF; 20 years at the art school; myopia- wears glasses; socioeconomic status/high; range of time of artwork used in the study: 2001-2006**

381-1; *Acueducto, Aqueduct*, 2002; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

6	black	V1/2, L1/4, 1/8; H upper 1/8, upper 1/4
2	yellow	V1/3; Hna
5	diagonal	V1; H4

Total lines 12

Measurements: length 17.22 cm; height 11018 cm; ratio = 0.649

V: 1/2, L1/4, R1/8, VL1/4<sup>c</sup> H upper FR      H: upper 1/8, upper 1/4, 2<sup>nd</sup> 1/5<sup>c</sup>

1/2 = 8.7

upper 1/3, lower FR<sup>c</sup> upper 1/3,

L1/4 = 4.35

lower 1/4<sup>c</sup> upper FR, lower 1/4

1/8 = 2.175, 15.045

<sup>c</sup> upper FR; upper 1/8 = 1.3975

1/3 = 5.74, 11.48

upper 1/4 = 2.795

diagonal = 2.175<sup>c</sup> 4.27

4.472<sup>c</sup> 3.726, 8.25<sup>c</sup> 3.726

6.9<sup>c</sup> 3.726, 13.705<sup>c</sup> 4.27

Total = 7 lines

Total = 6 lines

Accuracy of lines: HR3/4, V1/3H1/4; VL1/3 = 2.0, VR1/3 = 2.0; H upper 1/8 = 3.0,

H upper 1/4 = 2.0, H1/2 = 2.8, H lower 1/4 = 3.0, H lower 1/8 = 1.5; V= 2.0, H = 2.46;

A = 2.23

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								

Strong			x				V2	H2
Moderate								
Low								
Inconsistent								
Not Found	x	x		x		x		
Accuracy 0- 3			2.23					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-1; horizontal; length 17.22 cm, height 11.18 cm; ratio = 0.649;  
 vertical lines: 1/2, L1/4, R1/8, VL1/4<sup>c</sup> H upper FR; horizontal lines: upper 1/8,  
 upper 1/4, 2<sup>nd</sup> 1/5<sup>c</sup> upper 1/3, lower FR<sup>c</sup> upper 1/3, lower 1/4<sup>c</sup> upper FR,  
 lower 1/4<sup>c</sup> upper FR ; accuracy of line placement: A = 2.23; harmonic ratio: 3/4,  
 the fourth; overall composition assessment: HR3/4, strong. The composition  
 analysis of #381-1 is at the level of a strong representation of a 3/4, the fourth  
 harmonic, V1/3H1/4. Additional notes: This is an image of an aqueduct. The  
 structure is designed with linear perspective and this technique gives the  
 impression of depth. The horizontal 1/8 line aligns precisely with the line the  
 artist gives for the top of the structure. The H1/2 aligns to the division on the left  
 side (looking at the picture) of the two levels of the aqueduct. The slanted lines of  
 perspective from the 2<sup>nd</sup> 1/5 and H 1/2 go to the H upper 1/3. The H lower FR and  
 lower 1/4 go to the upper FR. These diagonal lines have a varying location for the  
 vanishing point. The vertical 1/3 lines align at a moderate level to the section of  
 the tunnels of the aqueduct. The overall composition demonstrates a combined  
 use of linear perspective and DEMR with Rule of Three. This is a 3-dimensional  
 image. The artist used black and white lines with shapes and linear perspective to  
 create the artwork.

**#381-2**; Chango, Monkey, 2003; óleo sobre tela, oil on canvas; assessment grid  
 lines: count/color/ description:

1	black	V1/4; Hna
10	yellow	V1/3; H1/9
4	red	V1/5; Hna
3	green	VFR; H upper FR

Total lines 18

Measurements: length 13.7 cm; height 17.15 cm; ratio = 0.798  
 V: R1/4, 1/3, 1/5, FR                      H: 1/9, upper FR

15.2

$R1/4 = 10.475$

$1/9 = 1.90, 3.8, 5.7, 7.6, 9.5, 11.4, 13.3,$

$1/3 = 4.56, 9.133$

upper FR = 6.55

$1/5 = 2.74, 5.48, 8.22, 10.96$

FR = 5.23, 8.467

Total = 9 lines

Total = 9 lines

Accuracy of lines: HR3/5, V1/5H1/3; V 1<sup>st</sup> 1/5 = 1.5, 2<sup>nd</sup> 1/5 = 2.4, 3<sup>rd</sup> 1/5 2.7, 4<sup>th</sup>

1/5 = 2.6; H upper 1/3 = 1.5, H lower 1/3 = 2.4; V = 2.3, H = 1.95; A = 2.125

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2 H2	V2 H1
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.125			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-2; vertical; length 13.7 cm, height 17.15 cm; ratio = 0.798; vertical lines: R1/4, 1/3, 1/5, FR; horizontal lines: 1/9, upper FR; accuracy of line placement: A = 2.125; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, strong. The composition analysis of #381-2 is at the level of a strong representation of a 3/5, the sixth harmonic, V1/5H1/3. Additional notes: This is an image of a monkey climbing downward in a tree while eating a banana. The artist placed the monkey on the right side of the picture (looking at the image). The tree extends in the entire picture frame except the lower left hand corner, which is left blank except for a few leaves. The V 3<sup>rd</sup> and 4<sup>th</sup> 1/5 lines frame the position of the monkey. The V 4<sup>th</sup> 1/5 line goes directly through the center of the monkey's left eye. The VFR supports the V 3<sup>rd</sup> 1/5 in describing the placement of the monkey's body, right arm, right leg and tail. The horizontal lines also align to the placement of the monkey in the tree. The H 1<sup>st</sup> 1/9 aligns to the end of the tail, 2<sup>nd</sup> 1/9 aligns to the bend in the tail, 3<sup>rd</sup> 1/9 aligns in general to the placement of the edges of the tree limbs. The H 4<sup>th</sup> 1/9 aligns to the right foot, H 5<sup>th</sup> 1/9 aligns to the placement of the eyes and ear. The H 6<sup>th</sup> 1/9 aligns to the bend



Analysis #381-3; horizontal; length 24.33 cm, height 20.22 cm; ratio = 0.83; vertical lines: 1/2; horizontal lines: 1/3; accuracy of line placement: A = 2.0; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #381-3 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a sea town. The artist has divided the composition vertically in half. The V1/2 aligns to this delineation. The H upper 1/3 accurately describes the horizon line. The H lower 1/3 in general aligns to the lines of the bridge. The H lower FR accurately aligns to the bridge placement. The artist divided horizontally the picture into thirds. The top third is from the horizon line to the clouds. The middle third section is from the houses just before the bridge to the horizon line of the mountains. The lower third is the bridge and water. This is a 2-dimensional image. The artist used shapes with light and dark values with fore, middle and background technique to create the artwork.

**#381-4; *El velero, Salboat*, 2001; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:**

3 black V1/2, 1/4; Hna  
 2 yellow Vna; H1/3  
 Total lines 4

Measurements: length 19.86 cm; height 24.45 cm; ratio = 0.812  
 V: 1/2, 1/4 H: 1/3  
 1/2 = 9.93 1/3 = 8.15, 16.3  
 1/4 = 4.965, 14.895  
 Total = 3 lines Total = 2 lines

Accuracy of lines: HR3/4, V1/4H1/3; VL1/4 = 2.6, V1/2 = 2.2, VR1/4 = 2.2;  
 H upper 1/3 = 2.3, H lower 1/3 = 2.4; V = 2.33, H = 2.35; A = 2.34

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				H2	
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		

Accuracy			2.34					
0- 3								

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-4; vertical; length 19.86 cm, height 24.45 cm; ratio = 0.812; vertical lines: 1/2, 1/4; horizontal lines: 1/3; accuracy of line placement: A = 2.34; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, strong. The composition analysis of #381-4 is at the level of a strong representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This is an image of a sailboat on the water with houses on the shore in the background. The artist divided the horizontal composition in thirds. The H upper 1/3 aligns to the tallest building and the lowest clouds. The H lower 1/3 moderately aligns to the shoreline. The VL1/4 accurately aligns to the placement of the tallest building. The V1/2 describes the placement of the center cloud, center house and front of the large fish in the water. This line delineates the left side of the sailboat (looking at the picture). The VR1/4 aligns to the placement of the cloud on the right side and identifies the right side of the sailboat. There is an indication of linear perspective in the use of the light and dark shadows of the buildings and the angle of the roofs. This is a 3-dimensional image. The artist used shapes with light and dark values and fore, middle and back ground technique with some linear perspective to create the image.

**#381-5; *Mi novio Vicente, My Boyfriend Vincente*, 2006; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:**

5 black V1/2; H1/4, 1/8  
7 yellow V1/3; H1/6  
Total lines 12

Measurements: length 19.75 cm; height 24.07 cm; ratio = 0.82  
V: 1/2, 1/3 H: 1/4, 1/8, 1/6  
1/2 = 9.875 1/4 = 6.0, 18.07  
1/3 = 6.58, 13.17 1/8 = 3.0, 21.0  
1/6 = 4.0, 8.0, 12.0, 16.0, 20.0

Total = 3 lines

Total = 9 lines

Accuracy of lines: HR3/4, V1/3H1/4; VL1/3 = 2.4, VR1/3 = 2.2;  
H upper 1/8 = 2.7, H upper 1/4 = 2.6, H1/2 = 2.4, H lower 1/4 = 2.8; H lower 1/8 = 2.0; V = 2.3, H = 2.5; A = 2.4



<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				H2	
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.4					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-5; vertical; length 19.75 cm, height 24.07 cm; ratio = 0.82; vertical lines: 1/2, 1/3; horizontal lines: 1/2 , 1/4, 1/8, 1/6; accuracy of line placement: A = 2.4; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, strong. The composition analysis of #381-5 is at the level of a strong representation of a 3/4, the fourth harmonic, V1/3H1/4. Additional notes: This is an image of a figure. At the top of the picture are two birds and clouds, which are on both sides of the figure placed symmetrically. The background of the picture is made with multiple horizontal layers of various textures and objects. The figure is placed in the center of a vertical division of three sections. The V 1/3 lines describe the placement on both sides of the figure. The H upper 1/8 accurately describes the placement of the eyebrows and ears of the figure. The H upper 1/4 accurately describes the chin and hairline. The H1/2 aligns to the placement of the waist of the figure and the top of the background layer that has large droplets of water within the layer. The H lower 1/4 accurately aligns to the background layer with black dots and the figure's shoes. This is a 2-dimensional image. The artist used shapes with light and dark values to create the artwork.

**#381-6; *La abuela, Grandmother*, 2006; la litografía, lithograph; assessment grid lines: count/color/ description:**

2 black V1/2; H1/2  
 2 yellow Vna; H1/3  
 Total lines 4

Measurements: length 15.8 cm; height 23.76 cm; ratio = 0.664

V: 1/2  
 1/2 = 7.9  
 Total = 1 lines

H: 1/2, 1/3  
 1/2 = 11.88  
 1/3 = 7.92, 15.84  
 Total = 3 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 0.5; H upper 1/3 = 2.4, H upper 1/3 = 0.8; V = 0.5, H = 1.6; A = 1.05

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					H2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.05						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-6; vertical; length 15.8 cm, height 23.76 cm; ratio = 0.664; vertical lines: 1/2; horizontal lines: 1/2 , 1/3; accuracy of line placement: A = 1.05; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3 , low. The composition analysis of #381-6 is at the level of a low representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a portrait in profile of an elder woman. The image fills the entire picture frame. The V1/2 aligns to the division the artist has made for the front versus the back of the head. The line identifies the placement in general of the hair and neck muscles. The horizontal upper 1/3 accurately aligns to the bottom of the eye. The H lower 1/3 in general aligns to the sweater and the image of a building in the background. This is a 2-dimensional image. The artist used black and white line with shapes to create the artwork.

**#381-7;** *Dormitorio de van Gogh, Van Gogh's Bedroom*, 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

1 black V1/2; Hna  
 4 red V1/5; Hna  
 2 green VFR;Hna  
 2 diagonals Vna; H2  
 Total lines 9

Measurements: length 17.42 cm; height 23.83 cm; ratio = 0.73

V: 1/2, 1/5, FR H: 2<sup>nd</sup> 1/12 <sup>c</sup> 3<sup>rd</sup> 1/12, 7<sup>th</sup> 1/12 <sup>c</sup> lower FR

1/2 = 7.9 3.97 <sup>c</sup> 5.957, 13.9 <sup>c</sup> 14.727

1/5 = 3.48, 6.96, 10.44, 13.9

FR = 6.65, 10.76

Total = 7 lines

Total = 2 lines

Accuracy of lines: HR1/2, V1/2Hna; V1/2 = 1.5; Hna; V = 1.5, Hna; A= 1.5

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate	x							V2
Low								
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.5							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-7; vertical; length 17.42 cm, height 23.83 cm; ratio = 0.73; vertical lines:1/2, 1/5, FR; horizontal lines: 2<sup>nd</sup> 1/12 <sup>c</sup> 3<sup>rd</sup> 1/12, 7<sup>th</sup> 1/12 <sup>c</sup> lower FR; accuracy of line placement: A = 1.5; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, moderate. The composition analysis of #381-7 is at the level of a moderate representation of a 1/2, the octave harmonic, V1/2Hna. Additional notes: This is an image of a bedroom. There are multiple objects in the room. There is an indication of the use of linear perspective; however, the use is inconsistent. There are inconsistent vanishing points. There is evidence of the use

of a HR1/2 harmonic ratio. This is supported by the VRFR and the V3rd 1/5 lines. The placement of the bedpost of the bed, which is set at a 3/4 angle, is near the V1/2. The artist offset the center of the composition to the asymmetrical point on the right (looking at the picture). Due to the confusing use of the linear perspective, there are no horizontal lines that align to a harmonic ratio of Rule of Three division. Overall, the composition is consistent. The vertical lines of the V1/5 lines, FR and V1/2 lines maintain the HR1/2 harmonic perceivable in the picture. This is a 2-dimensional image. The artist used black and white line with shapes to create the artwork.

**#381-8; *El rey, The King*, 2005; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

1 black V1/2;Hna  
 6 yellow V1/3; H (1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup> 7<sup>th</sup>)1/9  
 Total lines 7

Measurements: length 15.54 cm; height 24.26 cm; ratio = 0.64  
 V: 1/3 H: (1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup> 7<sup>th</sup>)1/9  
 1/3 = 5.18, 10.36 1/9 = 2.6955, 8.086, 16.17, 18.868

Total = 3 lines Total = 4 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 1.8; H 1<sup>st</sup> 1/9 = 2.3, 3<sup>rd</sup> 1/9 = 2.8, 6<sup>th</sup> 1/9 = 2.4, 7<sup>th</sup> 1/9 = 2.9; V = 1.8, H = 2.6; A= 2.2

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x					V2 H2	
Moderate								
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.2						

### Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-8; vertical; length 17.42 cm, height 23.83 cm; ratio = 0.73; vertical lines: 1/3; horizontal lines: (1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup>, 7<sup>th</sup>) 1/9; accuracy of line placement: A = 2.2; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of #381-8 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a large heart and a figure with outspread arms standing in front of it. There are objects drawn on the heart shape on the side and in front of the heart. The artist placed the figure at the VR1/3 location precisely. The VL1/3 in general aligns to the placement of the heart shape on the left side (looking at the image). The V1/2 aligned to the rectangle with a small figure in it at the base of the heart and in the fore ground of the picture. The H 1<sup>st</sup> 1/9 accurately aligns to the top of the heart. The H 3<sup>rd</sup> 1/9 accurately aligns to the line of the outstretched arms. The 6<sup>th</sup> 1/9 precisely aligns to the knees of the figure and the 7<sup>th</sup> 1/9 accurately aligns to the line given by the artist at the bottom of the heart. The artist distorted the heart shape and this asymmetrical alignment created the main composition line at the figure's location at VR1/3. The V1/2 carries the weight of the heart shape, which gives the balance to the picture. This is a 2-dimensional image. The artist used black and white shapes with line to create the artwork.

**#381-9; *El toro, The Bull*, 2004; la litografía, lithograph; assessment grid lines: count/color/ description:**

8 black V(1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup>) 1/12; Hna  
8 yellow Vna; H 1/9  
1 green Vna; H lower FR  
Total lines 17

Measurements: length 24.56 cm; height 15.72 cm; ratio = 0.64  
V: (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup>) 1/12 H: 1/9, lower FR  
1/12 = 2.046, 4.0926, 6.1386, 8.1846 1/9 = 1.746, 3.49, 5.239, 6.986,  
12.27, 16.78, 18.82, 20.87 8.73, 10.47, 12.22, 13.97  
lower FR = 9.7154

Total = 8 lines

Total = 9 lines

Accuracy of lines: HR3/4, V1/4H1/3; VL1/4 = 2.6, V1/2 = 2.0, VR1/4 = 2.8; H  
1<sup>st</sup> 1/9  
= 3.0, 2<sup>nd</sup> 1/9 = 2.7, 3<sup>rd</sup> 1/9 = 2.6, 4<sup>th</sup> 1/9 = 3.0, 5<sup>th</sup> 1/9 = 2.8, 6<sup>th</sup> 1/9 = 2.9, 7<sup>th</sup>  
1/9 = 2.8,  
8<sup>th</sup> 1/9 = 2.0; V = 2.46, H = 2.725; A = 2.59

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong			x				V2 H2	H1
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.59					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-9; horizontal; length 24.56 cm, height 15.72 cm; ratio = 0.64; vertical lines: (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup>) 1/12; horizontal lines: 1/9, lower FR; accuracy of line placement: A = 2.59; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, strong. The composition analysis of #381-9 is at the level of a strong representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This is an image of an oversized bull disproportionate to the bullfighter. The artist has accurately made a composition of vertical 1/12 divisions of the (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup>) 1/12's. This arrangement encompasses the 1/4 lines and the 1/3 lines. The horizontal composition is divided into 1/9's. The accuracy of the H 1/9 lines is 2.725. Since the vertical (5<sup>th</sup>, 7<sup>th</sup> and 11<sup>th</sup>) 1/12 lines were not aligned to the composition the overall harmonic ratio could not be a 9/12/16. The harmonic ratio with the most information and highest accuracy is the HR3/4, V1/4H1/3, A = 2.59. This is a 2-dimensional image. The artist used black lines and fore, middle and background technique to create the image.

**#381-10**; *Niños de la calle, Street Children*, 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

14 black V1/2, 1/4;H1/12  
 1 green Vna; H lower FR  
 Total lines 15

Measurements: length 16.1 cm; height 24.61 cm; ratio = 0.654

V: 1/4, 1/2, LFR

H: 1/12

1/2 = 8.05

1/12 = 2.05, 4.1, 6.15, 8.2, 10.25, 12.3,

14.35,

1/4 = 4.025, 12.075

16.4, 18.45, 20.5, 22.55

LFR = 6.149

Total = 4 lines

Total = 11 lines

Accuracy of lines: HR3/4, V1/4H1/3; VL1/4 = 1.8, V1/2 = 2.2, VR1/4 = 2.4; H upper

1/3 = 1.5, H lower 1/3 = 1.0; V = 2.133, H = 1.25; A = 1.69

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							H2	V1
Moderate			x					
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.69					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-10; horizontal; length 16.1 cm, height 24.61 cm; ratio = 0.654; vertical lines: 1/2, 1/4, LFR; horizontal lines: 1/12; accuracy of line placement: A = 1.69; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, moderate. The composition analysis of #381-10 is at the level of a moderate representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This is an image of a school scene. There are buildings in the background with children and cars in the front of the buildings. The artist placed a mountain in the center of the background. A large profile of a woman is on the right side in the lower half of the picture. The V1/2 line delineates the position of the woman's face. The VL1/4 and VR1/4 lines aligns to the left and right sides of the center part of the building. The composition of the picture is divided into 1/12 horizontally. The artist indicated sections of the buildings as 1/12 divisions. The H upper 1/3 aligns to a line connecting the buildings. The H lower 1/3 aligns to the placement of the

children and cars in the front. This is a 2-dimensional image. The artist used white line on black and black line on white to create the artwork.

**#381-11**; *China poblana, Country Girl*, 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

6 black V1/2, 1/4;H1/2, 1/4  
 4 red Vna; H1/5  
 Total lines 10

Measurements: length 16.41 cm; height 24.93 cm; ratio = 0.658

V: 1/2, 1/4

H: 1/2, 1/4, 1/5

1/2 = 8.2

1/12 = 12.465

1/4 = 4.1, 12.3

1/4 = 6.23, 18.697

1/5 = 4.98, 9.97, 14.95, 19.9

Total = 3 lines

Total = 7 lines

Accuracy of lines: HR1/2, V1/4H1/3; V1/2 = 3.0; H upper

1/4 = 2.5, H1/2 = 2.6, H lower 1/4 = 2.5; V = 3.0, H = 2.53; A= 2.76

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong	x							
Moderate								
Low								
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	2.76							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #381-11; horizontal; length 16.41 cm, height 24.93 cm; ratio = 0.658; vertical lines: 1/2, 1/4; horizontal lines: 1/2, 1/4, 1/5; accuracy of line placement: A = 2.76; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, strong. The composition analysis of #381-11 is at the level of a strong representation of a 1/2, the octave harmonic, V1/2H1/4. Additional notes: This is an image of a girl standing in a doorway. The artist placed the figure precisely at the V1/2 division. The VL 1/4 is the left side of the doorway (looking at the



picture). The VR1/4 is the right side of the doorway. The composition arrangement of the picture can be divided into 1/5's. The H 1<sup>st</sup> 1/5 is the alignment to the placement of the figure's eyes. The 2<sup>nd</sup> 1/5 is the location of the shoulders. The 3<sup>rd</sup> 1/5 identifies location of the bird image on the figure's dress. The 4<sup>th</sup> 1/5 accurately aligns to the bottom of the doorway and for the wall. The H 1/2 aligns to the lines on the wall. The H upper 1/4 aligns to the figure's nose. This is a symmetric image. This is a 2-dimensional image. The artist used black and white lines with shapes to create the artwork.

**#382, male; 28 years old; 19 years at JLDF; 5 years at the art school; myopia; socioeconomic status/medium; range of time of artwork used in the study: 2010-2014**

**#382-1; *Tigres, Tigres*, 2010; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:**

5 black V1/4;H1/2, 1/4  
 2 yellow V1/3; Hna  
 2 green VFR; Hna

Total lines 9

Measurements: length 16.56 cm; height 13.82 cm; ratio = 0.834

V: 1/4, 1/3, FR

H: 1/2, 1/4

1/4 = 4.14, 12.42

1/2 = 6.91

1/3 = 5.52, 11.04

1/4 = 3.455, 10.365

FR = 6.325, 10.23

Total = 6 lines

Total = 3 lines

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 2.3, VR1/3 = 1.0; H1/2 = 1.8;

V = 1.65, H = 1.8; A= 1.725

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2	V2
Low								
Inconsistent								
Not Found	x		x	x	x	x		

Accuracy 0- 3		1.725						
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Harmonic ratio with Rule of Three Analysis per Image

Analysis #382-1; horizontal; length 16.56 cm, height 13.82 cm; ratio = 0.834; vertical lines: 1/4, 1/3, FR; horizontal lines: 1/2, 1/4; accuracy of line placement: A = 1.725; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #382-1 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of tigers. The main tiger is placed at the V1/3 alignment. The VR1/3 in general aligns to the right side of the tree (looking at the picture). The VFFR supports this placement. The horizontal 1/2 describes accurately the placement of the change in the background from a dark to the lighter gray and the lowest level of the leaves on the tree. This is a 2-dimensional image. The artist used shapes with light and dark values and fore, middle and background technique to create the artwork.

**#382-2;** Dos caras, Two Faces, 2011; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:

5 black V1/2, 1/4;H1/2, upper 1/4  
2 yellow V1/3; Hna

Total lines 7

Measurements: length 21.8 cm; height 18.05 cm; ratio = 0.827

V: 1/2, 1/8, 1/3

H: 1/2, upper 1/4

1/2 = 10.9

1/2 = 9.025

1/8 = 2.725, 19.075

upper 1/4 = 4.5

1/3 = 7.266, 14.53

Total = 5 lines

Total = 2 lines

Accuracy of lines: HR1/2, V1/2H1/2; VL1/2 = 0.5; H1/2 = 1.5;

V = 0.5, H = 1.5; A= 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate							V2	

Low	x							
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.0							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #382-2; horizontal; length 21.8 cm, height 28.05 cm; ratio = 0.827; vertical lines: 1/2, 1/8, 1/3; horizontal lines: 1/2, upper 1/4; accuracy of line placement: A = 1.0; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, low. The composition analysis of #382-2 is at the level of a low representation of a 1/2, the octave harmonic, V1/2H1/2. Additional notes: This is an image of two figures that are placed in the rectangular shapes. These shapes are placed symmetrically on the picture frame equal distant from the V1/2 centerline. The H1/2 delineates the bottom of the rectangles (A = 1.5). The H upper 1/4 accurately aligns to the eyes of each figure. The VR1/3 line in general aligns to the right side of the left rectangle and the VR1/8 accurately aligns to the right side of the left rectangle. Overall, this is a low representation of the HR 1/2 , however, the use of the V1/3 divisions and the H1/2 are indicated. This is a 2-dimensional image. The artist used dark and light values and shapes to create the artwork.

**#382-3;** *Dos mundos, Two Worlds*, 2012; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:

4 black V1/2;H1/2, 1/4  
1 red Vna; H 3<sup>rd</sup> 1/5

Total lines 5

Measurements: length 19.2 cm; height 15.19 cm; ratio = 0.79

V: 1/2 H: 1/2, 1/4, 3<sup>rd</sup> 1/5

1/2 = 9.6 1/2 = 7.595

1/4 = 3.797, 11.39

3<sup>rd</sup> 1/5 = 9.114

Total = 1 line

Total = 4 lines

Accuracy of lines: HR1/2, V1/2H1/2; VL1/2 = 2.8; H1/2 = 1.0;

V = 2.8, H = 1.0; A= 1.9

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate	x							
Low								
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.9							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #382-3; horizontal; length 19.2 cm, height 15.19 cm; ratio = 0.79; vertical lines: 1/2; horizontal lines: 1/2, 1/4, 3<sup>rd</sup> 1/5; accuracy of line placement: A = 1.9; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, moderate. The composition analysis of #382-3 is at the level of a moderate representation of a 1/2, the octave harmonic, V1/2H1/2. Additional notes: This is an image of two large circles of the globe. The globes are set together in the center of the picture frame and are precisely at the V1/2 line placement. Below the circles are two photo images of clipper ships. The horizontal 1/4 aligns to the top of the two globes. The H 1/2 is off center and the H lower 1/4 in general aligns to the bottom of the globes and to the top of the ships. The H 3<sup>rd</sup> 1/5 accurately aligns to the bottom of the globes. This is a 2-dimensional image. The artist used lines of black and white with dark and light values to create the artwork.

**#382-4; *Mujer dormida, Sleeping woman*, 2014; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:**

5 black V1/2, L1/4;H1/4, upper 1/8

3 yellow VR1/3; H1/3

Total lines 8

Measurements: length 16.91 cm; height 14.07 cm; ratio = 0.842

V: 1/2, L1/4, R1/3

1/2 = 8.455

L1/4 = 4.227

VR1/3 = 11.27

Total = 3 line

H: 1/4, upper 1/8, 1/3

1/4 = 3.517, 10.55

upper 1/8 = 1.758

1/3 = 4.69, 9.38

Total = 5 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 1.5; H upper 1/3 = 1.0, H lower 1/3 = 2.4; V = 1.5, H = 1.7; A= 1.6

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V1 H2	
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.6						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #382-4; horizontal; length 16.91 cm, height 14.07 cm; ratio = 0.842; vertical lines: 1/2, L1/4, R1/3; horizontal lines: 1/4, upper 1/8, 1/3; accuracy of line placement: A = 1.6; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #382-4 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of two snow-covered mountains in the background and a building in the valley on the right side (looking at the picture). The VL1/4 and the VR1/3 align to the placement of the mountains in general. The V1/2 line is the DEMR point between the VL1/4 and the VR1/3 lines. The V1/3 line aligns to the building in the front. The main compositional line is the V1/3. The H lower 1/3 accurately delineates the placement of the top of the building in the picture. The building is drawn in linear perspective. This is a 3-dimensional image. The artist used shapes with light and dark values with fore, middle and background technique and linear perspective to create the artwork.

**#382-5; Abejas, Bees, 2010; técnica mixta sobre madera, mixed media on wood; assessment grid lines: count/color/ description:**

5 black V1/4;H1/2, 1/4  
Total lines 5

Measurements: length 7.32 cm; height 17.98 cm; ratio = 0.407  
V: 1/4 H: 1/4, upper 1/8, 1/3

1/4 = 1.83, 5.49

Total = 2 lines

1/2 = 8.99

1/4 = 4.495, 13.485

Total = 3 lines

Accuracy of lines: HR1/2, V1/4H1/; VL1/4 = 2.0, VR1/4 = 1.8; H1/2 = 1.0; V = 1.9, H = 1.0; A= 1.45

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate	x							
Low								
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.45							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #382-5; vertical; length 7.32 cm, height 17.98 cm; ratio = 0.407; vertical lines: 1/4; horizontal lines: 1/2,1/4; accuracy of line placement: A = 1.45; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, moderate. The composition analysis of #382-5 is at the level of a moderate representation of a 1/2, the octave harmonic, V1/4H1/2. Additional notes: This is a vertically oriented image of a beehive hanging in a tree branch. There are about 8 bees around the hive. The artist placed the beehive in the top half of the picture. The H1/2 aligns in general the hive and accurately to two of the bees. The VL1/4 and the VR1/4 at a moderate level bracket the placement of the beehive vertically. This is a 3-dimensional image. The artist has created a beehive with accurate detail of the geometric hexagons. Each hexagon has light and dark shading, which gives the impression of depth. The artist used shapes with lines and dark and light values and the indication of linear perspective in creating the artwork.

**#383, male; 27 years old; 21 years at JLDF; 4 years at the art school; myopia; socioeconomic status/medium to high; range of time of artwork used in the study: 2013-2015**

**#383-1;** Autorretrato, Self- Portrait, 2014; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:

2 black V1/2,R1/4; Hna  
 4 yellow V1/3; H1/3  
 2 green VRFR; H upper FR  
 Total lines 8

Measurements: length 12.7 cm; height 15.34 cm; ratio = 0.8279

V:1/2, R1/4, RFR

H: 1/3, upper FR

1/2 = 6.35

1/3 = 5.11, 10.226

1/4 = 9.5

upper FR = 5.859

1/3 = 4.23, 8.46

RFR = 7.848

Total = 5 lines

Total = 3 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 1.5; H upper 1/3 = 1.0, H lower 1/3 = 2.2; V = 1.5, H = 1.6; A= 1.55

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2 H2	V1 H1
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.55						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #383-1; vertical; length 12.7 cm, height 15.34 cm; ratio = 0.8279; vertical lines: 1/2, R1/4, RFR; horizontal lines: 1/3, upper FR; accuracy of line placement: A = 1.55; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #383-1 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is a self-portrait image. The V1/2 line aligns moderately to the center of the face. The VL1/3 accurately aligns to the right side of the face. The VRFR accurately aligns to the placement of the left eye, mouth and chin. The VR1/3 moderately aligns to the left side of the face. The H upper 1/3 aligns in general to the placement of the nose of the face. The H upper FR accurately aligns to the bottom of the nose. The H lower 1/3 aligns to the bottom of the chin. This is a 2-

dimensional image. The artist used shape and line with light and dark values to create the image.

#383-2; *El caballo y Don Quijote*, The Horse and Don Quijote, 2010; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/description:

3 black V1/3; H1/2  
 2 yellow V1/3; Hna  
 2 green Vna; HFR  
 Total lines 7

Measurements: length 8.33 cm; height 13.56 cm; ratio = 0.6143

V:1/3

1/3 = 2.776, 5.55

Total = 2 lines

H: 1/2, 1/4, FR

1/2 = 6.78

1/4 = 3.39, 10.17

FR = 8.38, 5.179

Total = 5 lines

Accuracy of lines: HR2/3, V1/3H1/2; VL1/3 = 2.0, VR1/3 = 1.5; H1/2 = 1.5, V = 1.75, H = 1.5; A = 1.625

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2 H2	V1 H1
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.625						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #383-2; vertical; length 8.33 cm, height 13.56 cm; ratio = 0.643; vertical lines: 1/3; horizontal lines: 1/2, 1/4, FR; accuracy of line placement: A = 1.625; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #383-2 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of a horse



and rider. The rider is carrying a large circular shield with a target pattern on it. The VL1/3 accurately aligns to the figure on the horse and the left side of the shield. The VR1/3 moderately aligns to the head, face, body and legs of the horse. The H upper 1/4 accurately aligns to the top of the shield and the horse's eyes. The upper FR accurately delineates the smaller circle, which is in the center, on the shield. The H 1/2 aligns to the tail and the rear of the horse and the bottom of the shield. The H lower FR aligns to the bottom of the horse. The H lower 1/4 aligns also to the horse's legs and the line of the ground. This is a 2-dimensional image. The artist used black and white shape to create the artwork.

#383-3; *Metate*, 2014; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:

3 black V1/2, L1/8; H upper 1/4  
 2 yellow VL1/3; H lower 1/3  
 Total lines 5

Measurements: length 19.46 cm; height 16.27 cm; ratio = 0.836  
 V:1/2, L1/8, L1/3 H: upper 1/4, lower 1/3  
 1/2 = 9.73 upper 1/4 = 4.06  
 L1/8 = 2.43 lower 1/3 = 5.4  
 L1/3 = 6.486  
 Total = 3 lines Total = 2 lines

Accuracy of lines: HRNF

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x	x	x		
Accuracy 0- 3								

Harmonic ratio with Rule of Three Analysis per Image

Analysis #383-3; horizontal; length 19.46 cm, height 16.27 cm; ratio = 0.8.36; vertical lines: 1/2, L1/8, L1/3; horizontal lines: upper 1/4, lower 1/3; accuracy of line placement: NF; harmonic ratio: NF; overall composition assessment: NF. The composition analysis of #383-3 is NF in the composition of the artwork.

Additional notes: This is a description of an animal in general description. There is a head and large eye. The H upper 1/4 aligns to a line in the picture behind the animal. The VL1/3 line aligns to the large eye. Overall, there is no harmonic ratio relationship found in the composition. This is a 2-dimensional image. The artist used light and dark values with line to create the artwork.

**#383-4; *La mujer, The woman*, 2013; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:**

7 black V1/2, 1/4; H1/2, 1/4, upper 1/8  
 2 yellow V1/3; Hna  
 2 green VFR; Hna  
 Total lines 11

Measurements: length 13.77 cm; height 16.51 cm; ratio = 0.834  
 V:1/2, 1/4, 1/3, FR H: 1/2, 1/4, upper 1/8  
 1/2 = 6.885 1/2 = 8.255  
 1/4 = 3.44, 10.327 1/4 = 4.127, 12.38  
 1/3 = 4.59, 9.18 upper 1/8 = 2.06  
 FR = 8.51, 5.259  
 Total = 7 lines Total = 4 lines

Accuracy of lines: HR3/4, V1/3H1/4; VL1/3 = 0.8, VR1/3 = 1.0; H upper 1/4 = 0.5, H1/2 = 0.8, H lower 1/4 = 0.8; V = 0.9, H = 0.7; A= 0.8

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate							V2	V1
Low			x					
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			0.8					

### Harmonic ratio with Rule of Three Analysis per Image

Analysis #383-4; vertical; length 13.77 cm, height 16.51 cm; ratio = 0.834; vertical lines: 1/2, 1/4, 1/3, FR; horizontal lines: 1/2, 1/4, upper 1/8; accuracy of line placement: A = 0.8; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, low. The composition analysis of #383-4 is at the level of a low representation of a 3/4, the fourth harmonic, V1/3H1/4. Additional notes: This is an image of a figure. The artist placed the figure, in general, in the middle third section of the picture vertically. The VFR's support this placement of the elements of the composition. The V1/2 aligns to the placement of the left eye of the figure. The H upper 1/8 aligns to the placement of the chin. The H upper 1/4 in general aligns to the chest of the figure. The H 1/2 in general aligns to the placement of the upper torso of the figure and the H lower 1/4 in general aligns to the abstract placement of the leg. This is a 2-dimensional image. The artist used light and dark values to create the artwork.

**#384, male, 31 years old; 15 years at JLDF; 12 at the art school; myopia and astigmatism; socioeconomic status/low to medium; range of time of artwork used in the study: 2007-2014**

**#384-1; *Serenata, Serenade*, 2014; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:**

3	black	V1/2, 1/4; Hna
16	yellow	V1/9; H1/9

Total lines 19

Measurements: length 15.76 cm; height 13.22 cm; ratio = 0.838

V:1/2, 1/4, 1/9

H: 1/9

1/2 = 7.88

1/9 = 1.468, 2.937, 4.406, 5.875,

7.344,

1/4 = 3.94, 11.82

8.81, 10.27, 11.74

1/9 = 1.75, 3.5, 5.25, 7, 8.75, 10.5,

12.25, 14

Total = 11 lines

Total = 8 lines

Accuracy of lines: HR4/6/9, V1/4H1/9; VL1/4 = 0.825, V1/2 = 2.6, VR1/4 = 1.5; H

1<sup>st</sup> 1/9 = 2.0, 2<sup>nd</sup> 1/9 = 2.7, 3<sup>rd</sup> 1/9 = 2.8, 4<sup>th</sup> 1/9 = 2.8, 5<sup>th</sup> 1/9 = 1.0, 6<sup>th</sup> 1/9 = 2.2, 7<sup>th</sup> 1/9

= 2.0, 8<sup>th</sup> 1/9 = 2.0; V = 2.2, H = 2.1875; A = 2.1937

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong						x	V2 H2	
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x	x			
Accuracy 0- 3						2.1937		

Harmonic ratio with Rule of Three Analysis per Image

Analysis #384-1; horizontal; length 15.76 cm, height 13.22 cm; ratio = 0.838; vertical lines: 1/2, 1/4, 1/9; horizontal lines: 1/9; accuracy of line placement: A = 2.1937; harmonic ratio: 4/6/9, the double fifth; overall composition assessment: HR4/6/9, strong. The composition analysis of #384-1 is at the level of a strong representation of a 4/6/9, the double fifth harmonic, V1/4H1/9. Additional notes: This is an image of a young woman serenaded by a young man playing the guitar. The artist arranged the elements of the picture using linear perspective and fore, middle, and strong background. The arrangement of the figures and the outdoor environment they are in aligns to the horizontal divisions of the 1/9's and the vertical 1/9's. The VL1/4 accurately aligns to the placement of the face of the figure, woman's hand, shoulder, and along the right side of the body. The V1/2 accurately aligns to the man's face, hat, arm, and the woman's left hand on her knee. This placement of the woman's hand on her knee is the center of the picture frame. The H 1/9's all describe the placement of the two figures their relationship to one another and their surroundings. This is a 3-dimensional image. The artist used shapes and lines with light and dark values, linear perspective and fore, middle and background techniques to create the artwork.

**#384-2;** *Ofrenda de muertos, Offering of the Dead*, 2008; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

- 5 black V1/2, 1/4, 1/8; Hna
- 2 yellow Vna; H1/3
- 3 green VFR; H lower FR

Total lines 10

Measurements: length 16.4 cm; height 11.43 cm; ratio = 0.696

V: 1/2, 1/4, 1/8, FR

H: 1/3, lower FR

1/2 = 8.2

1/3 = 3.81, 7.62

1/4 = 4.1, 12.3

lower FR = 7.06

1/8 = 2.05, 14.35

FR = 6.26, 10.13

Total = 7 lines

Total = 3 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 2.4; H upper 1/3 = 1.5, H lower 1/3 = 2.0; V = 2.5, H = 1.75; A = 2.075

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					H2	V2 H1
Low								
Inconsistent								
Not Found	x			x	x	x		
Accuracy 0- 3		2.075						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #384-2; horizontal; length 16.4 cm, height 11.43 cm; ratio = 0.696; vertical lines: 1/2, 1/4, 1/8, FR; horizontal lines: 1/3, lower FR; accuracy of line placement: A = 2.075; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #384-2 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a skull on a table with candles. The artist placed the skull in the center of the picture frame. The V1/2 aligns accurately to this placement. The H upper 1/3 aligns in general to the background of the black and

white horizontal shapes. The H lower 1/3 moderately aligns to the back of the table and to the back wall. The H lower FR supports this placement of the objects at this location. There is an indication of linear perspective from the angles of the sides of the table diverging to the same vanishing point. This is a 2-dimensional image. The artist used black and white lines to create the artwork.

**#384-3**; *Radio y música, Radio and Music*, 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

4 black V1/4; H1/2, lower 1/4  
 1 green VLFR; Hna

Total lines 5

Measurements: length 7.98 cm; height 9.53 cm; ratio = 0.837  
 V:1/4 , VFR H: 1/2, lower 1/4  
 1/4 = 1.995, 5.985 1/2 = 4.765  
 LFR = 3.048 lower 1/4 = 7.147  
 Total = 3 lines Total = 2 lines

Accuracy of lines: HR1/2; VnaH1/2; Vna; H1/2 = 1.0; Vna, H = 1.0; A = 1.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low								
Inconsistent	x							V1
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.0							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #384-3; vertical; length 7.98 cm, height 9.53 cm; ratio = 0.837; vertical lines: 1/4 , VFR; horizontal lines: 1/2, lower 1/4; accuracy of line placement: A = 1.0; harmonic ratio: 1/2, the octave; overall composition assessment: 1/2, inconsistent. The composition analysis of #384-3 is at the level of an inconsistent representation of a HR1/2, the octave harmonic, VnaH1/2. Additional notes: This

is an image of a radio. In general the picture frame is divided into half horizontally, H 1/2, looking at the large circle representing the speaker part of the radio. The artist attempted to draw the side of the radio box in perspective. The result is a confusion of the lines from the side to the front facing radio. These shapes on the side are not consistent to the HR1/2. This is a 2-dimensional image. The artist used black and white lines to create the artwork.

#384-4; *Amor rojo, Red Love*, 2008; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:

- 3 black Vna; H1/2, 1/4
- 4 yellow V1/3; H1/3
- 4 red V1/5; Hna
- 2 green VFR; Hna

Total lines 13

Measurements: length 24.79 cm; height 19.84 cm; ratio = 0.8

V: 1/3, 1/5, FR	H: 1/2, 1/4, 1/3
1/3 = 8.263, 16.526	1/2 = 9.92
1/5 = 4.958, 9.916, 14.87, 19.83	1/4 = 4.96, 14.88
FR = 9.469, 15.32	1/3 = 6.61, 13.226
Total = 8 lines	Total = 5 lines

Accuracy of lines: HR3/5; V1/5H1/3; V 1<sup>st</sup> 1/5 = 2.5, 2<sup>nd</sup> 1/5 = 2.0, 3<sup>rd</sup> 1/5 = 2.8, 4<sup>th</sup>

1/5 = 2.4; H upper 1/3 = 2.0, H lower 1/3 = 1.8; V = 2.425, H = 1.9; A = 2.162

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2	V2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					2.162			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #384-4; horizontal; length 24.79 cm, height 19.84 cm; ratio = 0.8; vertical lines: 1/3, 1/5, FR; horizontal lines: 1/2, 1/4, 1/3; accuracy of line placement: A = 2.162; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, strong. The composition analysis of #384-4 is at the level of a strong representation of a 3/5, the sixth harmonic, V1/5H1/3. Additional notes: This is an image of a couple kissing. The artist has placed them in an asymmetrical off center alignment. The VR1/3, VRFR and V 3<sup>rd</sup> 1/5 are all aligned to the placement of the arms, hands and bodies of the figures. The H upper 1/3 aligns to the top of the woman's head. The H lower 1/3 aligns to the placement of a ball that is located on the man's body at his heart. This is a 2-dimensional image. The artist used light and dark values with shapes and black lines to create the artwork.

#384-5; *Libros, Books*, 2008; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

- 1 black V1/2; Hna
- 4 yellow V1/3; H1/3

Total lines 5

Measurements: length 15.44 cm; height 19.86 cm; ratio = 0.779  
 V:1/2, 1/3 H:1/3  
 1/2 = 7.745 1/3 = 6.62, 13.24  
 1/3 = 5.16, 10.326  
 Total = 3 lines Total = 2 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 0.5; H upper 1/3 = 0.8, H lower 1/3 = 0.5; V = 0.5, H = 0.65; A= 0.575

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low		x					V2	



							H2	
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		0.575						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #384-5; vertical; length 15.44 cm, height 19.86 cm; ratio = 0.779; vertical lines: 1/2, 1/3; horizontal lines: 1/3; accuracy of line placement: A = 0.575; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, low. The composition analysis of #384-5 is at the level of a low representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a stack of books. The V1/2 line aligns in general to the corners of the books stacked on top. The H upper 1/3 in general aligns to the same corners of the books on top. The H lower 1/3 in general aligns to the bottom section of the books. This is a 2-dimensional image. The artist used black and white lines to create the artwork.

**#384-6; *La Bamba, The Dance*, 2009; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

5 black V1/2, 1/4; H1/2 1/4  
 4 yellow V1/3; H1/3  
 4 red Vna; H1/5

Total lines 13

Measurements: length 24.81 cm; height 18.8 cm; ratio = 0.779

V:1/2, 1/4, 1/3

H: 1/2, 1/4, 1/5

1/2 = 12.4

1/2 = 9.4

1/4 = 6.2, 18.6

1/4 = 4.7, 14.1

1/3 = 8.27, 16.54

1/5 = 3.76, 7.52, 11.28, 15.04

Total = 5 lines

Total = 4 lines

Accuracy of lines: HR3/4; V1/4H1/3; VL1/4 = 1.8, V1/2 = 1.5, VR1/4 = 2.6;

H upper 1/3 = 2.4, H lower 1/3 = 1.8; V = 1.966, H = 2.1; A= 2.033

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								

Strong								
Moderate			x				V2 H2	
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.033					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #384-6; vertical; length 24.81 cm, height 18.8 cm; ratio = 0.757; vertical lines: 1/2, 1/4, 1/3; horizontal lines: 1/2, 1/4, 1/5; accuracy of line placement: A = 2.033; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, moderate. The composition analysis of #384-6 is at the level of a moderate representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This is an image of two dancers in traditional Mexican dress. The woman is on the left side and the man is on the right side (looking at the picture). The V1/2 aligns to the placement of the center back ground post. The VL1/4 in general aligns to the head of the woman, her right side and dress in the front. The VR1/3 accurately aligns to the face, scarf and center of the body of the man. The H upper 1/3 accurately aligns to the placement to the woman's out stretched arms, which are holding up the edges of the dress. The H lower 1/4 moderately aligns to the waist of the man. This is a 2-dimensional image. The artist used black and white lines to create the artwork.

**#385, male; 38 years old; 32 years at JLDF; 18 years at the art school; dry eye; socioeconomic status/very low; range of time of artwork used in the study: 1995-2012**

**#385-1; *Cielo en la ciudad, Sky in the city*, 1997; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:**

2 black V1/2; H1/2  
 2 yellow V1/3; Hna  
 Total lines 4

Measurements: length 15.68 cm; height 9.65 cm; ratio = 0.615

V: 1/2, 1/3

H: 1/2

1/2 = 7.84

1/2 = 4.825

1/3 = 5.226, 10.45

Total = 3 lines

Total = 1 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 2.2; H upper 1/3 = 1.5, H lower 1/3 = 1.3; V = 2.2, H = 1.4; A = 1.8

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2	
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.8						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-1; horizontal; length 15.68 cm, height 9.65 cm; ratio = 0.615; vertical lines: 1/2, 1/3; horizontal lines: 1/2; accuracy of line placement: A = 1.8; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #385-1 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a cityscape. The artist has a high horizon line going from the city to the clouds. The artist placed the sun just slightly off center to the left. The V1/2 aligns to this placement at A = 2.2. The H upper 1/3 aligns to the line of houses across the picture frame. The H lower 1/3 aligns to the row of geometric rectangles placed in a section of the city. The V1/3 lines in general align to the placement of the sections of the city. This is a 2-dimensional image. The artist used shapes with light and dark values and some indication of fore, middle and background technique to create the artwork.

**#385-2; México, Mexico, 1995;** pastel sobre papel, pastel on paper; assessment grid lines: count/color/ description:

- 2 black Vna; H1/2, upper 1/4
  - 2 yellow V1/3; Hna
  - 1 green Vna; H lower FR
- Total lines 5

Measurements: length 15.58cm; height 13.31 cm; ratio = 0.854

V:1/3 H: 1/2, upper 1/4 , lower FR

1/3 = 5.19, 10.38 1/2 = 6.655

upper 1/4 = 3.327

Total = 2 lines lower FR = 8.225  
 Total = 3 lines Total = 3 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 1.0, VR1/3 = 1.5; H1/2 = 1.5;  
 V = 1.25, H = 1.5; A = 1.375

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2	
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.375						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-2; horizontal; length 15.58 cm, height 13.31 cm; ratio = 0.615; vertical lines: 1/3; horizontal lines: 1/2, upper 1/4, lower FR; accuracy of line placement: A = 1.375; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #385-2 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of a city with large mountains in the background. The artist has placed three mountains across the picture frame at the top, which indicate a 1/3 division of the space. The V1/3 lines aligns to this placement. The H upper 1/4 in general aligns across the cityscape to a building where the line accurately delineates the roof of the building. The lower H FR aligns to the bottom of the building. This is a 2-dimensional image. The artist used shapes with dark and light values to create the artwork.

#385-3; *Elefantes, Elephants*, 2012; aguafuerte sobre zinc, etching and aqua tint on zinc; assessment grid lines: count/color/ description:

5 black V1/2, 1/4; H1/2, upper 1/4  
 2 yellow V1/3; Hna  
 2 green VLFR; H lower FR  
 Total lines 9

Measurements: length 17.17 cm; height 11.68 cm; ratio = 0.68  
 V: 1/2, 1/4, 1/3, LFR                      H: 1/2, upper 1/4 , lower FR  
 1/2 = 8.588                                      1/2 = 5.84  
 1/4 = 4.29, 12.87                            upper 1/4 = 2.92  
 1/3 = 5.72, 11.44                            lower FR = 7.218  
 LFR = 6.56  
 Total = 6 lines                                      Total = 3 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 2.4, VR1/3 = 2.6; H1/2 = 1.8;  
 V = 2.5, H = 1.8; A = 2.15

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x					V2	V1 H1
Moderate								
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.15						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-3; horizontal; length 17.17 cm, height 11.68 cm; ratio = 0.68; vertical lines: 1/2, 1/4, 1/3, LFR; horizontal lines: 1/2, upper 1/4, lower FR; accuracy of line placement: A = 2.15; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of #385-3 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of two elephants. They are spaced in general on each side of the horizontal picture frame. The VL1/3 line accurately aligns to the placement of the left eye and left side of the elephant's trunk on the left side (looking at the image). The V1/2 does not clearly delineate the two elephants due to the texture of the image materials. The VR1/3 aligns accurately to the right ear and right leg of the elephant on the right side. The H upper 1/4 line accurately describes the placement of the tusks and underbelly of the elephants. The HFR in general aligns to the placement of the knees of the elephants. This is a 2-

dimensional image. The artist used black lines with white spaces to create the artwork.

**#385-4; Perfil egipcio, Egyptian Profile, 2007;** grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

7 black V1/2, 1/4; H1/2,1/4, upper 1/8  
 3 yellow V1/3; H upper 1/3  
 4 red Vna; H1/5  
 4 green VFR; HFR  
 Total lines 18

Measurements: length 12.24 cm; height 17.12 cm; ratio = 0.714

V: 1/2, 1/4, 1/3, FR	H: 1/2, 1/4, upper 1/8, upper 1/3, 1/5, FR
1/2 = 6.12	1/2 = 8.56
1/4 = 3.06, 9.18	1/4 = 4.28, 12.84
1/3 = 4.08, 8.16	upper 1/8 = 2.14
FR = 4.675, 7.56	upper 1/3 = 5.7
	1/5 = 3.42, 6.84, 10.26, 13.68
	FR = 6.539, 10.58
Total = 7 lines	Total = 11 lines

Accuracy of lines: HR3/5; V1/3H1/5; VL1/3 = 1.5, VR1/3 = 1.0; H 1<sup>st</sup> 1/5 = 2.0, 2<sup>nd</sup> 1/5 = 2.4, 3<sup>rd</sup> 1/5 = 2.5, 4<sup>th</sup> 1/5 = 1.0; V = 1.25, H = 1.975; A = 1.61  
 HR3/4; V1/3H1/4; VL1/3 = 1.0, VR1/3 = 1.0; H upper 1/4 = 1.8, H1/2 = 2.8, H lower 1/4 = 1.0; V = 1.25, H = 1.866; A = 1.558

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2 H1	V2 H2
Moderate			x		x			
Low								
Inconsistent								
Not Found	x	x		x		x		
Accuracy			1.558			1.61		

0-3								
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Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-4; horizontal; length 12.24 cm, height 17.12 cm; ratio = 0.714; vertical lines: 1/2, 1/4, 1/3, FR; horizontal lines: 1/2, 1/4, upper 1/8, upper 1/3, 1/5, FR; accuracy of line placement: A = 1.61; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, moderate. The composition analysis of #385-4 is at the level of a moderate representation of a 3/5, the sixth harmonic, V1/3H1/5. There is evidence of a second harmonic ratio HR3/4; V1/3H1/4; VL1/3 = 1.5, V1/2 = 2.1, VR1/4 = 1.0; H upper 1/4 = 1.8, H1/2 = 2.8, H lower 1/4 = 1.0; V = 1.25, H = 1.866; A = 1.558. Additional notes: This is an image of an Egyptian face with headdress in profile. The placement of the eye and front of the neck is in general 1/3 of the spacing in the picture frame. The ear and back of the neck are in general in the 1/3 spacing of the picture frame. The VL1/3 and VR1/3 lines align to this description at a moderate level of accuracy. The H 1/5 lines align to the profile composition at a moderate level. The H 1<sup>st</sup> 1/5 aligns to the placement of the bottom of the snake image on the headdress. The H 2<sup>nd</sup> 1/5 accurately aligns to the placement of the center of the eye. The H 3<sup>rd</sup> 1/5 line aligns accurately to the mouth and bottom of the ear. The H 4<sup>th</sup> 1/5 in general describes the widest section of the curvature of the neck. The HR3/5 is at a moderate level of accuracy, A = 1.61. There is evidence of a HR3/4 harmonic. The H upper 1/8 accurately describes the line across the top of the picture of the geometric pattern. The H upper 1/4 aligns to the placement of the headdress pattern on the head. The H1/2 accurately aligns to the bottom of the nose and the top section of the ear. The H lower 1/4 in general aligns to the location of the bottom of the chin and the neck. The HFR lines support the 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines. The VFR lines support the V1/3 lines. The level of accuracy for the two harmonic ratios is nearly the same. The placement and spacing of the profile of the head is in accordance with the artist's principle of proportionality for the human head in profile. The artist used the 1/2, 1/4, 1/3, 1/5 and FR lines to "build" the composition using an asymmetrical pattern. Overall, the H1/5 lines describe more of the image information so the HR3/5 harmonic is the best representation of the artwork. This is a two dimensional image. The artist used white lines with black spaces to create the artwork.

**#385-5;** *Castillo, Castle*, 1999; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:

- |   |        |                  |
|---|--------|------------------|
| 1 | black  | Vna; H upper 1/8 |
| 2 | yellow | V1/3; Hna        |
| 4 | red    | Vna; H1/5        |

1 green Vna; H lower FR  
 Total lines 8

Measurements: length 24.08 cm; height 20.69 cm; ratio = 0.859

V: 1/3 H: upper 1/8, 1/5, lower FR  
 1/3 = 8.026, 16.05 upper 1/8 = 2.58  
 1/5 = 4.138, 8.27, 12.41, 16.55  
 lower FR = 12.78  
 Total = 2 lines Total = 6 lines

Accuracy of lines: HR3/5; V1/3H1/5; VL1/3 = 1.0, VR1/3 = 2.5; H 1<sup>st</sup> 1/5 = 1.5,  
 2<sup>nd</sup>  
 1/5 = 1.0, 3<sup>rd</sup> 1/5 = 2.0, 4<sup>th</sup> 1/5 = 1.0; V = 1.75, H = 1.375; A = 1.56

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2	H1
Moderate					x			
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.56			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-5; horizontal; length 24.08 cm, height 20.69 cm; ratio = 0.859; vertical lines: 1/3; horizontal lines: upper 1/8, 1/5, lower FR; accuracy of line placement: A = 1.56; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, moderate. The composition analysis of #385-5 is at the level of a moderate representation of a 3/5, the sixth harmonic, V1/3H1/5. Additional notes: This is an image of a building with multiple towers. At the base of the structure in the fore ground across the picture frame are piles of skulls. The VR1/3 accurately aligns to the roof at the top of the building on the right side (looking at the picture). The VL1/3 in general aligns to a 1/3 division on the left side. The H 1<sup>st</sup> 1/5 moderately aligns to the line of the roof of the building. The H 2<sup>nd</sup> 1/5 line delineates the space at the bottom of the towers and the main building section. The H 3<sup>rd</sup> 1/5 lines accurately aligns (along with the H lower FR) to the division of the base of the building at the piles of skulls. The H 4<sup>th</sup> 1/5 in general



aligns to the arrangement of the skulls. The H upper 1/8 accurately aligns to the clouds going across the picture frame horizontally. This is a 2-dimensional image. The artist used black and white shapes with light and dark values with some indication of fore, middle and background technique to create the artwork.

#385-6; *Cuidad (la fábrica), City (Factory)*, 1998; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:

3 black V1/2, 1/4; Hna  
 2 yellow V1/3; Hna  
 4 red Vna; H1/5  
 1 green VRFR; Hna  
 2 diagonal Vna; H2  
 Total lines 12

Measurements: length 23.94 cm; height 17.12 cm; ratio = 0.715

V: 1/2, 1/4, 1/3, RFR

H: 1/5

1/2 = 11.97

1/5 = 3.42, 6.84, 10.27, 13.69

1/4 = 5.985, 17.95

diagonal = L23.94 ° H0

1/3 = 7.98, 15.96

diagonal = VL1/3° H upper 1/3

RFR = 14.79

Total = 6 lines

Total = 6 lines

Accuracy of lines: HR3/5; V1/3H1/5; VL1/3 = 2.3, VR1/3 = 2.5; H 1<sup>st</sup> 1/5 = 1.0, 2<sup>nd</sup> 1/5 = 1.0, 3<sup>rd</sup> 1/5 = 2.0, 4<sup>th</sup> 1/5 = 1.0; V = 2.4, H = 1.25; A = 1.825

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2	V1
Moderate					x			
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.825			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-6; horizontal; length 23.94 cm, height 17.12 cm; ratio = 0.715; vertical lines: 1/2, 1/4, 1/3, RFR; horizontal lines: 1/5, 2 diagonal lines; accuracy of line placement: A = 1.825; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, moderate. The composition analysis of #385-6 is at the level of a moderate representation of a 3/5, the sixth harmonic, V1/3H1/5. Additional notes: This is an image of a factory building. There is an indication of the use of linear perspective in the fore ground of the picture. The H 3<sup>rd</sup> 1/5 moderately delineates the placement of the large geometric shape that is angled to the right from the far right corner of the picture frame. At the VL1/3, the artist also placed a line angled to the same vanishing point as the other diagonal line from the shape. The large building on the right side is drawn in perspective and the VR1/3 accurately aligns to the placement of the edge of the building. The VL1/3 aligns to the smoke stack of a building on the left side. The H 1<sup>st</sup> 1/5 moderately aligns to the top of the buildings. The H 2<sup>nd</sup> 1/5 in general aligns to the structures. The H 3<sup>rd</sup> 1/5 accurately aligns to the horizontal line of the large shape in the fore ground. The H 4<sup>th</sup> 1/5 in general aligns to the changes in light and dark values on the large shape in the fore ground. There is an indication of the use of linear perspective but it is not consistent within the overall image to give the correct indication of depth. This is a 2-dimensional image. The artist used shape and line with light and dark values and some indication of linear perspective with fore, middle and background techniques to create the artwork.

**#385-7; *Composición n. 1, Composition No. 1*, 1995; lápiz sobre papel, pen on paper; assessment grid lines: count/color/ description:**

3	black	Vna; H1/2, 1/8
2	yellow	V1/3, Hna
2	red	Vna ; H(2 <sup>nd</sup> 3 <sup>rd</sup> ) 1/5
1	green	VRFR; Hna
Total lines 8		

Measurements: length 24.6 cm; height 18.58 cm; ratio = 0.755

V: 1/3, RFR	H: 1/2, 1/8, (2 <sup>nd</sup> 3 <sup>rd</sup> ) 1/5
1/3 = 8.2, 16.4	1/2 = 9.29
RFR = 15.2	1/8 = 2.32, 16.257
	(2 <sup>nd</sup> 3 <sup>rd</sup> ) 1/5 = 7.432, 11.148

Total = 3 lines

Total = 5 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 1.0, VR1/3 = 1.5; H1/2 = 2.5; V = 1.25, H = 2.5; A = 1.825

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2	V1
Moderate		x						
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.825						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-7; horizontal; length 24.6 cm, height 18.58 cm; ratio = 0.755; vertical lines: 1/3, RFR; horizontal lines: 1/2, 1/8, (2<sup>nd</sup> 3<sup>rd</sup>) 1/5; accuracy of line placement: A = 1.825; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #385-7 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of houses, streets, trees and clouds. The artist placed the sun in the precise V 3<sup>rd</sup> 1/5 location. This is an asymmetrical alignment. The vertical 1/3 lines support this arrangement. The VRFR supports the V 3<sup>rd</sup> 1/5 and VR1/3 lines. The H upper 1/8 in general aligns to the top of the trees and the bottom of the clouds. The H1/2 accurately aligns to the street that the artist created across the horizontal 1/2 placement in the picture. This is a 2-dimensional image. The artist used shape and line with light and dark values to create the artwork.

**#385-8; Robot con perro, Robot with Dog, 1997;** acuarela sobre papel, watercolor on paper; assessment grid lines: count/color/ description:

8 black V1/2, 1/4, 1/8; H1/2, 1/4  
Total lines 8

Measurements: length 23.93 cm; height 16.9 cm; ratio = 0.7

V:1/2, 1/4, 1/8

H: 1/2, 1/4

1/2 = 11.96

1/2 = 8.45

1/4 = 5.98, 17.9

1/4 = 4.225, 12.67

1/8 = 2.9, 20.93

Total = 5 lines

Total = 3 lines

Accuracy of lines: HR1/2; V1/2H1/2; V1/2 = 1.5; H1/2 = 2.0;  
V = 1.5, H = 2.0; A = 1.75

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								V1
Moderate	x							
Low								
Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	1.75							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-8; horizontal; length 23.93 cm, height 16.9 cm; ratio = 0.7; vertical lines: 1/2, 1/4, 1/8; horizontal lines: 1/2, 1/4; accuracy of line placement: A = 1.75; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, moderate. The composition analysis of #385-8 is at the level of a moderate representation of a 1/2, the octave harmonic, V1/2H1/2. Additional notes: This is an image of a vertical standing figure placed on the left side of the picture. A dog placed horizontally is on the right side of the picture. The V1/2 in general aligns to the left arm of the figure and the tail of the dog. The VL1/8 accurately aligns to the right side of the figure's head and leg. The VL1/4 aligns moderately to the center of the figure's face and body. The VR1/4 in general aligns to the placement of the dog's front legs. The VR1/8 delineates the placement of the dog's right eye. The H upper 1/4 accurately aligns to the hips of the figure and the bottom of the feet of the dog. This is a 2-dimensional image. The artist used shapes and lines with light and dark values to create the artwork.

**#385-9; *Romulus and Emus*, 1999; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:**

10 black V1/2, 1/4, 1/8; H1/2, 1/4, 1/8  
4 yellow V1/3; H1/3  
Total lines 14

Measurements: length 24.1 cm; height 19.85 cm; ratio = 0.82

V: 1/2, 1/4, 1/8, 1/3

1/2 = 12.05

1/4 = 6.025, 18.07

1/8 = 3.0, 21.0

1/3 = 8.0, 16.0

H: 1/2, 1/4, 1/8, 1/3

1/2 = 9.92

1/4 = 4.96, 14.8

1/8 = 2.48, 17.36

1/3 = 6.61, 13.23

Total = 7 lines

Total = 7 lines

Accuracy of lines: HR3/4; V1/3H1/4; VL1/3 = 2.2, VR1/3 = 1.8; H upper 1/4 = 2.0,

H1/2 = 1.5, H lower 1/4 = 2.0; V = 2.0, H = 2.0; A = 2.0

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2 H2	
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.0					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-9; horizontal; length 24.1 cm, height 19.85 cm; ratio = 0.82; vertical lines: 1/2, 1/4, 1/8, 1/3; horizontal lines: 1/2, 1/4, 1/8, 1/3; accuracy of line placement: A = 2.0; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, moderate. The composition analysis of #385-9 is at the level of a moderate representation of a 3/4, the fourth harmonic, V1/3H1/4. Additional notes: This is an image of the Roman mythology of Romulus and Remus, the twins. The artist divided the picture frame into 1/3's vertically and into 1/4's horizontally. The image of the large dog is elongated and the V1/2 aligns to the placement of the two figures underneath the dog on either side of the centerline. The head of the dog is extended into the left third (looking at the picture). The rear end of the dog extends into the right 1/3 section. The H upper 1/4 accurately aligns to the placement of the eyes of the dog. The H1/2 in general aligns to the head of the two figures. The H lower 1/4 accurately aligns to the line of the floor

across the picture frame. This is a 2-dimensional image. The artist used black and white shapes with light and dark values to create the artwork.

**#385-10**; *Los besos, Kisses*, 2008; pirograbado en madera, pyrograph in wood; assessment grid lines: count/color/ description:

4 black V1/2; H1/2, 1/4  
 4 yellow V1/3; H1/3  
 2 green Vna; HFR  
 Total lines 10

Measurements: length 9.86 cm; height 27.27 cm; ratio = 0.361

V:1/2, 1/3 H: 1/2, 1/4, 1/3, FR  
 1/2 = 4.93 1/2 = 13.63  
 1/3 = 3.28, 6.57 1/4 = 6.8, 20.45  
 1/3 = 9.09, 18.18  
 FR = 16.85, 10.11

Total = 3 lines

Total = 7 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 2.4, VR1/3 = 1.0; H1/2 = 1.5; V = 1.7; H = 1.5; A = 1.6

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					V2 H2	H2
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.6						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-10; vertical; length 9.86 cm, height 27.27 cm; ratio = 0.361; vertical lines: 1/2, 1/3; horizontal lines: 1/2, 1/4, 1/3, FR; accuracy of line placement: A = 1.6; harmonic ratio: 2/3, the fifth; overall composition

assessment: HR2/3, moderate. The composition analysis of #385-10 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of two profile faces set in an elongated vertical alignment. One face is upside down and the other is right side up. They are kissing. The artist divided the vertical space into thirds both vertically and horizontally. The VL1/3 accurately aligns to the placement of the eye of the upside down face. The VR1/3 in general describes the 1/2 division of the profile of the right side up head and face. The H 1/2 moderately aligns to the placement of the faces' mouths. The H upper 1/3 accurately aligns to the nose of the right side up face. The H lower 1/3 accurately aligns to the eye of the up side down face. The H lower FR aligns to the placement of the up side down face. This is a 2-dimensional image. The artist used white lines with black background to create the artwork.

**#385-11; *El calidoscopio, Kaleidoscope*, 2006; técnica mixta sobre madera, mixed media on wood; assessment grid lines: count/color/ description:**

- 1 black Vna; H1/2
- 2 yellow V1/3; Hna
- Total lines 3

Measurements: length 14.73 cm; height 17.09 cm; ratio = 0.86

V:1/3 H: 1/2  
 1/3 = 4.91, 9.82 1/2 = 8.54

Total = 2 lines Total = 1 line  
 Accuracy of lines: HRNF

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x	x	x	V2	
Accuracy 0- 3								

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-11; vertical; length 14.73 cm, height 17.09 cm; ratio = 0.86; vertical lines: 1/3; horizontal lines: 1/2; accuracy of line placement: A = NF; harmonic ratio: NF; overall composition assessment: NF. The composition analysis of #385-11 is not found. Additional notes: This is an abstract image of shapes with varying light and dark values. There is no evidence for a harmonic ratio relationship in the composition of the artwork. This is a 2-dimensional image. The artist used shapes with light and dark values to create the artwork.

**#385-12; *El gallo, The Rooster*, 1995; técnica mixta sobre papel, mixed media on paper; assessment grid lines: count/color/ description:**

5 black V1/2, 1/4, 1/8; Hna  
 2 yellow V1/3; Hna  
 8 red V1/5, H1/5  
 2 green VFR; Hna  
 Total lines 17

Measurements: length 14.73 cm; height 17.09 cm; ratio = 0.86

V:1/2, 1/4, 1/8, 1/3, 1/5, FR H: 1/5  
 1/2 = 8.085 1/5 = 3.226, 6.45, 9.67, 12.9  
 1/4 = 4.04, 12.12  
 1/8 = 2.02, 14.14  
 1/3 = 5.39, 10.78  
 1/5 = 3.23, 6.46, 9.7, 12.9  
 FR = 9.99, 6.17  
 Total = 13 lines Total = 4 lines

Accuracy of lines: HR3/5; V1/3H1/5; VL1/3 = 2.6, VR1/3 = 2.4; H 1<sup>st</sup> 1/5 = 2.8, 2<sup>nd</sup> 1/5 = 2.4, 3<sup>rd</sup> 1/5 = 2.0, 4<sup>th</sup> 1/5 = 1.5; V = 2.5, H = 2.175; A = 2.337

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong					x		V2	H2
Moderate								
Low								
Inconsistent								



Not Found	x	x	x	x		x		
Accuracy 0- 3					2.337			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #385-12; horizontal; length 14.73 cm, height 17.09 cm; ratio = 0.86; vertical lines: 1/2, 1/4, 1/8, 1/3, 1/5, FR; horizontal lines: 1/5; accuracy of line placement: A = 2.337; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, strong. The composition analysis of #385-12 is at the level of a strong representation of a 3/5, the sixth harmonic, V1/3H1/5. Additional notes: This is an image of a rooster. The artist placed the rooster's feet directly aligned to the VL1/3 line. The balance of the rooster's position is along the VL1/3 line. The VR1/3 line delineates the value change in the rooster's tale. The H 1<sup>st</sup> 1/5 line accurately aligns to the placement of the rooster's eye. The V 1<sup>st</sup> 1/5 accurately aligns to the rooster's eye. Therefore, these two lines are perpendicular. This is significant because the eye is small in area and the two lines precisely delineate the location. The H 2<sup>nd</sup> 1/5 accurately aligns to the background line and neck feathers of the rooster along with the pattern of the tail feathers. The H 3<sup>rd</sup> and 4<sup>th</sup> 1/5 lines in general are aligned to the placement of the feathers and rooster's feet. This is a 2-dimensional image. The artist used shape and line with light and dark values to create the artwork.

**#386; female; 28 years old; 22 years at JLDF; 4 years at the art school; keratoconus; socioeconomic status/low to medium; range of time of artwork used in the study: NA**

**#386-1; *La gitana, The Gyps*, 2013; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

7 black V1/2, 1/4, 1/8; H1/4  
 3 yellow VL1/3; H1/3  
 1 green Vna; H lower FR  
 Total lines 11

Measurements: length 8.27 cm; height 14.79 cm; ratio = 0.559

V: 1/2, 1/4, 1/8, L1/3 H: 1/4, 1/3, lower FR  
 1/2 = 4.135 1/4 = 3.69, 11.09  
 1/4 = 2.06, 6.2 1/3 = 4.93, 9.86  
 1/8 = 1.03, 7.23 lower FR = 9.14  
 L1/3 = 2.75  
 Total = 6 lines Total = 5 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 2.0; H upper 1/3 = 1.5, H lower 1/3  
 1.0; V = 2.0, H = 1.25; A = 1.625

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x					H1 H2	H1
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.625						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #386-1; horizontal; length 8.27 cm, height 14.79 cm; ratio = 0.559; vertical lines: 1/2, 1/4, 1/8, L1/3; horizontal lines: 1/4, 1/3, lower FR; accuracy of line placement: A = 1.625; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #386-1 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a figure sitting. The artist has placed the figure slightly off center. The V1/2 moderately aligns to the center of the figure. The H upper 1/3 line accurately aligns to the chin of the figure. The H lower 1/3 in general aligns to the chair and knees of the sitting figure. This is a 2-dimensional image. The artist used white lines on a black background to create the artwork.

**#386-2;** *Dos Fridas, Two Fridas*, 2013; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:

- 5 black V1/2, 1/4; H1/2, upper 1/4
  - 4 yellow V1/3; H1/3
  - 2 green Vna; HFR
- Total lines 11

Measurements: length 17.61 cm; height 14.92 cm; ratio = 0.847  
 V:1/2, 1/4, 1/3 H:1/2, upper 1/4, 1/3, FR  
 1/2 = 8.805 1/2 = 7.6

1/4 = 4.4, 13.2  
 1/3 = 5.87, 11.74

Total = 5 lines

upper 1/4 = 3.73  
 1/3 = 4.97, 9.94  
 FR = 5.69, 9.22

Total = 6 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 2.9; H upper 1/3 = 2.6, H lower 1/3 = 2.7; V = 2.9, H = 2.65; A = 2.775

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x					V2 H2	H2
Moderate								
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.775						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #386-2; horizontal; length 17.61 cm, height 14.92 cm; ratio = 0.847; vertical lines: 1/2, 1/4, 1/3; horizontal lines: 1/2, upper 1/4, 1/3, FR; accuracy of line placement: A = 2.775; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of #386-2 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of two Fridas. The artist has placed them sitting side by side and holding hands. There is a distinct vertical line precisely at the V1/2 created by the change in values on the background. The H upper 1/3 accurately aligns to the bottom of the noses and ears of the figures. The H upper 1/4 precisely aligns to the “uni-brow” of each figure. The H upper FR accurately aligns to the mouths of the figures. The H1/2 aligns to the shoulders and clothes at the neck of the figures. The H lower FR and 1/3 lines accurately align to the placement of the elbows of all four arms of the figures. The VL1/4 aligns accurately to the right eye of the Frida on the right side and the VR1/4 accurately aligns to the left eye of the Frida on the left (looking at the picture). This is a symmetrical composition and the vertical and horizontal lines of the 1/2, 1/4, 1/3 and FR are aligned to each major portrait element in the correct proportion. This is a 2-dimensional image. The artist used shape and lines with light and dark values to create the artwork.

**#387; male; 34 years old; 15 years at JLDF; 12 years at the art school; squint- wears glasses; socioeconomic status/low to medium; range of time of artwork used in the study: NA**

**#387-1; Colores, Colors, 2014; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:**

4 black V1/2, 1/4, L1/8; H1/2  
 3 yellow VR1/3; H1/3  
 3 green VRFR; HFR  
 Total lines 10

Measurements: length 16.87 cm; height 14.21 cm; ratio = 0.84

V:1/2, 1/4, L1/8, R1/3, RFR H:1/2, lower 1/3, FR

1/2 = 8.435

1/2 = 7.105

1/4 = 4.217, 12.65

lower 1/3 = 9.94

L1/8 = 2.10

FR = 5.427, 8.78

R1/3 = 11.24

RFR = 10.43

Total = 6 lines

Total = 4 lines

Accuracy of lines: HR3/4; V1/4H1/3; VL1/4 = 2.0, V1/2 = 1.7, VR1/4 = 1.0; H upper

1/3 = 1.0, H lower 1/3 = 2.0; V = 1.566, H = 1.5; A = 1.533

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x					
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.533					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #387-1; horizontal; length 16.87 cm, height 14.21 cm; ratio = 0.84; vertical lines: 1/2, 1/4, L1/8, R1/3, RFR; horizontal lines: 1/2, lower 1/3, FR;



Inconsistent								
Not Found		x	x	x	x	x		
Accuracy 0- 3	2.8							

Harmonic ratio with Rule of Three Analysis per Image

Analysis #388-1; vertical; length 16.76 cm, height 24.18 cm; ratio = 0.69; vertical lines: 1/2, 1/4; horizontal lines: 1/2, upper 1/4, lower 1/3; accuracy of line placement: A = 2.8; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, strong. The composition analysis of #388-1 is at the level of a strong representation of a 1/2, the octave harmonic, V1/2H1/2. Additional notes: This is an image of four faces. The artist divided the picture into 4 vertical and horizontal sections. The V1/2 line and the H1/2 line aligns accurately to these divisions. The VL1/4 and the VR1/4 lines each align accurately to the center of the faces. The H upper 1/4 aligns to the placement of the center of the eye of the top two faces. The H lower 1/3 line aligns to the center of the eyes of the bottom two faces. This is a 2-dimensional image. The artist used shapes, lines and light and dark values to create the artwork.

**#388-2**; *Cara, Face*, 2007; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:

6	black	V1/2, 1/4; H1/2, 1/4
2	yellow	Vna; Hna
2	green	VFR; Hna
1	blue dotted line	V1; Hna
Total lines 11		

Measurements: length 24.5 cm; height 20.96 cm; ratio = 0.855

V:1/2, 1/4, 1/3, FR, blue dotted line	H:1/2, 1/4
1/2 = 12.25	1/2 = 10.48
1/4 = 6.125, 18.375	1/4 = 5.24, 5.72
1/3 = 8.166, 16.33	
FR = 15.14, 9.358	
Blue dotted line = 11.286	
Total = 8 lines	Total = 3 lines

Accuracy of lines: HR3/4; V1/3H1/4; VL1/3 = 2.0, VR1/3 = 2.8; H upper 1/4 = 3.0, H1/2 = 2.4, H lower 1/4 = 2.0; V = 2.4, H = 2.466; A = 2.43;

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of</u>	<u>Use of Frame Ratio</u>

							<u>Three lines</u>	
<i>Level of Evidence</i>								
Strong			x				V2	V2
Moderate								
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.43					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #388-2; horizontal; length 24.5 cm, height 20.96 cm; ratio = 0.855; vertical lines: 1/2, 1/4, 1/3, FR; horizontal lines: 1/2, 1/4; accuracy of line placement: A = 2.43; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, strong. The composition analysis of #388-2 is at the level of a strong representation of a 3/4, the fourth harmonic, V1/3H1/4. Additional notes: This is an image of a face. The face covers the entire picture frame. The artist placed the center of the face in an asymmetrical alignment. The blue dotted line is the center of the face. The distance between the VL1/3 and the VR1/3 lines is the precise DEMR point. The facial elements are accurately described with the correct proportionality by the VL1/4, VL1/3, VLFR, blue dotted line, V1/2, VRFR, VR1/3 and VR1/4. The H upper 1/4 precisely aligns to the center of the eyes of the face. The H1/2 accurately aligns to the bottom of the nose. The H lower 1/4 accurately aligns to the chin of the face. The artist used the various geometric lines in the vertical dimension to asymmetrically align the facial elements. This is a 2-dimensional image. The artist used shapes and lines with light and dark values to create the artwork.

**#389; female; 47 years old; 44 years at JLDF; 22 years at the art school; astigmatism- no glasses; socioeconomic status/medium; range of time of artwork used in the study: 2002-2009**

**#389-1; Auditorio, Audience, 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

- 4 black Vna; H1/2, upper 1/4, 1/8
- 2 yellow Vna; H1/3
- 4 red V1/5; Hna
- 2 green Vna; HFR

Total lines 12

Measurements: length 14.89 cm; height 10.8 cm; ratio = 0.725

V: 1/5

1/5 = 2.97, 5.95, 8.93, 11.9

H: 1/2, upper 1/4, 1/8, 1/3, FR

1/2 = 5.4

upper 1/4 = 2.7

1/8 = 1.35, 9.45

1/3 = 3.6, 7.2

FR = 4.125, 6.674

Total = 4 lines

Total = 8 lines

Accuracy of lines: HR3/5; V1/5H1/3; V 1<sup>st</sup> 1/5 = 2.3, 2<sup>nd</sup> 1/5 = 2.0, 3<sup>rd</sup> 1/5 = 2.0, 4<sup>th</sup> 1/5 = 2.0; H upper 1/3 = 1.5, H lower 1/3 = 1.5; V = 2.075, H = 1.5; A = 1.78

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate					x		H2	H2
Low								
Inconsistent								
Not Found	x	x	x	x		x		
Accuracy 0- 3					1.78			

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-1; horizontal; length 14.89 cm, height 10.8 cm; ratio = 0.725; vertical lines: 1/5; horizontal lines: 1/2, upper 1/4, 1/8, 1/3, FR; accuracy of line placement: A = 1.78; harmonic ratio: 3/5, the sixth; overall composition assessment: HR3/5, moderate. The composition analysis of #389-1 is at the level of a moderate representation of a 3/5, the sixth harmonic, V1/3H1/5. Additional notes: This is an image of five faces presented in the upper half of the picture frame. The faces are placed above a series of small square white shapes. The V 1/5 lines align moderately to each set of three squares that are lined up across the picture horizontally. The H upper 1/3 aligns moderately to three of the sets of eyes of the faces and accurately to two of the faces. The H lower FR aligns to the precise placement of the top of the line of squares. The H upper 1/8 and upper 1/4 align to the top of the faces and the eyebrows. The H lower 1/8 line aligns



accurately to the placement of the lowest section of white squares. This is a 2-dimensional image. The artist used white and black shapes with lines to create the artwork.

#389-2; *El perico, The Parakeet*, 2003; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

2	black	Vna; H1/2, upper 1/4, 1/8
2	yellow	Vna; H1/3
3	diagonal	Vna; H3

Total lines 7

Measurements: length 8.08 cm; height 10.41 cm; ratio = 0.776

V: 1/2, 1/3

H: 1/2, 3 diagonal lines

1/2 = 4.04

1/2 = 5.2

1/3 = 2.69, 5.386

diagonal = H1/2 ° lower FR, 5.2 ° 6.43

upper 1/3 ° upper FR, 3.47 ° 3.97

lower 1/3 ° lower 1/4, 6.94 ° 7.8

Total = 3 lines

Total = 4 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 2.5, VR1/3 = 2.6: H1/2 = 2.4; V = 2.55, H = 2.4; A = 2.475

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x					V2	
Moderate								
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.475						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-2; vertical; length 8.08 cm, height 10.41 cm; ratio = 0.776; vertical lines: 1/2, 1/3; horizontal lines: 1/2, 3 diagonals; accuracy of line placement: A = 2.475; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of #389-2 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of a bird on a perch. The artist placed the large bird in the center of the picture frame. The V1/2 aligns accurately to this placement. The VL 1/3 accurately aligns to the right side of the bird, its wing and right front claw on the perch. The horizontal 1/2 line aligns to the placement of the bird's perch. The bird's position is slightly to the right (looking at the picture). This is a 2-dimensional image. The artist used white line and black shapes to create the artwork.

#389-3; *Hojas de café, Leaves of Coffee*, 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

1	black	Vna; H1/2
4	yellow	V1/3; H1/3
3	green	Vna; HFR
1	diagonal	Vna; H1
Total lines 9		

Measurements: length 12.74 cm; height 9.45 cm; ratio = 0.741  
 V: 1/3, RFR  
 1/3 = 4.246, 8.49  
 RFR = 7.87  
 H: 1/2, 1/3, FR, diagonal  
 1/2 = 4.725  
 1/3 = 3.15, 6.3  
 FR = 3.6, 5.84

diagonal = lower 1/8<sup>c</sup> upper 1/4

1.18<sup>c</sup> 2.36

Total = 3 lines

Total = 6 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 1.0, VR1/3 = 2.3; H1/2 = 2.0; V = 1.65, H = 2.0; A = 1.825

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								

Strong								
Moderate		x					V2 H2	V1 H2
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		1.825						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-3; horizontal; length 12.74 cm, height 9.45 cm; ratio = 0.741; vertical lines: 1/3, RFR; horizontal lines: 1/2, 1/3, FR, 1 diagonal; accuracy of line placement: A = 1.825; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #389-3 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of branches of coffee leaves and beans. The artist placed one branch in the center at the horizontal 1/2 line and the other main branch at the H upper 1/3. A third branch is the diagonal line from the lower 1/8<sup>c</sup> upper 1/4. The leaves and beans are placed in general in a vertical thirds division. The VL1/3 in general aligns to the placement of the convergence of the branches on the right side of the picture (looking at the image). The H upper FR aligns to the upper branch. This is a 2-dimensional image. The artist used white shapes with lines on a black background to create the artwork.

**#389-4; *Leopardo, Leopard*, 2006; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

1 black	V 1 <sup>st</sup> 1/12; Hna
13 yellow	V1/6; H1/9
Total lines 14	

Measurements: length 15.69 cm; height 15.28 cm; ratio = 0.973

V: 1<sup>st</sup> 1/12, 1/6

H: 1/9

1<sup>st</sup> 1/12 = 1.3

1/9 = 1.69, 3.39, 5.09, 6.78, 8.48, 10.18,

1/6 = 2.615, 5.23, 7.84, 10.46, 13

11.87, 13.57

Total = 6 lines

Total = 8 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 2.0; H upper 1/3 = 2.6, H lower 1/3 = 2.8; V = 2.0, H = 2.7; A = 2.35

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x					V2 H2	
Moderate								
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.35						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-4; horizontal; length 15.69 cm, height 15.28 cm; ratio = 0.973; vertical lines: 1<sup>st</sup> 1/12, 1/6; horizontal lines: 1/9; accuracy of line placement: A = 2.35; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of #389-4 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a leopard running. There are clouds above the leopard, twelve trees and a series of line patterns below the leopard. The V1/2 describes in general the division the artist makes on the left and right side of the image. The H upper 1/3 accurately aligns to the line of the trees and the tops of the leopard's ears. The H lower 1/3 precisely aligns across the length of the leopard and picture frame with each element of the anatomy of the animal's movement. There is an indication of the HR9/12/16 in this composition. The horizontal 1/9's are aligned with the placement of the elements in the composition. The V1/12's in general align to the leopard's movement. Overall, the V 1/6's are the most accurate. This is a 2-dimensional image. The artist used white shapes and lines to create the artwork.

**#389-5; *La jirafa y la cebra*, The Girafe and the Zebra, 2005; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:**

1 black                      Vna; H1/2  
5 yellow                     V1/3; H(1<sup>st</sup> 4<sup>th</sup> 5<sup>th</sup>)1/6  
Total lines 6

Measurements: length 8.48 cm; height 11.86 cm; ratio = 0.715  
V: 1/3                             H: 1/2, (1<sup>st</sup> 4<sup>th</sup> 5<sup>th</sup>)1/6  
1/3 = 2.82, 5.65                1/2 = 5.93  
    (1<sup>st</sup> 4<sup>th</sup> 5<sup>th</sup>)1/6 = 1.97, 7.9, 9.88

Total = 2 lines

Total = 4 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 1.0, VR1/3 = 2.5; H1/2 = 2.3; V = 1.75, H = 2.3; A = 2.025

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong							V2 H2	
Moderate		x						
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.025						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-5; vertical; length 8.48 cm, height 11.86 cm; ratio = 0.715; vertical lines: 1/3; horizontal lines: 1/2, (1<sup>st</sup> 4<sup>th</sup> 5<sup>th</sup> )1/6; accuracy of line placement: A = 2.025; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #389-5 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of a giraffe and a zebra. The H1/2 line aligns to the placement of a tall fence the giraffe is standing next to and below the fence is the zebra. Above the fence, the artist depicted mountains and a tree with leaves. The VR1/3 accurately aligns to the placement of the giraffe and the zebra. This is a 2-dimensional image. The artist used white shapes and lines to create the artwork.

**#389-6; *La obra (Mago de Oz), The Work (Wizard of Oz)*, 2004; grabado sobre linóleo, engraving on linoleum ; assessment grid lines: count/color/ description:**

3 black	V1/2, 1/4; Hna
2 yellow	Vna; H1/3
2 green	Vna; HFR
Total lines 7	

Measurements: length 8.63 cm; height 12.58 cm; ratio = 0.686  
V: 1/2, 1/4 H: 1/3, FR

1/2 = 4.315  
 1/4 = 2.157, 6.47  
 Total = 3 lines

1/3 = 4.19, 8.38  
 FR = 7.77, 4.8  
 Total = 4 lines

Accuracy of lines: HR3/4; V1/4H1/3; VL1/4 = 2.7, V1/2 = 2.4, VR1/4 = 1.5;  
 H upper 1/3 = 1.0, H lower 1/3 = 2.0; V = 2.2, H = 1.5; A = 1.85

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				H2	H2
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.85					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-6; vertical; length 8.63 cm, height 12.58 cm; ratio = 0.686; vertical lines: 1/2, 1/4; horizontal lines: 1/3, FR; accuracy of line placement: A = 1.85; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, moderate. The composition analysis of #389-6 is at the level of a moderate representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This is an image of two figures inside a structure. The artist placed the main figure on the V1/2 line. The center of the face is slanted slightly to the right. The VL1/4 describes the placement of the center of the smaller standing figure. The H upper 1/3 in general describes the location of the upper part of the structure. The H lower 1/3 accurately aligns to the chin and shoulders of the large sitting figure. This is a 2-dimensional image. The artist used white shapes and lines on a black background to create the artwork.

**#389-7; Pareja, Couple, 2005;** óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:

8 black	V1/2, R1/4, 1/8; H1/2, 1/4, 1/8
4 yellow	V1/3; H1/3
4 green	VFR; HFR
Total lines 16	

Measurements: length 16.11 cm; height 19.63 cm; ratio = 0.82

V: 1/2, R1/4, 1/8, 1/3, FR

H: 1/2, 1/4, 1/8, 1/3, FR

1/2 = 8.05

1/2 = 9.81

R1/4 = 12.08

1/4 = 4.9, 14.7

1/8 = 2.01, 14.09

1/8 = 2.45, 17.18

1/3 = 5.37, 10.74

1/3 = 6.54, 13.08

FR = 9.95, 6.15

FR = 12.13, 7.49

Total = 8 lines

Total = 8 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 2.6; H upper 1/3 = 2.3, H lower

1/3 = 2.0; V = 2.6, H = 2.15; A = 2.375

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong		x					V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.375						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-7; vertical; length 16.11 cm, height 19.63 cm; ratio = 0.82; vertical lines: 1/2, R1/4, 1/8, 1/3, FR; horizontal lines: 1/2, 1/4, 1/8, 1/3, FR; accuracy of line placement: A = 2.375; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of #389-7 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of a couple walking outside. The V1/2 line accurately aligns to the placement of the couple holding hands in the center of the picture. The H upper 1/3 line accurately describes the placement of the mouths of the figures. The H lower 1/3 moderately describes the placement of the man's right hand, his legs and the couple's hands together. The VL1/3 accurately aligns to the full length of the man's body and head. VR1/3 accurately aligns to the placement of the woman's right eye, dress and shoe. The VLFR accurately aligns to the man's









Strong						x	V2 H2	
Moderate								
Low								
Inconsistent								
Not Found	x	x	x	x	x			
Accuracy 0- 3						2.27		

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-10; horizontal; length 24.88 cm, height 20.42 cm; ratio = 0.82; vertical lines: 1/9; horizontal lines: 1/6; accuracy of line placement: A = 2.27; harmonic ratio: 4/6/9, the double fifth; overall composition assessment: HR4/6/9, moderate. The composition analysis of #389-10 is at the level of a strong representation of a 4/6/9, the double fifth harmonic, V1/9H1/6. Additional notes: This is an image of a line of camels and an elephant crossing the desert near an oasis where there are palm trees. The artist composed the image in vertical 1/9 divisions. The primary focus is the largest palm tree accurately aligned to the V5th 1/9. The horizontal 1/6's describe the placement of the top of the trees in general and the location of the sun. The H 2<sup>nd</sup> 1/6 aligns moderately to the highest hill and the H 3<sup>rd</sup> 1/6 aligns accurately to the hill at the center horizontally. The H 4<sup>th</sup> 1/6 describes the location of the animals in a line. The 5<sup>th</sup> 1/6 aligns to the hills in the fore ground. There is a use of the technique of fore, middle and background to give the illusion of depth in the picture. The darker values are used in the front and the values change to lighter as the image moves in space to the background. This is a 3-dimensional image. The artist used shape with light and dark values and fore, middle and background techniques to create the artwork.

**#389-11**; *La pirámide Pyramid*, 2006; técnica mixta sobre tela, mixed media on canvas; assessment grid lines: count/color/ description:

5	black	Vna; H1/2, 1/4, 1/8
2	yellow	V1/3; Hna
4	red	Vna; H1/5
Total lines 11		

Measurements: length 25.0 cm; height 20.42 cm; ratio = 0.816	
V: 1/3	H: 1/2, 1/4, 1/8, 1/5
1/3 = 8.3, 16.6	1/2 = 10.2
	1/4 = 5.1, 15.3
	1/8 = 2.55, 17.8
	1/5 = 4.08, 8.16, 12.2, 16.3
Total = 2 lines	Total = 9 lines

Accuracy of lines: HR2/3; V1/3H1/2; VL1/3 = 2.5, VR1/3 = 2.0; H1/2 = 1.8;  
V = 2.25, H = 1.8; A = 2.025

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate		x						
Low								
Inconsistent								
Not Found	x		x	x	x	x		
Accuracy 0- 3		2.025						

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-11; horizontal; length 25.0 cm, height 20.42 cm; ratio = 0.816; vertical lines: 1/3; horizontal lines: 1/2, 1/4, 1/8, 1/5; accuracy of line placement: A = 2.025; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, moderate. The composition analysis of #389-11 is at the level of a moderate representation of a 2/3, the fifth harmonic, V1/3H1/2. Additional notes: This is an image of a pyramid with a large statue standing next to it. The VL1/3 line accurately delineates the stairs at the front of the pyramid. The VR1/3 line aligns to the edge of the pyramid on the right side and this is the area of separation between the pyramid and the statue. The H 1<sup>st</sup> 1/5 aligns to a top edge of the pyramid. The H 2<sup>nd</sup> 1/5 in general aligns to the pyramid and statue. The 3<sup>rd</sup> and 4<sup>th</sup> 1/5 align to the structure of the pyramid at the bottom. The H 1/2 in general aligns to one half of the pyramid and the statue. The H upper 1/4 aligns to the top of the pyramid and the H lower 1/4 accurately aligns to the base. There is evidence that the image, due to the multiple lines of the pyramid, could be a HR3/4 or HR3/5 at a moderate level of representation. The HR2/3 is the more simplistic ratio and fits the simplistic subject matter of the image best. This is a 2-dimensional image. The artist used light and dark values with shapes to create the artwork.

**#389-12; *La vaca, The Cow*, 2002; óleo sobre tela, oil on canvas; assessment grid lines: count/color/ description:**

15	black	V1/16; Hna
8	yellow	Vna; H1/9

Total lines 23

Measurements: length 24.75 cm; height 20.02 cm; ratio = 0.808

V: 1/16

H: 1/9

1/16 = 1.54, 3.09, 4.64, 6.18, 7.73,

1/9 = 2.22, 4.44, 6.67, 8.89, 11.1,

9.28, 10.8, 12.37, 13.9, 15.4, 17.0

13.3, 15.5, 17.7

18.5, 20.1, 21.6, 23.2

Total = 15 lines

Total = 8 lines

Accuracy of lines: HR9/12/16; V1/16H1/9; V 1<sup>st</sup> 1/16 = 2.4, 2<sup>nd</sup> 1/16 = 2.4, 3<sup>rd</sup> 1/16 = 2.4, 4<sup>th</sup> 1/16 = 2.8, 5<sup>th</sup> 1/16 = 2.8, 7<sup>th</sup> 1/16 = 2.4, 8<sup>th</sup> 1/16 = 2.5, 9<sup>th</sup> 1/16 = 2.4, 10<sup>th</sup> 1/16 = 2.4, 11<sup>th</sup> 1/16 = 2.5, 12<sup>th</sup> 1/16 = 2.4, 13<sup>th</sup> 1/16 = 2.4, 14<sup>th</sup> 1/16 = 2.0, 15<sup>th</sup> 1/16 = 2.0; H 1<sup>st</sup> 1/9 = 1.5, 2<sup>nd</sup> 1/9 = 2.6, 3<sup>rd</sup> 1/9 = 2.7, 4<sup>th</sup> 1/9 = 2.2, 5<sup>th</sup> 1/9 2.2, 6<sup>th</sup> 1/9 = 2.4, 7<sup>th</sup> 1/9 = 2.4, 8<sup>th</sup> 1/9 = 2.4; V = 2.426, H = 2.3; A = 2.36

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong				x			H2	
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy 0- 3				2.36				

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-12; horizontal; length 24.75 cm, height 20.02 cm; ratio = 0.808; vertical lines: 1/16; horizontal lines: 1/9; accuracy of line placement: A = 2.36; harmonic ratio: 9/12/16, the fourth and fifth; overall composition assessment: HR9/12/16, strong. The composition analysis of #389-12 is at the level of a strong representation of a 9/12/16, the fourth and fifth harmonic, V1/16H1/9. Additional notes: This is an image of a cow standing at the edge of a pond. There are two large clouds symmetrically placed in the sky above the pasture behind the cow. There is evidence of the use of linear perspective as the fences on both sides of the pasture angle to the top of each hill. The line of the edge of the pond and the groups of reeds and grasses are all drawn in perspective. The cow is rendered with light and dark values and this gives the animal the illusion of depth. The painting composition can be described in the detail of the vertical 1/16 divisions. The

horizontal 1/9 divisions describe accurately the placement of the elements of the detailed artwork. This is an excellent example of a HR9/12/16 composition. The artist used the Rule of Three principle to align the objects horizontally. The vertical 1/16 lines followed the composition placements most strongly at the 4<sup>th</sup> and 5<sup>th</sup> 1/16. There is also a strong use of the fore, middle and background technique. The pond and the various items in and around the pond are in the fore ground. The cow standing on a short hill just above the pond is in the middle ground and the pasture with fences, hills and symmetrically shaped and placed clouds are the background. This is a 3-dimensional image. The artist used shapes with light and dark values, linear perspective and fore, middle and background techniques to create the artwork.

#389-13; *Mujer en el espejo, Woman in the Mirror*, 2007; grabado sobre linóleo, engraving on linoleum; assessment grid lines: count/color/ description:

6	black	V1/2; H1/2, 1/4, 1/8
4	yellow	V1/3; H1/3
2	green	Vna; HFR
Total lines 12		

Measurements: length 13.43 cm; height 24.06 cm; ratio = 0.558

V:1/2, 1/3

H:1/2, 1/4, 1/8, 1/3, FR

1/2 = 6.71

1/2 = 12.03

1/3 = 4.47, 8.95

1/4 = 6.015, 18.045

1/8 = 3.0, 21.0

1/3 = 8.0, 16.0

FR = 9.19, 14.8

Total = 3 lines

Total = 9 lines

Accuracy of lines: HR3/4; V1/3H1/4; VL1/3 = 2.5, VR1/3 = 2.5; h upper 1/8 = 1.0, H upper 1/4 = 2.2, H1/2 = 2.7, H lower 1/4 = 1.5, H lower 1/8 = 1.0; V = 2.5, H = 1.7; A = 2.09

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2 H2	H2

Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			2.09					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-13; vertical; length 13.43 cm, height 24.06 cm; ratio = 0.558; vertical lines: 1/2, 1/3; horizontal lines: 1/2, 1/4, 1/8, 1/3, FR; accuracy of line placement: A = 2.09; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, moderate. The composition analysis of #389-13 is at the level of a moderate representation of a 3/4, the fourth harmonic, V1/3H1/4. Additional notes: This is an image of a woman's face that is reflected precisely on the H lower FR line. The artist lined up the center of the two faces one above the other just slightly off center. The faces fit in the entire picture frame. The VL1/3 line aligns to the eyes of both faces on the right side. The VR1/3 aligns to the eyes on the left side. The H1/2 line accurately aligns to the center of the eyes on the upper face. The H lower 1/4 in general describes the area of the eyes of the lower face. The H upper 1/8 line in general describes the placement of the hair. The H lower 1/8 in general describes the top of the head. The placement of the image on the picture frame is symmetrical for the vertical dimensions. The horizontal lower FR is an asymmetric alignment and the primary compositional line. The HR3/4 is strongly represented and would have a greater accuracy, however, the vertical 1/2 line is just slightly off center. This is a 2-dimensional image. The artist used white lines on a black background to create the artwork.

**#389-14;** Adelitas II, 2009; aguafuerte sobre zinc, etching and aqua tint on zinc; assessment grid lines: count/color/ description:

4 black V1/2, 1/4; H1/2  
4 yellow V1/3; H1/3

Total lines 8

Measurements: length 24.99 cm; height 16.75cm; ratio = 0.67

V:1/2, 1/4, 1/3 H:1/2, 1/3  
1/2 = 12.49 1/2 = 8.37  
1/4 = 6.24, 18.7 1/3 = 5.58, 11.16  
1/3 = 8.33, 16.6

Total = 5 lines Total = 3 lines  
Accuracy of lines: HR3/4; V1/4H1/3; VL1/4 = 2.4, V1/2 = 1.8, VR1/4 = 2.0;  
H upper 1/3 = 1.8, H lower 1/3 = 1.0; V = 2.06, H = 1.4; A = 1.73

<u>Harmonic ratios/number of lines</u>	<u>1/2</u>	<u>2/3</u>	<u>3/4</u>	<u>9/12/16</u>	<u>3/5</u>	<u>4/6/9</u>	<u>Number of Rule of Three lines</u>	<u>Use of Frame Ratio</u>
<i>Level of Evidence</i>								
Strong								
Moderate			x				V2 H2	x
Low								
Inconsistent								
Not Found	x	x		x	x	x		
Accuracy 0- 3			1.73					

Harmonic ratio with Rule of Three Analysis per Image

Analysis #389-14; vertical; length 24.99 cm, height 16.75 cm; ratio = 0.67; vertical lines: 1/2, 1/4, 1/3; horizontal lines: 1/2, 1/3; accuracy of line placement: A = 1.73; harmonic ratio: 3/4, the fourth; overall composition assessment: HR3/4, moderate. The composition analysis of #389-14 is at the level of a moderate representation of a 3/4, the fourth harmonic, V1/4H1/3. Additional notes: This is an image of five figures standing next to one another across the picture frame. The figures are placed in general in the thirds sections. The H upper 1/3 delineates the heads of the figures. The H lower 1/3 in general describes the lower area of the clothes the figures are wearing. The VL1/4 aligns accurately to the placement of the left eye of the figure on the far left. The V1/2 line aligns to the position of the third figure in the center. The VR1/4 aligns to the space between the 4<sup>th</sup> and 5<sup>th</sup> figures. The artist used the Rule of Three principle to “build” the image around the outside of the center rectangle of the geometric grid of the V1/4H1/3 relationship. This is a 2-dimensional image. The artist used shapes and lines with light and dark values to create the artwork.

### Master Artist’s (MA) Group Image Composition Analysis

The Master artist’s group is referenced with the letters (MA) and the number of the Master artists is listed in chronological order of when the painting was made, such as MA-1- *the artist Masaccio*; the HR type- *the multiple HR-RT(s) are identified with the letters harmonic ratio (HR) and the exact name HR 2/3; V1/2H1/3, the same as the art*



*students works. This image is an HR2/3, V1/2 H1/3. This states that the composition of the artwork was a 2/3 harmonic ratio of a vertical 1/2 and horizontal 1/3's. This painting had multiple HR's and they are listed as HR3/5, V1/3H1/5; a HR4/6/9, V1/6H1/9; and HR9/12/16, V1/12H1/16; the title- is given of the painting, name of the author and year(s) made; materials used- what did the artist use to make the work; depth dimension- 3D; orientation vertical or horizontal; picture dimensions; artwork dimensions length 13.31 cm; height 26.62 cm; ratio = 0.50; list of lines: count /color/ description and assessment of grid lines. Assessment of grid lines: count/color/ description- this is the condensed form; the full information is in an extended form because the Master artists used many lines in their compositions.*

**MA-1;** HR2/3; V1/2H1/3; Additional: HR3/5, V1/3H1/5; HR4/6/9, V1/6H1/9; HR9/12/16, V1/12H1/16; “The Trinity” by Masaccio, 1425-1427; materials: fresco; 3D; assessment of grid lines: count/color/ description. Analysis MA-1; vertical; length 13.31 cm, height 26.62 cm; ratio = 0.50; vertical lines: 1/2, 1/4, 1/8, 1/3, 1/5, FR; horizontal lines: 1/16, 1/9, 1/5, FR, blue dotted line; accuracy of line placement: A = 2.9; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of MA-1 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/2H1/3. The artist built a composition on a vertical HR2/3; V1/2H1/3; A = 2.9. There is evidence of multiple harmonic ratios. One example given is the HR9/12/16; V1/12H1/16; A = 2.77.

**MA-1; HR2/3; V1/2H1/3; Additional: HR3/5, V1/3H1/5; HR4/6/9, V1/6H1/9; HR9/12/16, V1/12H1/16 “The Trinity” by Masacio, 1425-1427, materials: fresco; 3D; assessment grid lines: count/color/ description:**

20	black	V1/2, 1/4, 1/8; H1/16
10	yellow	V1/3; H1/9
8	red	V1/5; H1/5
4	green	VFR; HFR
1	blue dotted line	Vna; H1
Total lines 43		

Measurements: length 13.31 cm; height 26.62 cm; ratio = 0.50

V: 1/2, 1/4, 1/8, 1/3, 1/5, FR	H: 1/16, 1/9, 1/5, FR, blue dotted line
1/2 = 6.65	1/16 = 1.6637, 3.327, 4.99, 6.654, 8.318,
1/4 = 3.327, 9.98	9.98, 11.645, 13.3, 14.97, 16.63, 18.3, 19.96,
1/8 = 1.66, 11.646	21.62, 23.29, 24.955
1/3 = 4.436, 8.87	1/9 = 2.957, 5.9, 8.87, 11.82, 14.785
1/5 = 2.66, 5.32, 7.98, 10.64	17.74, 20.69, 23.65
FR = 8.225, 5.084	1/5 = 5.324, 10.648, 15.97, 21.29
	FR = 10.168, 16.45
	blue dotted line = 7.18
Total = 13 lines	Total = 30 lines

Accuracy of lines: HR2/3, V1/2H1/3; V1/2 = 3.0; H upper 1/3 = 2.9, H lower 1/3 = 2.7; V = 3.0, H = 2.8; A = 2.9

HR9/12/16; V1/12H1/16; V 1<sup>st</sup> 1/12 = 3.0, 2<sup>nd</sup> 1/12 = 2.6, 3<sup>rd</sup> 1/12 = 3.0, 4<sup>th</sup> 1/12 = 3.0, 5<sup>th</sup> 1/12 = 2.4, 6<sup>th</sup> 1/12 = 3.0, 7<sup>th</sup> 1/12 = 2.8, 8<sup>th</sup> 1/12 = 3.0, 9<sup>th</sup> 1/12 = 3.0, 10<sup>th</sup> 1/12 = 2.9, 11<sup>th</sup> 1/12 = 3.0; H 1<sup>st</sup> 1/16 = 3.0, 2<sup>nd</sup> 1/16 = 2.6, 3<sup>rd</sup> 1/16 = 2.5, 4<sup>th</sup> 1/16 = 3.0, 5<sup>th</sup> 1/16 = 3.0, 6<sup>th</sup> 1/16 = 3.0, 7<sup>th</sup> 1/16 = 2.9, 8<sup>th</sup> 1/16 = 3.0, 9<sup>th</sup> 1/16 = 3.0, 10<sup>th</sup> 1/16 = 2.8, 11<sup>th</sup> 1/16 = 2.2, 12<sup>th</sup> 1/16 = 2.7, 13<sup>th</sup> 1/16 = 2.4, 14<sup>th</sup> 1/16 = 2.9, 15<sup>th</sup> 1/16 = 1.0; V = 2.88, H = 2.667, A = 2.77

Harmonic ratios/number of lines	1/2	2/3	3/4	9/12/16	3/5	4/6/9	Number of Rule of Three lines	Use of Frame Ratio
<i>Level of Evidence</i>								
Strong		x		x			V2 H2	V2 H2
Moderate								

Low								
Inconsistent								
Not Found	x		x		x	x		
Accuracy 0- 3		2.9		2.77				

Harmonic ratio with Rule of Three Analysis per Image

Analysis MA-1; vertical; length 13.31 cm, height 26.62 cm; ratio = 0.50; vertical lines: 1/2, 1/4, 1/8, 1/3, 1/5, FR; horizontal lines: 1/16, 1/9, 1/5, FR, blue dotted line; accuracy of line placement: A = 2.9; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of MA-1 is at the level of a strong representation of a 2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of the crucifixion of Christ. This painting is the first example of linear perspective done in the Quattrocento. The artist built a composition on a vertical HR2/3; V1/2H1/3; A = 2.9. There is evidence of multiple harmonic ratios. One example given is the HR9/12/16; V1/12H1/16; A = 2.77. In the painting God is holding up the body of Christ. The apostle St John and the Virgin Mary are at Christ's feet. The setting is inside a tall hallway of a Romanesque building depicted as a chapel. Below the crucifixion scene is the sarcophagus of Adam, the first man, his skeleton is shown on the outside. The V1/2 line aligns precisely to the center of the artwork, which is the location of the center of Christ's body and the figure of God holding him up. The V1/2 line sets up a line of reflection for the composition for the arrangement of the grid lines. The H upper 1/3 aligns accurately to the depiction of the Holy Spirit as a dove above Christ's head. The H lower 1/3 in general aligns to the kneeling figures who are the patrons of the painting Domenico Lenzi and his wife. Masaccio started the artwork with the HR2/3 and added complexity to the composition. One example is the HR9/12/16; V1/12H1/16. The 1/16 divisions accurately align to the elements of the painting. In looking at the DEMR construct, the 5<sup>th</sup> 1/16 and the 10<sup>th</sup> 1/16 are the respective HFR's. The vertical divisions are the 1/12's. The 5<sup>th</sup> 1/12 and the 10<sup>th</sup> 1/12 are precisely the 2<sup>nd</sup> and 4<sup>th</sup> 1/5 lines. The VFR lines are closely aligned to the 2<sup>nd</sup> and 3<sup>rd</sup> 1/5 lines. The artist composed the painting with the vertical symmetry of the DEMR lines bracketing Christ's body. The horizontal lines of DEMR align to the placement at the location of the arms and head of Christ for the upper set of lines (the H lower 1/3, FR and 2<sup>nd</sup> 1/5). The H lower set of lines (H lower 1/3, FR and 3<sup>rd</sup> 1/5) aligned to the placement of the praying patrons. The horizontal dotted blue line across the major columns of the chapel and at the top of the head of God is the DEMR point in the rectangle from the top of the painting to the patrons' feet. The lines of linear perspective inside the vaulted hallway are precisely a DEMR geometric construction. This is a 3-dimensional image. The artist used shapes, lines, light and dark values with extensive linear perspective and fore, middle and back ground techniques to create the artwork.

**MA-2; HR1/2; V1/2Hna; Additional: HR3/5, V1/3H1/5 or V1/5H1/3; HR4/6/9, V1/6H1/9; HR9/12/16, V1/16H1/12**

“The Annunciation” by Fra Angelico, c. 1432, materials: fresco; 3D; assessment grid lines: count/color/ description:

33	black	V1/16; H1/12
12	yellow	V1/9; H1/9
8	red	V1/5; H1/5
4	green	VFR; HFR
2	diagonal	V2; Hna
Total lines 59		

Measurements: length 26.85 cm; height 17.48 cm; ratio = 0.65

V: 1/12, 1/16, 1/9, 1/5, FR	H: 1/12, 1/9, 1/5, FR
1/12 = 2.235, 4.47, 6.7, 8.94, 11.175, na, na, 17.88, na, 22.35, 24.58	1/12 = 1.456, 2.913, 4.369, 5.826, 7.28, 8.739, 10.19, 11.65, 13.1, 14.56, 16.02
1/16 = 1.678, 3.356, 5.034, na, 8.39, 10.068, 11.74, 13.42, 15.1, 16.7, 18.4, 20.13, 21.8, 23.49, 25.17,	1/9 = 1.94, 3.88, na, 7.76, 9.71, na, 13.59, 15.53
1/9 = 2.98, 5.96, na, 11.9, 14.9, na, 20.8, 23.8	1/5 = 3.49, 6.99, 10.48, 13.9
1/5 = 5.37, 10.74, 16.11, 21.48	FR = 10.8, 6.67
FR = 16.59, 10.25	

diagonal = 1<sup>st</sup> 1/12 <sup>c</sup> 11<sup>th</sup> 1/12,

2<sup>nd</sup> 1/16 <sup>c</sup> 15<sup>th</sup> 1/16

Total = 36 lines

Total = 23 lines

Accuracy of lines: HR1/2, V1/2Hna; V1/2 = 2.8; Hna; V = 2.8, Hna; A = 2.8; HR9/12/16; V1/16H1/12; V 1<sup>st</sup> 1/16 = 2.7, 2<sup>nd</sup> 1/16 = 3.0, 3<sup>rd</sup> 1/16 = 3.0, 4<sup>th</sup> 1/16 = 2.0, 5<sup>th</sup> 1/16 = 2.7, 6<sup>th</sup> 1/16 = 2.8, 7<sup>th</sup> 1/16 = 3.0, 8<sup>th</sup> 1/16 = 2.8, 9<sup>th</sup> 1/16 = 2.6, 10<sup>th</sup> 1/16 = 3.0, 11<sup>th</sup> 1/16 = 2.9, 12<sup>th</sup> 1/16 = 2.9, 13<sup>th</sup> 1/16 = 2.7, 14<sup>th</sup> 1/16 = 2.6, 15<sup>th</sup> 1/16 = 2.7; H 1<sup>st</sup> 1/12 = 2.7, 2<sup>nd</sup> 1/12 = 2.6, 3<sup>rd</sup> 1/12 = 2.0, 4<sup>th</sup> 1/12 = 3.0, 5<sup>th</sup> 1/12 = 3.0, 6<sup>th</sup> 1/12 = 2.5, 7<sup>th</sup> 1/12 = 2.8, 8<sup>th</sup> 1/12 = 2.5, 9<sup>th</sup> 1/12 = 2.0, 10<sup>th</sup> 1/12 = 2.5, 11<sup>th</sup> 1/12 = 2.0; V = 2.76, H = 2.5, A = 2.63

Harmonic ratios/number of lines	1/2	2/3	3/4	9/12/16	3/5	4/6/9	Number of Rule of Three lines	Use of Frame Ratio
<i>Level of Evidence</i>								

Strong	x			x			V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found		x	x		x	x		
Accuracy 0- 3	2.8			2.63				

Harmonic ratio with Rule of Three Analysis per Image

Analysis MA-2; horizontal; length 26.85 cm, height 17.48 cm; ratio = 0.65; vertical lines: 1/12, 1/16, 1/9, 1/5, FR; horizontal lines: 1/12, 1/9, 1/5, FR; accuracy of line placement: A = 2.8; harmonic ratio: 1/2, the octave; overall composition assessment: HR1/2, strong. The composition analysis of MA-2 is at the level of a strong representation of a 1/2, the octave harmonic, V1/2Hna. Additional notes: This is an image of the Angel Gabriel appearing to the Virgin Mary to announce the Immaculate Conception. The artist placed a central post between the two figures that divides the horizontal picture frame in half vertically. The V1/2 aligns to the left side of the post, A = 2.8. The artist extended the HR1/2 into a HR9/12/16; V1/16H1/12, A = 2.63. There are two diagonal lines that align precisely to the far left post and wall in the lower corner going through the window to God's Garden up to the far right corner, 1<sup>st</sup> 1/12<sup>c</sup> 11<sup>th</sup> 1/12 and 2<sup>nd</sup> 1/16<sup>c</sup> 15<sup>th</sup> 1/16. These lines are a significant linear perspective element in the composition and they are precisely the DEMR alignment in the composition vertically and horizontally. The lines are the VR1/3, V 7<sup>th</sup> 1/16, V 10<sup>th</sup> 1/16 and VRFR. The H 4<sup>th</sup> 1/12, 5<sup>th</sup> 1/12, 2<sup>nd</sup> 1/5, and upper FR bracket the window to the garden on all four sides. The placement of the window vertically in the picture frame is the DEMR point. The horizontal placement is also the DEMR point. This is a 3-dimensional image. The artist used shapes, lines, light and dark values with extensive linear perspective and fore, middle and back ground techniques to create the artwork.

**MA-3;** HR2/3/4; V1/2Hna into a HR2/3 and HR3/4; "Procession of the Magi" by Benozzo Gozzoli, c. 1459, materials: fresco; 3D; assessment grid lines: count/color/ description:

36	black	V1/12; H1/16
13	yellow	V1/9; H1/9
8	red	V1/5; H1/5
4	green	VFR; HFR
Total lines 61		

Measurements: length 26.06 cm; height 20.27 cm; ratio = 0.777

V: 1/12, 1/16, 1/9, 1/5, FR

H: 1/12, 1/16, 1/9, 1/5, FR

1/12 = 2.1716, 4.343, na, na, 10.85, 13.029, 15.2, na, 19.54, 21.71, 23.88	1/12 = 1.689, na, 5.067, 6.756, 8.445, 10.134, 11.82, na, 15.2, 16.89, 18.57
1/16 = 1.628, 3.257, 4.88, na, 8.143, na, 11.4, na, 14.65, 16.28, na, na, na, 22.8, 19	1/16 = 1.266, na, na, na, 6.33, 7.6, 8.86, na, 11.4, 12.66, 13.9, 15.2, na, 17.73,
24.43	1/9 = 2.25, na, na, 9, 11.26, 13.5, 15.7, 18.0
1/9 = 2.89, na, 8.68, 11.58, 14.47, 17.37	1/5 = 4.05, 8.1, 12.16, 16.2
20.26, 23.16	FR = 7.74, 12.52
1/5 = 5.21, 10.42, 15.63, 20.84	
FR = 9.95, 16.1	
Total = 30 lines	Total = 31 lines

Accuracy of lines: HR2/3/4; V1/2Hna into a HR2/3 and HR3/4; HR9/12/16;  
is the combination of the fourth and fifth, V1/12H1/16. V1<sup>st</sup> 1/12 = 2.5, 2<sup>nd</sup> 1/12 = 2.3, 3<sup>rd</sup> 1/12 = 2.0, 4<sup>th</sup> 1/12 = 2.6, 5<sup>th</sup> 1/12 = 2.5, 6<sup>th</sup> 1/12 = 2.7, 7<sup>th</sup> 1/12 = 2.8, 8<sup>th</sup> 1/12 = 2.8, 9<sup>th</sup> 1/12 = 3.0, 10<sup>th</sup> 1/12 = 2.8, 11<sup>th</sup> 1/12 = 2.2; H 1<sup>st</sup> 1/16 = 2.7, 2<sup>nd</sup> 1/16 = 2.2, 3<sup>rd</sup> 1/16 = 2.4, 4<sup>th</sup> 1/16 = 2.4, 5<sup>th</sup> 1/16 = 2.4, 6<sup>th</sup> 1/16 = 2.6, 7<sup>th</sup> 1/16 = 2.6, 8<sup>th</sup> 1/16 = 2.6, 9<sup>th</sup> 1/16 = 3.0, 10<sup>th</sup> 1/16 = 2.9, 11<sup>th</sup> 1/16 = 3.0, 12<sup>th</sup> 1/16 = 2.9, 13<sup>th</sup> 1/16 = 2.7, 14<sup>th</sup> 1/16 = 2.4, 15<sup>th</sup> 1/16 = 2.4; V = 2.56, H = 2.61; A = 2.586

Harmonic ratios/number of lines	1/2	2/3	3/4	9/12/16	3/5	4/6/9	Number of Rule of Three lines	Use of Frame Ratio
<i>Level of Evidence</i>								
Strong				x			V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy 0- 3				2.586				

Harmonic ratio with Rule of Three Analysis per Image

Analysis MA-3; horizontal; length 26.06 cm, height 20.27 cm; ratio = 0.777; vertical lines: 1/12, 1/16, 1/9, 1/5, FR; horizontal lines: 1/12, 1/16, 1/9, 1/5, FR; accuracy of line placement: A = 2.586; harmonic ratio: HR2/3/4; V1/2Hna into a HR2/3 and HR3/4; the fourth and fifth; overall composition assessment: HR9/12/16, strong. The composition analysis of MA-3 is at the level of a strong representation of a HR9/12/16, the fourth and fifth harmonic, V1/12H1/16. Additional notes: This is an image of a young Lorenzo, the magnificent, Medici

with his father Piero and grandfather Cosimo Medici. This painting is on the east wall of the hallway leading to Medici Chapel. The procession depicted the noble prince in a parade that was both historical and religious in meaning. The artist used a HR 2/3/4, which starts as a HR1/2. The V1/2 is aligned to the large tree in the center of the painting. The combination of the HR2/3 and HR3/4 is the HR9/12/16. The 1/16 divisions of the composition are in the vertical dimension. The artist designed the composition to give the impression of movement. The trees on the right side of the picture frame are spaced at the V1/2, the VR1/3 and the VR1/4, which gives the 2/3/4/ harmonic. In order to achieve the level of detail that is in the painting the artist further divided the composition into the HR9/12/16, V1/16H1/12. The vertical lines of the 9<sup>th</sup> 1/12, 12<sup>th</sup> 1/16 and 7<sup>th</sup> 1/9 align to the placement of the leading horse. The VRFR, 3<sup>rd</sup> 1/5, 10<sup>th</sup> 1/16, and 7<sup>th</sup> 1/12 align to the Lorenzo the rider. Horizontally, the composition is described by the 1/12 divisions. The primary focus of the image is along the H lower FR, 5<sup>th</sup> 1/9, 9<sup>th</sup> 1/16, 7<sup>th</sup> 1/12 and H lower 1/3. This is an asymmetric arrangement of the objects of the painting. These sets of lines describe the horses, soldiers, philosophers and Medici family members of the parade. This is a 3-dimensional image. The artist used shapes, lines, light and dark values with extensive linear perspective and fore, middle and back ground techniques to create the artwork.

**MA-4;** HR2/3; V1/2H1/3; Additional: HR3/5, V1/3H1/5 or V1/5H1/3; HR4/6/9, V1/6H1/9; HR9/12/16, V1/16H1/12

“Pinacoteca di Brera of the Madonna with Child and Saints” by Piero della Francesca, 1472-1474, materials: tempera on wood panel; 3D; assessment grid lines: count/color/ description:

38	black	V1/16; H1/12
15	yellow	V1/9; H1/9
8	red	V1/5; H1/5
4	green	VFR; HFR
Total lines 65		

Measurements: length 18.98 cm; height 26.95 cm; ratio = 0.704

V: 1/12, 1/16, 1/9, 1/5, FR	H: 1/12, 1/16, 1/9, 1/5, FR
1/12 = 1.58, 3.16, na, na, 7.9, na, 13.47, 11.07, na, na, 15.8, 17.39	1/12 = 2.245, 4.49, 6.73, na, 11.22, 15.72, na, 20.2, 22.45, 24.7
1/16 = na, 2.37, 3.55, 4.74, 5.93, 7.11, 10.1, 8.3, 9.48, 10.67, na, 13.04, 14.23, 15.4, 16.6, 17.7,	1/16 = 1.68, 3.36, 5.05, na, 8.42, na, na, 15.15, 16.84, 18.52, na, 21.89, na, 25.26
1/9 = 2.1, 4.21, 6.32, 8.43, 10.54, 12.6, 20.9, 14.7, 16.8,	1/9 = 2.99, 5.98, 8.98, na, 14.9, 17.96, 23.95

1/5 = 3.79, 7.59, 11.38, 15.18  
 FR = 7.24, 11.73  
 Total = 33 lines

1/5 = 5.39, 10.78, 16.17, 21.56  
 FR = 10.41, 16.53  
 Total = 32 lines

Accuracy of lines: HR2/3; V1/2H1/3; V1/2 = 3.0; H upper 1/3 = 3.0, H lower 1/3 = 3.0; V = 3.0, H = 3.0; A = 3.0 HR9/12/16, V1/16H1/12; V 1<sup>st</sup> 1/16 = na, 2<sup>nd</sup> 1/16 = 2.8, 3<sup>rd</sup> 1/16 = 2.8, 4<sup>th</sup> 1/16 = 2.4, 5<sup>th</sup> 1/16 = 2.4, 6<sup>th</sup> 1/16 = 2.8, 7<sup>th</sup> 1/16 = 3.0, 8<sup>th</sup> 1/16 = 3.0, 9<sup>th</sup> 1/16 = 2.7, 10<sup>th</sup> 1/16 = 2.6, 11<sup>th</sup> 1/16 = 2.6, 12<sup>th</sup> 1/16 = 2.7, 13<sup>th</sup> 1/16 = 2.7, 14<sup>th</sup> 1/16 = 2.7, 15<sup>th</sup> 1/16 = 2.7; H 1<sup>st</sup> 1/12 = 2.2, 2<sup>nd</sup> 1/12 = 2.4, 3<sup>rd</sup> 1/12 = 2.7, 4<sup>th</sup> 1/12 = 3.0, 5<sup>th</sup> 1/12 = 3.0, 6<sup>th</sup> 1/12 = 3.0, 7<sup>th</sup> 1/12 = 2.8, 8<sup>th</sup> 1/12 = 3.0, 9<sup>th</sup> 1/12 = 3.0, 10<sup>th</sup> 1/12 = 2.5, 11<sup>th</sup> 1/12 = 2.5; V = 2.7, H = 2.736, A = 2.718

Harmonic ratios/number of lines	1/2	2/3	3/4	9/12/16	3/5	4/6/9	Number of Rule of Three lines	Use of Frame Ratio
<i>Level of Evidence</i>								
Strong		x		x			V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x		x		x	x		
Accuracy 0- 3		3.0		2.718				

Harmonic ratio with Rule of Three Analysis per Image

Analysis MA-4; vertical; length 18.98 cm, height 26.95 cm; ratio = 0.704; vertical lines: 1/12, 1/16, 1/9, 1/5, FR; horizontal lines: 1/12, 1/16, 1/9, 1/5, FR; accuracy of line placement: A = 3.0; harmonic ratio: 2/3, the fifth; overall composition assessment: HR2/3, strong. The composition analysis of MA-4 is at the level of a strong representation of a HR2/3, the fifth harmonic, V1/2H1/3. Additional notes: This is an image of the Virgin Mary holding the Christ child. They are in front of a high portal similar to a gothic Christian church architecture structure known as an apse. The Duke of Urbino is kneeling in front of and on the right side of the Madonna and child. There are saints and angels standing in a semi-circle behind them. There are multiple symbols used in the composition of the painting. The underlying HR2/3 is a V1/2H1/3, A = 3.0. Each of the lines of the harmonic are precisely aligned to the composition. There are multiple harmonic ratios represented, such as, the HR9/12/16, V1/16H1/12. The detail of the subject iconography, the numerous figures and the architecture can be described using the



geometric grid to show the vertical 1/16 divisions and the horizontal 1/12 divisions,  $A = 2.718$ . This is a symmetrical alignment of the elements of the composition. The artist set the Madonna at the centerline of the picture frame. The V1/2 is the reflection line for the sets of lines on either side in the order of 4<sup>th</sup> 1/9 (yellow), 7<sup>th</sup> 1/16 (black), 5<sup>th</sup> 1/12 (black), 2<sup>nd</sup> 1/5 (red), V1FR (green), and the 6<sup>th</sup> 1/16 (black). The two vertical sets of lines bracket the Madonna and Child. Horizontally, the same two sets describe the location of the line of saints, angles and main figures for the H lower 1/3 and the various symbols and architecture for the H upper 1/3 divisions. The composition is aligned to the DEMR construct as depicted by the HR9/12/16, V1/16H1/12 and the underlying HR2/3; V1/2H1/3. This is a 3-dimensional image. The artist used shapes, lines, light and dark values with extensive linear perspective and fore, middle and back ground techniques to create the artwork.

**MA-5;** HR9/12/16; V1/16H1/12; Additional: HR3/5, V1/3H1/5; HR4/6/9, V1/9H1/6;

“The Birth of Venus” by Botticelli, c. 1484, materials: tempera on canvas; 3D; assessment grid lines: count/color/ description:

36	black	V1/16; H1/12
14	yellow	V1/9; H1/9
8	red	V1/5; H1/5
4	green	VFR; HFR
1	dotted blue line	V1; Hna

Total lines 63

Measurements: length 26.58 cm; height 16.83 cm; ratio = 0.633

V: 1/12, 1/16, 1/9, 1/5, FR	H: 1/12, 1/16, 1/9, 1/5, FR
1/12 = na, 4.43, na, na, 11.0, na	1/12 = 1.4, 2.8, 4.2, na, 7.0, 8.4, 9.8, na,
15.5, na, 19.93, 22.15	12.6, 14.0, 15.4
1/16 = 1.66, 3.32, na, 6.64, 8.3, 9.96, 11.6	1/16 = 1.05, 2.1, 3.15, na, 5.25, 6.31,
13.2, 14.9, 16.6, 18.2, 19.9, 21.5, na, 24.9,	7.36, na, 9.46, na, na, na, na, 14.7,
1/9 = 2.95, na, 8.85, 11.8, 14.7, 17.7, 20.6,	15.77
23.6	1/9 = 1.87, 3.74, 5.6, 7.48, 9.35,
11.22,	
1/5 = 5.31, 10.6, 15.9, 21.26	na, 14.96
FR = 10.15, 16.4	1/5 = 3.36, 6.73, 10.98, 13.4
dotted blue line	FR = 6.42, 10.4
Total = 32 lines	Total = 31 lines

Accuracy of lines: HR9/12/16; V1/16H1/12; V 1<sup>st</sup> 1/16 = 2.2, 2<sup>nd</sup> 1/16 = 2.4, 3<sup>rd</sup> 1/16 = 2.4, 4<sup>th</sup> 1/16 = 2.6, 5<sup>th</sup> 1/16 = 2.6, 6<sup>th</sup> 1/16 = 2.7, 7<sup>th</sup> 1/16 = 2.7, 8<sup>th</sup> 1/16 = 2.8, 9<sup>th</sup> 1/16 = 2.9, 10<sup>th</sup> 1/16 = 2.7, 11<sup>th</sup> 1/16 = 2.7, 12<sup>th</sup> 1/16 = 2.8, 13<sup>th</sup> 1/16 =

2.8, 14<sup>th</sup> 1/16 = 2.6, 15<sup>th</sup> 1/16 = 2.6; H 1<sup>st</sup> 1/12 = 3.0, 2<sup>nd</sup> 1/12 = 2.9, 3<sup>rd</sup> 1/12 = 2.8, 4<sup>th</sup> 1/12 = 2.8, 5<sup>th</sup> 1/12 = 2.9, 6<sup>th</sup> 1/12 = 2.8, 7<sup>th</sup> 1/12 = 2.7, 8<sup>th</sup> 1/12 = 2.7, 9<sup>th</sup> 1/12 = 2.7, 10<sup>th</sup> 1/12 = 2.8, 11<sup>th</sup> 1/12 = 2.8; V = 2.633, H = 2.8, A = 2.72

Harmonic ratios/number of lines	1/2	2/3	3/4	9/12/16	3/5	4/6/9	Number of Rule of Three lines	Use of Frame Ratio
<i>Level of Evidence</i>								
Strong				x			V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy 0- 3				2.72				

Harmonic ratio with Rule of Three Analysis per Image

Analysis MA-5; horizontal; length 26.58 cm, height 16.83 cm; ratio = 0.633; vertical lines: 1/12, 1/16, 1/9, 1/5, FR; horizontal lines: 1/12, 1/16, 1/9, 1/5, FR; accuracy of line placement: A = 2.72; harmonic ratio: 9/12/16, the fourth and the fifth; overall composition assessment: HR9/12/16, strong. The composition analysis of MA-5 is at the level of a strong representation of a HR9/12/16, the fourth and the fifth harmonic, V1/16H1/12. Additional notes: This is an image of the mythology of the birth of Venus. Venus is standing on a large seashell and a handmaiden is waiting on the right side to dress her with clothes. The muses of the wind are on the left side and blowing Venus to shore. The overall picture frame dimensions are near to DEMR for the original artwork. The artist placed the figure of Venus, which leans at an angle to the right (4<sup>th</sup> 1/9 connecting to the 3<sup>rd</sup> 1/5), off of the centerline. The dotted blue line is the center of the figure. The distance of the 5<sup>th</sup> 1/16 to the 8<sup>th</sup> 1/12 is cut in DEMR precisely at the blue line. The composition of V1/16H1/12 is asymmetrically aligned to this line. The horizontal elements of the composition are “built” using the 1/12, 1/16, 1/9, 1/5 and FR lines H = 2.8. The vertical compositional lines of 1/12, 1/16, 1/9, 1/5 and FR lines describe the composition, primarily, the 1/16 lines are aligned to the placement of the elements of the composition. The H upper FR, 2<sup>nd</sup> 1/5, 6<sup>th</sup> 1/16 and 5<sup>th</sup> 1/12 lines align to the placement of the horizon line of the sea. The figure of Venus is bracketed by the sets of lines that describe the DEMR construct the V 6<sup>th</sup> 1/16, VLFR, 2<sup>nd</sup> 1/5, 5<sup>th</sup> 1/12, 7<sup>th</sup> 1/16 and 5<sup>th</sup> 1/9 on the right side (looking at

the picture) and the 5<sup>th</sup> 1/9, 9<sup>th</sup> 1/16, 7<sup>th</sup> 1/12, 3<sup>rd</sup> 1/5 and the VFR. The artist used the technique of fore, middle and background to create the illusion of the depth in the image. This is a 3-dimensional image. The artist used shapes, lines, light and dark values with linear perspective and extensive fore, middle and background techniques to create the artwork.

**MA-6;** HR1/2; V1/2Hna; Additional: HR3/5, V1/3H1/5 or V1/5H1/3; HR4/6/9, V1/9H1/4; HR9/12/16, V1/16H1/12 “The Last Supper” by Leonardo da Vinci, 1495-1497, materials: tempera on plaster; 3D; assessment grid lines: count/color/description:

33	black	V1/16; H1/12
13	yellow	V1/9; H1/9
8	red	V1/5; H1/5
4	green	VFR; HFR
1	dotted blue line	V1; Hna

Total lines 59

Measurements: length 27.01 cm; height 14.22 cm; ratio = 0.526

V: 1/12, 1/16, 1/9, 1/5, FR

H: 1/12, 1/16, 1/9, 1/5, FR

1/12 = 2.25, 4.5, na, na, 11.2, na, 15.7, 1/12 = 1.18, 2.37, na, na, 5.92, 7.11, 8.29,

na, na, 22.5, 24.7

9.48, 10.6, 11.8, 13.03

1/16 = 1.68, 3.37, 5.06, 6.75, 8.44, 10.1,

1/16 = na, na, na, na, na, 5.33, 6.22,

na

11.8, 13.5, 15.19, 16.8, 18.5, 20.25, 21.9

na, na, na, na, 11.55, na, na

23.6, 25.3

1/9 = 1.58, na, 4.74, 6.32, 7.9, 9.48,

na,

1/9 = 3.0, 6.0, 9.0, 12.0, 15.0, 18.0, 21.0,

na

24.0

1/5 = 2.84, 5.68, 8.53, 11.37

1/5 = 5.4, 10.8, 16.2, 21.6

FR = 5.43, 8.78

FR = 10.3, 16.69

blue dotted line = 14.36

Total = 36 lines

Total = 23 lines

Accuracy of lines: HR9/12/16, V1/16H1/12; V 1<sup>st</sup> 1/16 = 2.6, 2<sup>nd</sup> 1/16 = 2.6, 3<sup>rd</sup> 1/16 =

2.7, 4<sup>th</sup> 1/16 = 2.8, 5<sup>th</sup> 1/16 = 2.9, 6<sup>th</sup> 1/16 = 2.9, 7<sup>th</sup> 1/16 = 2.9, 8<sup>th</sup> 1/16 = 2.8, 9<sup>th</sup> 1/16 =

2.8, 10<sup>th</sup> 1/16 = 2.8, 11<sup>th</sup> 1/16 = 2.9, 12<sup>th</sup> 1/16 = 2.8, 13<sup>th</sup> 1/16 = 2.7, 14<sup>th</sup> 1/16 = 2.8, 15<sup>th</sup>

1/16 = 2.8; H 1<sup>st</sup> 1/12 = 2.6, 2<sup>nd</sup> 1/12 = 2.9, 3<sup>rd</sup> 1/12 = na, 4<sup>th</sup> 1/12 = 2.8, 5<sup>th</sup> 1/12 = 3.0,

6<sup>th</sup> 1/12 = 3.0, 7<sup>th</sup> 1/12 = 3.0, 8<sup>th</sup> 1/12 = 3.0, 9<sup>th</sup> 1/12 = 3.0, 10<sup>th</sup> 1/12 = 2.8, 11<sup>th</sup> 1/12 =

2.8; V = 2.786, H = 2.89, A = 2.838

Harmonic ratios/number of lines	1/2	2/3	3/4	9/12/16	3/5	4/6/9	Number of Rule of Three lines	Use of Frame Ratio
<i>Level of Evidence</i>								
Strong				x			V2 H2	V2 H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy 0- 3				2.838				

Harmonic ratio with Rule of Three Analysis per Image

Analysis MA-6; horizontal; length 27.01 cm, height 14.22 cm; ratio = 0.526; vertical lines: 1/12, 1/16, 1/9, 1/5, FR; horizontal lines: 1/12, 1/16, 1/9, 1/5, FR; accuracy of line placement: A = 2.838; harmonic ratio: 9/12/16, the fourth and the fifth; overall composition assessment: HR9/12/16, strong. The composition analysis of MA-6 is at the level of a strong representation of a HR9/12/16, the fourth and the fifth harmonic, V1/16H1/12. Additional notes: This is an image of the Last Supper of Jesus Christ with his disciples. Christ is seated in the center of a long horizontal table. The apostles are grouped in sets of three. There are two sets per side. The linear perspective from both sides and the ceiling converge to a vanishing point in the distance, which is directly behind the head of Christ. The primary harmonic ratio is the HR1/2; V1/2Hna. The picture is divided in half vertically (V1/2) slightly to the left of the head of Christ. A dotted blue line aligns to the center of Christ's face. The line is the DEMR point between the lines of the 5<sup>th</sup> 1/16 to the 8<sup>th</sup> 1/12. The artist used the V1/16 divisions to vertically align the elements of the painting. The V1/9's, 1/5 lines and VFR lines also were used to "build" the composition. The primary focus of the artwork is placed in the bottom horizontal 1/2 of the painting. The H 1/12 line is aligned to the detail of the 12 apostles, the objects on the long table and tablecloth. The harmonic ratio sets of lines were used for the alignment to the linear perspective in the large room, table and windows on the sides. The detail of the faces, hands and apostles' bodies were in general aligned to the DEMR construct because the composition spaces between the lines were larger than the sizes the human detail was created within. The effect of this arrangement is to create an unquestionable visual focus on Christ along with the empty space immediately around him. The HR9/12/16, V1/16H1/12, described the complex painting composition for both the vertical and horizontal elemental placement. This is a 3-dimensional image. The artist

used shapes, lines, light and dark values with extensive linear perspective and fore, middle and back ground techniques to create the artwork.

**MA-7;** caesuras HR9/12/16; V1/16H1/9; Additional: HR3/5, V1/5H1/3; HR4/6/9, V1/4H1/9 “Lady Viceroy of Naples” by Raphael, 1518, materials: oil on wood; 3D; assessment grid lines: count/color/ description:

32	black	V1/16; H1/12
10	yellow	V1/9; H1/9
8	red	V1/5; H1/5
4	green	VFR; HFR
1	dotted blue line	V; H1

Total lines 55

Measurements: length 20.0 cm; height 26.36 cm; ratio = 0.759

V: 1/12, 1/16, 1/9, 1/5, FR	H: 1/12, 1/16, 1/9, 1/5, FR
1/16 = 1.25, 2.5, 3.75, 5.0, 6.25, <b>7.5</b> , na, 8.75,10.11, 11.25, <b>12.5</b> , 13.75, 15.0, 16.25,17.5, 18.75	1/16 = na, na, 4.94, na, 8.235, 9.88, na, na, na, na, na, na, 23.0, 24.7 1/12 = na, na, na, na, na, 10.98, 13.17, 15.37,
1/12 = na, na, na, 6.67, 8.337, na, 11.67, 13.34, na, 16.67, 18.34	na, 19.76, 21.96, 24.15 1/9 = na, 5.85, 8.78, 11.7, 14.64, 17.56,
1/9 = na, na, na, 8.89, 11.11, 10.0, na, na	20.49, 23.42 1/5 = 5.27, 10.54, 15.8, 21.08
1/5 = 4.0, 8.0, 12.0, 16.0	FR = 10.06, 16.29
FR = 7.64, 12.36	blue dotted line = 7.41
Total = 30 lines	Total = 25 lines

Accuracy of lines: HR9/12/16, V1/16H1/12; V 1<sup>st</sup> 1/16 = 2.7, 2<sup>nd</sup> 1/16 = 2.7, 3<sup>rd</sup> 1/16 = 2.8, 4<sup>th</sup> 1/16 = 2.8, 5<sup>th</sup> 1/16 = 2.8, 6<sup>th</sup> 1/16 = 2.8, 7<sup>th</sup> 1/16 = 3.0, 8<sup>th</sup> 1/16 = 3.0, 9<sup>th</sup> 1/16 = 2.9, 10<sup>th</sup> 1/16 = 2.9, 11<sup>th</sup> 1/16 = 2.8, 12<sup>th</sup> 1/16 = 2.7, 13<sup>th</sup> 1/16 = 2.7, 14<sup>th</sup> 1/16 = 2.6, 15<sup>th</sup> 1/16 = 2.6; H 1<sup>st</sup> 1/9 = na, 2<sup>nd</sup> 1/9 = 3.0, 3<sup>rd</sup> 1/9 = 3.0, 4<sup>th</sup> 1/9 = 2.9, 5<sup>th</sup> 1/9 = 3.0, 6<sup>th</sup> 1/9 = 2.8, 7<sup>th</sup> 1/9 = 2.6, 8<sup>th</sup> 1/9 = 3.0; V = 2.786, H = 2.9, A = 2.843

Harmonic ratios/number of lines	1/2	2/3	3/4	9/12/16	3/5	4/6/9	Number of Rule of Three lines	Use of Frame Ratio
<i>Level of Evidence</i>								
Strong				x			V2	V2

							H2	H2
Moderate								
Low								
Inconsistent								
Not Found	x	x	x		x	x		
Accuracy 0- 3				2.843				

Harmonic ratio with Rule of Three Analysis per Image

Analysis MA-7; horizontal; length 20.0 cm, height 26.36 cm; ratio = 0.759; vertical lines: 1/12, 1/16, 1/9, 1/5, FR; horizontal lines: 1/12, 1/16, 1/9, 1/5, FR; accuracy of line placement: A = 2.843; harmonic ratio: caesuras 9/12/16, the fourth and the fifth; overall composition assessment: HR9/12/16, strong. The composition analysis of MA-6 is at the level of a strong representation of caesuras HR9/12/16, the fourth and the fifth harmonic, V1/16H1/9. Additional notes: This is an image of the Lady Viceroy of Naples. The artist placed the figure nearly at the center point of the picture frame. The caesuras HR9/12/16 composition gives a vertical diagonal from the 5<sup>th</sup> 1/12 connecting to the 5<sup>th</sup> /9 within the V1/16H1/9 composition. The artist elongated the arms and torso of the figure. The V1/2 sets up a line of reflection for the composition. The V 4<sup>th</sup> and 5<sup>th</sup> 1/9's bracket precisely the figure's face the V 7<sup>th</sup> 1/16 and 9<sup>th</sup> /1/16 are very close to the same placement. The V 5<sup>th</sup> 1/12 and 7<sup>th</sup> 1/12 align to the placement of the hair. The VLFR describes the left edge of the front of the dress and the VRFR describes the right edge (looking at the picture). The V 6<sup>th</sup> /1/16 and 10<sup>th</sup> 1/16 are within 2 tenths of a millimeter the same line. The VL1/3 delineates accurately the placement of the figure's right forefinger. The 10<sup>th</sup> 1/12 aligns accurately to the figure's left arm. The 3<sup>rd</sup> 1/16 and 1<sup>st</sup> 1/5 describe the placement of the wrist of the right hand and the 4<sup>th</sup> 1/5 describes the edge of the dress on the left arm. Horizontally, the H 3<sup>rd</sup> 1/16 aligns precisely to the top of the head. The 1<sup>st</sup> 1/5 supports the position. The H 2<sup>nd</sup> 1/9 accurately aligns to the edge of the forehead. The 5<sup>th</sup> 1/12 aligns to the cheeks and nose. The H upper 1/3 accurately aligns to the upper lip of the mouth. The H 6<sup>th</sup> 1/16 precisely aligns to the bottom of the chin. The H 2<sup>nd</sup> 1/5, H upper FR and 5<sup>th</sup> 1/12 all delineate the neck and shoulders. The H1/2 accurately aligns to the left hand position and top of the front of the dress. The 5<sup>th</sup> 1/9 aligns to the bottom of the fingers of the left hand. The 6<sup>th</sup> 1/9 aligns to the bottom of the left arm dress sleeve. The 9<sup>th</sup> /12 accurately aligns to the top of the right arm dress sleeve. The 10<sup>th</sup> and 11<sup>th</sup> 1/12, 14<sup>th</sup> and 15<sup>th</sup> 1/16 and 8<sup>th</sup> 1/19 accurately describe the position of the right hand. There is a significant horizontal composition blue dotted line across the figure's eyes. The position of the chin is precisely the 6<sup>th</sup> 1/16, from the top of the picture frame to the 7<sup>th</sup> 1/12. This is an exact DEMR position and from the line of the top of the head, the 3<sup>rd</sup> 1/16 to the line of the chin, the 6<sup>th</sup> 1/16 exactly 1/2 the distance is the blue dotted line delineating the center of the eyes. This is a 3-dimensional image. The artist

used shapes, lines, light and dark values with linear perspective and extensive fore, middle and back ground techniques to create the artwork.

APPENDIX L

**HR-RT level of Accuracy on Year Artwork was Created Over Time**

#369; male; 37 years old; 37 years at JLDF; 17 years at the art school; wears glasses; socioeconomic status/low; range of time of artwork used in the study: 1998-2011.

No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>
369-1	2007	Strong; 3/5 HR
369-2	2000	Strong; 3/5 HR
369-3	2011	Low; 3/4 HR
369-4	1999	Low; 2/3 HR
369-5	2002	Low; 1/2 HR
369-5a	2002	Strong; 3/5 HR
369-5b	2002	Low; 3/4 HR
369-6	2007	Moderate; 3/4 HR
369-7	1998	Strong; 3/4 HR
369-8	2003	Strong; 2/3 HR
369-9	2008	Strong; 3/4 HR
369-10	2009	Strong; 2/3 HR
369-11	2002	Low; 2/3 HR

#370; male; 30 years old; 30 years at JLDF; 13 years at the art school; myopia and astigmatism; socioeconomic status/medium; range of time of artwork used in the study: 2003-2010. No increasing or decreasing pattern found. A variable use of HR-RT is evident.



<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>
370-1	2008	Strong; 3/5 HR
370-2	2008	Strong; 3/5 HR
370-3	2007	Inconsistent; 3/5 HR
370-4	2007	Inconsistent; 1/2 HR
370-5	2006	Strong; 9/12/16 HR
370-6	2007	Strong; 3/5 HR
370-7	2010	Strong; 3/5 HR
370-8	2009	Strong; 3/5 HR
370-9	2010	Moderate; 3/4 HR
370-10	2006	Low; 3/4 HR
370-11	2003	Strong; 3/5 HR
370-12	2008	Moderate; 3/4 HR
370-13	2003	Moderate; 2/3 HR
370-14	2006	Strong; 3/4 HR
370-15	2008	Strong; 3/4 HR
370-16	2005	Low; 2/3 HR
370-17	2005	Inconsistent; 1/2 HR
370-18	2007	Moderate; 1/2 HR
370-19	2005	Moderate; 3/5 HR
370-20	2005	Strong; 3/5 HR

#371, male, 37 years old; 37 years at JLDF; 16 years at the art school; no visual impairments; socioeconomic status/high; range of time of artwork used in the study: 1999-2007. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
371-1	2001	Strong; 3/4 HR
371-2	2007	Low; 2/3 HR
371-3	2001	Strong; 3/4 HR
371-4	2005	Strong; 3/5 HR
371-5	2003	Strong; 3/5 HR
371-6	1999	Moderate; 3/5 HR

#372, female, 40 years old; 31 years at JLDF; 16years at the art school; no visual impairments; socioeconomic status/very low; range of time of artwork used in the study: Not applicable.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
372-1	2000	Strong; 3/4 HR

#373, male, 25 years old; 22 years at JDLF; 5 years at the art school; myopia- wears glasses; socioeconomic status/medium; range of time of artwork used in the study: 2011-2013. No increasing or decreasing pattern found only three images to assess.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
373-1	2013	Strong; 3/5 HR
373-2	2013	Strong; 3/5 HR
373-3	2011	Moderate; 2/3 HR

#374, male, 32 years old; 20 years at JLDF; unknown years at art school; keratoconus- wears glasses; socioeconomic status/low; Range of time period of artwork used in the study: 2002-2015. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>
374-1	2015	M-3/5
374-2	2004	S-3/5
374-3	2002	M-3/4
374-4	2006	M-3/4
374-5	2010	M-3/5
374-6	2006	M-3/5
374-7	2002	S-3/5

374-8	2008	S-4/6/9
374-9	2009	S-9/12/16
374-10	2009	S-9/12/16
374-11	2004	S-3/4

#375, female, 30 years old, 30 years at the JLDF; 6 years at the art school; myopia; socioeconomic status/medium; range of time of artwork used in the study: 2009-2014. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
375-1	2011	L-2/3
375-2	2009	M-3/4
375-3	2010	S-3/5
375-4	2009	M-2/3
375-5	2014	M-3/4
375-6	2013	S-9/12/16

#376, male, 39 years old; 26 years at JLDF; 26 years at the art school; astigmatism – wears glasses; socioeconomic status/very low; range of time of artwork used in the study: 1995-2008. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>
376-1	2006	M-3/5
376-2	2005	I-2/3
376-3	1999	M-3/4
376-4	1998	I-3/4
376-5	1998	M-3/5
376-6	2007	M-3/4
376-7	1995	M-3/4
376-8	1995	L-2/3
376-9	1995	M-2/3
376-10	1995	L-2/3
376-11	1995	L-2/3
376-12	2005	L-3/4

#377, male, 26 years old; 5 years at JLDF; 4 years at the art school; unknown visual information; socioeconomic status/medium; range of time of artwork used in the study: Not applicable.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
377-1	2014	Low; 1/2 HR

#378, male, 46 years old; 30 years at the JLDF; 26 years at the art school; myopia and astigmatism; socioeconomic status/medium to high; range of time of artwork used in the study: 1997-2004. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
378-1	1995	I-1/2
378-2	1995	M-3/5
378-3	1997	M-2/3
378-4	2001	L-2/3
378-5	2004	M-9/12/16

#379, female, 41 years old; 41 years at JLDF; 20 years at the art school; no visual impairments; socioeconomic status/medium; range of time of artwork used in the study: 1995-2013. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>
379-1	2013	S-3/4
379-2	2005	L-2/3
379-3	2005	M-1/2
379-4	1998	M-2/3
379-5	1998	S-3/5
379-6	2007	S-3/5

379-7	1995	S-3/4
379-8	1995	L-2/3
379-9	2000	M-2/3

#380, male, 36 years old; 36 years at the JLDF; 17 years at the art school; myopia and astigmatism; socioeconomic status/medium; range of time of artwork used in the study: 2000-2008. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>
380-1	2007	S-3/4
380-2	2002	M-3/5
380-3	2007	M-3/4
380-4	2003	M-3/5
380-5	2001	S-2/3
380-6	2000	L-2/3
380-7	2005	S-1/2
380-8	2004	M-2/3
380-9	2005	M-2/3
380-10	2006	L-2/3
380-11	2008	S-1/2
380-12	2003	L-1/2
380-13	2005	S-1/2
380-14	2001	S-9/12/16
380-15	2002	M-3/4
380-16	2002	S-3/4
380-17	2005	M-2/3

#381, female, 40 years old; 38 years at JLDF; 20 years at the art school; myopia- wears glasses; socioeconomic status/high; range of time of artwork used in the study: 2001-2006. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>
381-1	2002	S-3/4
381-2	2003	S-3/5

381-3	2004	M-2/3
381-4	2001	S-3/4
381-5	2006	S-3/4
381-6	2006	L-2/3
381-7	2003	M-1/2
381-8	2005	S-2/3
381-9	2004	S-3/4
381-10	2003	M-3/4
381-11	2003	S-1/2

#382, male; 28 years old; 19 years at JLDF; 5 years at the art school; myopia; socioeconomic status/medium; range of time of artwork used in the study: 2010-2014. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
382-1	2010	M-2/3
382-2	2011	L-1/2
382-3	2012	M-1/2
382-4	2014	M-2/3
382-5	2011	M-1/2

#383, male; 27 years old; 21 years at JLDF; 4 years at the art school; myopia; socioeconomic status/medium to high; range of time of artwork used in the study: 2013-2015. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
383-1	2014	M-2/3
383-2	2015	M-2/3
383-3	2014	NF
383-4	2013	L-3/4

#384, male, 31 years old; 15 years at JLDF; 12 at the art school; myopia and astigmatism; socioeconomic status/low to medium; range of time of artwork used in the study: 2007-2014. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the</u>	<u>Year the artwork was created during</u>	<u>Score of HR determined by the</u>
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<u>number of the artwork</u>	<u>the time the participant was at the art school.</u>	<u>accuracy of the artwork composition to grid lines</u>
384-1	2014	S-4/6/9
384-2	2008	M-2/3
384-3	2007	I-1/2
384-4	2008	S-3/5
384-5	2008	L-2/3
384-6	2009	M-3/4

#385, male; 38 years old; 32 years at JLDF; 18 years at the art school; dry eye; socioeconomic status/very low; range of time of artwork used in the study: 1995-2012. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>
385-1	1997	M-2/3
385-2	1995	M-2/3
385-3	2012	S-2/3
385-4	2007	M-3/5
385-5	1999	M-3/5
385-6	1998	M-3/5
385-7	1995	M-2/3
385-8	1997	M-1/2
385-9	1999	M-3/4
385-10	2008	M-2/3
385-11	2006	NF
385-12	1995	S-3/5

#386; female; 28 years old; 22 years at JLDF; 4 years at the art school; keratoconus; socioeconomic status/low to medium; range of time of artwork used in the study: Not applicable.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
386-1	2013	M-2/3
386-2	2014	S-2/3

#387; male; 34 years old; 15 years at JLDF; 12 years at the art school; squint- wears glasses; socioeconomic status/low to medium; range of time of artwork used in the study: Not applicable.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>
387-1	2014	M-3/4

#388; female; 31 years old; 18 years at JLDF; 11 years at the art school; no visual impairments; socioeconomic status/low; range of time of artwork used in the study: NA  
 388-1; 2010; S-1/2  
 388-2; 2007; S-3/4

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR determined by the accuracy of the artwork composition to grid lines</u>	<u>Use of HR overtime increasing, decreasing, variable or not found.</u>
388-1	2010	S-1/2	
388-2	2007	S-3/4	

#389; female; 47 years old; 44 years at JLDF; 22 years at the art school; astigmatism- no glasses; socioeconomic status/medium; range of time of artwork used in the study: 2002-2009. No increasing or decreasing pattern found. A variable use of HR-RT is evident.

<u>Sequence code for participant and the number of the artwork</u>	<u>Year the artwork was created during the time the participant was at the art school.</u>	<u>Score of HR-RT determined by the accuracy of the artwork composition to grid lines</u>	<u>Use of HR-RT overtime increasing, decreasing, variable or not found.</u>
389-1	2003	M-3/5	
389-2	2003	S-2/3	
389-3	2007	M-2/3	
389-4	2006	S-2/3	
389-5	2005	M-2/3	
389-6	2004	M-3/4	
389-7	2005	S-2/3	



389-8	2005	L-2/3	
389-9	2009	M-2/3	
389-10	2003	S-4/6/9	
389-11	2006	M-2/3	
389-12	2002	S-9/12/16	
389-13	2007	M-3/4	
389-14	2009	M-3/4	

## APPENDIX M

### **Inter-rater Reliability (IRR) Assessments**

#### 1<sup>st</sup> Assessment Instructions

##### Overview

This assessment is necessary for the dissertation research of Theresa Ferg. Ms. Ferg is a PhD Candidate at the University of Denver (DU) in the education program. The inter-rater reliability (IRR) assessment will provide an independent rating of the 161 artwork images used as part of the case study data collection.

The individual taking the assessment is Dr. Jen Yin Lin, a mathematics educator with the Cherry Creek School District in Denver, Colorado.

The assessment administrator is Dr. Jill Fulkerson, an independent education researcher in the field of curriculum development.

Dr. Jill Fulkerson will administer this IRR assessment. The location of the assessment will be the DU library on Sunday February 19, 2017.

Initial instructions for the administrator:

There are four items that will be used in this assessment procedure.

1. The instructions
2. The packet of images
3. The visual diagrams
4. The response sheet and envelope

Once the rater is comfortably situated and ready to begin, the instructions from the administrator to the rater can be given.

Please read these instructions to the rater:

- A. This is a federally approved DU IRB study on the occurrence or not of a specific mathematics demonstrated in the composition of the artworks by a variety of art students. Federal law protects the art images so they are not to be copied, photographed, sketched or in any way reproduced. This is a voluntary participation; however, the rater's costs for gas to and from the administration site will be covered (please save the receipt for payment).
- B. There are three items that you will be given. The packet of images, the visual diagrams and a response sheet. Each image is to be looked at (precisely in the order given). You are to determine if there is evidence of a harmonic ratio pattern

in the design of the artwork composition. An artwork composition is the arrangement of the elements to one another within the picture frame. Stated another way, it is the spacing of the objects in the picture as an arrangement of what the artist intends for the viewer to see.

- C. The visual diagrams can assist you in determining if any of the examples are present as a compositional pattern in the artwork. You do not have to use the visual diagrams. They are an optional visual aid. The white paper has the images with the examples of harmonic ratio patterns that may or may not have been used in the artworks. The use of the ratios can be a general, moderate or very precise alignment. If you determine the artist used harmonic ratio patterning by line, spacing or other elements, then, that is a response of yes. There may be more than one harmonic ratio used within the image and that would be a response of yes. If, you do not determine that any of the harmonic ratio examples were used by the artist in the composition in a general, moderate or very precise alignment, then, that is a response of no.
- D. The response sheet is correlated to the image order. Each image has the number of the order it is presented in and an identifying sequence number.
- E. If, you have any questions please ask the administrator and if necessary, the researcher will be called to clarify any issue. The administrator will remain with the rater for the assessment to be of assistance and oversee the confidentiality of the images.
- F. The administrator cannot give any information about the artworks, artists or purpose of the research.
- G. When you are finished with the assessment, please, give all of the items to the administrator. Your responses will be sealed in an envelope by the administrator and returned to the chairperson of the researcher's PhD committee at DU
- H. Any questions you may have in regard to the research can be answered once the assessment is completed and the responses sealed.
- I. Thank you very much for participating in this research project. You will be asked to provide a short biography of your background for inclusion in the research documentation.
- J. Please let the administrator know if there were any items not included in the procedural information or any other comments you would like to make.

Completion instructions for the administrator:

Once the rater has finished the assessment, please check the response sheet to make sure the sheet is completed. If, the rater chooses to leave a response blank that is acceptable. Please check to make sure the rater intended to leave the response blank. The response sheet should be placed in the envelope and sealed. At your convenience, please return the envelope to Dr. Bruce Uhrmacher at DU. All of the images and visual diagrams should be returned to the researcher.

Please list any additional items necessary for the administration of the assessment that were not covered in these instructions that you deemed necessary to include in the process.

Thank you for your time and professionalism in conducting this assessment procedure. You will be asked to provide a short biography of your background for inclusion in the research documentation. Please relay the cost of the gas used to and from the assessment site to the researcher for reimbursement.

## Results of the Assessment

### Inter-rater Reliability (IRR) Assessment

This is the sheet for the record of the image ratings. There are 161 images listed. Each image has a sequence number, such as, 369 identifying the artist. Each artwork is indicated with a number, for example, 369-1, means the artist and the artwork. The sequence of numbers on this sheet is precisely matched to the images and the order in which the assessment is to be conducted. The rating is a dichotomous scale, yes or no answers. The rater is to determine (yes or no) did the artists use any of the six examples of geometric patterns in the composition of the artwork.

Sequence Number of Artwork	Yes	No
1. 369-1	_x_	_
2. 369-2	_	_x_
3. 369-3	_	_x_
4. 369-4	_x_	_
5. 369-5	_x_	_
369-5a	_x_	_
369-5b	_x_	_
6. 369-6	_	_x_
7. 369-7	_x_	_
8. 369-8	_x_	_
9. 369-9	_	_x_
10. 369-10	_x_	_
11. 369-11	_x_	_
12. 370-1	_	_x_
13. 370-2	_x_	_
14. 370-3	_x_	_
15. 370-4	_x_	_
16. 370-5	_	_x_
17. 370-6	_	_x_
18. 370-7	_x_	_
19. 370-8	_	_x_
20. 370-9	_x_	_
21. 370-10	_x_	_
22. 370-11	_	_
23. 370-12	_x_	_
24. 370-13	_	_x_
25. 370-14	_	_x_

26. 370-15	<u>  x  </u>	<u>      </u>
27. 370-16	<u>  x  </u>	<u>      </u>
28. 370-17	<u>      </u>	<u>  x  </u>
29. 370-18	<u>      </u>	<u>  x  </u>
30. 370-19	<u>  x  </u>	<u>      </u>
31. 370-20	<u>      </u>	<u>  x  </u>
32. 371-1	<u>      </u>	<u>  x  </u>
33. 371-2	<u>  x  </u>	<u>      </u>
34. 371-3	<u>      </u>	<u>  x  </u>
35. 371-4	<u>      </u>	<u>  x  </u>
36. 371-5	<u>      </u>	<u>  x  </u>
37. 371-6	<u>      </u>	<u>  x  </u>
38. 372-1	<u>  x  </u>	<u>      </u>
39. 373-1	<u>  x  </u>	<u>      </u>
40. 373-2	<u>      </u>	<u>  x  </u>
41. 373-3	<u>  x  </u>	<u>      </u>
42. 374-1	<u>      </u>	<u>  x  </u>
43. 374-2	<u>  x  </u>	<u>      </u>
44. 374-3	<u>  x  </u>	<u>      </u>
45. 374-4	<u>      </u>	<u>  x  </u>
46. 374-5	<u>      </u>	<u>  x  </u>
47. 374-6	<u>  x  </u>	<u>      </u>
48. 374-7	<u>  x  </u>	<u>      </u>
49. 374-8	<u>      </u>	<u>  x  </u>
50. 374-9	<u>      </u>	<u>  x  </u>
51. 374-10	<u>      </u>	<u>  x  </u>
52. 374-11	<u>  x  </u>	<u>      </u>
53. 375-1	<u>  x  </u>	<u>      </u>
54. 375-2	<u>  x  </u>	<u>      </u>
55. 375-3	<u>      </u>	<u>  x  </u>
56. 375-4	<u>  x  </u>	<u>      </u>
57. 375-5	<u>  x  </u>	<u>      </u>
58. 375-6	<u>  x  </u>	<u>      </u>
59. 376-1	<u>  x  </u>	<u>      </u>
60. 376-2	<u>  x  </u>	<u>      </u>
61. 376-3	<u>      </u>	<u>  x  </u>
62. 376-4	<u>  x  </u>	<u>      </u>
63. 376-5	<u>      </u>	<u>  x  </u>
64. 376-6	<u>      </u>	<u>  x  </u>
65. 376-7	<u>      </u>	<u>  x  </u>
66. 376-8	<u>  x  </u>	<u>      </u>
67. 376-9	<u>  x  </u>	<u>      </u>
68. 376-10	<u>  x  </u>	<u>      </u>
69. 376-11	<u>  x  </u>	<u>      </u>
70. 376-12	<u>  x  </u>	<u>      </u>
71. 377-1	<u>  x  </u>	<u>      </u>
72. 378-1	<u>  x  </u>	<u>      </u>
73. 378-2	<u>  x  </u>	<u>      </u>

74. 378-3	<u>  x  </u>	<u>      </u>
75. 378-4	<u>  x  </u>	<u>      </u>
76. 378-5	<u>      </u>	<u>  x  </u>
77. 379-1	<u>  x  </u>	<u>      </u>
78. 379-2	<u>      </u>	<u>  x  </u>
79. 379-3	<u>  x  </u>	<u>      </u>
80. 379-4	<u>      </u>	<u>  x  </u>
81. 379-5	<u>  x  </u>	<u>      </u>
82. 379-6	<u>  x  </u>	<u>      </u>
83. 379-7	<u>      </u>	<u>  x  </u>
84. 379-8	<u>  x  </u>	<u>      </u>
85. 379-9	<u>  x  </u>	<u>      </u>
86. 380-1	<u>  x  </u>	<u>      </u>
87. 380-2	<u>  x  </u>	<u>      </u>
88. 380-3	<u>  x  </u>	<u>      </u>
89. 380-4	<u>  x  </u>	<u>      </u>
90. 380-5	<u>  x  </u>	<u>      </u>
91. 380-6	<u>  x  </u>	<u>      </u>
92. 380-7	<u>  x  </u>	<u>      </u>
93. 380-8	<u>      </u>	<u>  x  </u>
94. 380-9	<u>  x  </u>	<u>      </u>
95. 380-10	<u>  x  </u>	<u>      </u>
96. 380-11	<u>  x  </u>	<u>      </u>
97. 380-12	<u>  x  </u>	<u>      </u>
98. 380-13	<u>      </u>	<u>  x  </u>
99. 380-14	<u>  x  </u>	<u>      </u>
100. 380-15	<u>      </u>	<u>  x  </u>
101. 380-16	<u>  x  </u>	<u>      </u>
102. 380-17	<u>      </u>	<u>  x  </u>
103. 381-1	<u>  x  </u>	<u>      </u>
104. 381-2	<u>      </u>	<u>  x  </u>
105. 381-3	<u>      </u>	<u>  x  </u>
106. 381-4	<u>  x  </u>	<u>      </u>
107. 381-5	<u>  x  </u>	<u>      </u>
108. 381-6	<u>  x  </u>	<u>      </u>
109. 381-7	<u>  x  </u>	<u>      </u>
110. 381-8	<u>  x  </u>	<u>      </u>
111. 381-9	<u>  x  </u>	<u>      </u>
112. 381-10	<u>  x  </u>	<u>      </u>
113. 381-11	<u>  x  </u>	<u>      </u>
114. 382-1	<u>      </u>	<u>  x  </u>
115. 382-2	<u>  x  </u>	<u>      </u>
116. 382-3	<u>  x  </u>	<u>      </u>
117. 382-4	<u>      </u>	<u>  x  </u>
118. 382-5	<u>  x  </u>	<u>      </u>
119. 383-1	<u>  x  </u>	<u>      </u>
120. 383-2	<u>  x  </u>	<u>      </u>
121. 383-3	<u>  x  </u>	<u>      </u>

122. 383-4	_____	__x__
123. 384-1	_____	__x__
124. 384-2	__x__	_____
125. 384-3	_____	__x__
126. 384-4	_____	__x__
127. 384-5	__x__	_____
128. 384-6	__x__	_____
129. 385-1	__x__	_____
130. 385-2	__x__	_____
131. 385-3	__x__	_____
132. 385-4	_____	__x__
133. 385-5	__x__	_____
134. 385-6	__x__	_____
135. 385-7	__x__	_____
136. 385-8	__x__	_____
137. 385-9	__x__	_____
138. 385-10	__x__	_____
139. 385-11	_____	_____
140. 385-12	_____	__x__
141. 386-1	__x__	_____
142. 386-2	__x__	_____
143. 387-1	_____	__x__
144. 388-1	__x__	_____
145. 388-2	__x__	_____
146. 389-1	__x__	_____
147. 389-2	__x__	_____
148. 389-3	__x__	_____
149. 389-4	__x__	_____
150. 389-5	__x__	_____
151. 389-6	_____	__x__
152. 389-7	_____	__x__
153. 389-8	__x__	_____
154. 389-9	_____	__x__
155. 389-10	_____	__x__
156. 389-11	_____	__x__
157. 389-12	__x__	_____
158. 389-13	__x__	_____
159. 389-14	_____	__x__

### Calculation of Kappa as a Measure of Concordance in Categorical Rating

The rater is to determine (yes or no) did the artists use any of the examples of the HR-RT geometric patterns in the composition of the artwork.

Number of categories = 2

Basis for weighting: imputed relative distances between ordinal categories, successive ordinal categories

Data entry: Case 1: 159/yes; 2/no

Case 2: 107/yes; 54/no

159	2	161
54	107	161
213	109	322

Kappa with Quadratic Weighting: Observed Kappa: 0.6522; Standard Error: 0.0332

Confidence Intervals: 0.95% of Observed- Lower Limit: 0.5738

Upper Limit: 0.7306

Proportions of Agreement: Maximum Possible: 0.7559/0.677; Composite: 0.8385

Chance Expected: 0.3981/0.2529; Composite: 0.5

Observed: 0.7395/1.6564; Composite: 0.8261

Confidence Intervals: 0.95% of Observed- Lower Limit: 0.6746/0.5775; Composite: 0.7792

Upper Limit: 0.7957/0.7278; Composite:

0.865

Frequencies of Agreement: Maximum Possible: 161/109; Composite: 270

Chance Expected: 106.5/54.5; Composite: 107

Observed: 159/107; Composite: 266



## 2<sup>nd</sup> Inter-rater Reliability (IRR) Assessment Instructions

### Overview

This assessment is necessary for the dissertation research of Theresa Ferg. Ms. Ferg is a PhD Candidate at the University of Denver (DU) in the education program. The inter-rater reliability (IRR) assessment to determine (yes or no) did the artists use the examples of geometric patterns in the composition of the artwork

The individual taking the assessment is Dawn McFadden, an arts educator, artist and illustrator at the Community College of Denver (CCD) and Metro State University at the Auraria Campus in Denver, Colorado.

The assessment administrator is Dr. Jill Fulkerson, an independent education researcher in the field of curriculum development.

Initial instructions for the administrator:

There are four items that will be used in this assessment procedure.

5. The instructions
6. The packet of images
7. The visual diagrams
8. The response sheet and envelope

Once the rater is comfortably situated and ready to begin, the instructions from the administrator to the rater can be given.

Please read these instructions to the rater:

- K. This is a federally approved DU IRB study. The art images analyzed in this study are protected by federal law so they are not to be copied, photographed, sketched or in any way reproduced. This is a voluntary participation, however, the rater's costs for gas to and from the administration site will be covered (please save the receipt for payment).
- L. There are three items that you will be given. The packet of images, the spatial division aids and a response sheet. Each image is to be looked at precisely in the order given.
- M. The visual diagrams can assist you in determining if any of the seven examples are present as a compositional pattern in the artwork. You do not have to use the visual diagrams. They are an optional visual aid. The response sheet is correlated to the image order. Each image has the number of the order it is presented in and an identifying sequence number.

- N. If, you have any questions please ask the administrator and, if necessary, the researcher will be called to clarify any issue. The administrator will remain with the rater for the assessment to be of assistance and oversee the confidentiality of the images.
- O. The administrator cannot give any information about the artworks, artists or purpose of the research.
- P. When you are finished with the assessment, please, give all of the items to the administrator. Your responses will be sealed in an envelope by the administrator and returned to the chairperson of the researcher's PhD committee at DU.
- Q. Any questions you may have in regard to the research can be answered once the assessment is completed and the responses sealed.
- R. Thank you very much for participating in this research project. You will be asked to provide a short biography of your background for inclusion in the research documentation.

Completion instructions for the administrator:

Once the rater has finished the assessment, please check the response sheet to make sure the sheet is completed. If, the rater chooses to leave a response blank that is acceptable. Please check to make sure the rater intended to leave the response blank. The response sheet should be placed in the envelope and sealed. At your convenience please return the envelope to Dr. Bruce Uhrmacher at DU. All of the images and visual diagrams should be returned to the researcher.

Please list any additional items necessary for the administration of the assessment that were not covered in these instructions that you deemed necessary to include in the process.

Thank you for your time and professionalism in conducting this assessment procedure. You will be asked to provide a short biography of your background for inclusion in the research documentation. Please relay the cost of the gas used to and from the assessment site to the researcher for reimbursement.

#### Inter-rater Reliability (IRR) Assessment

This is the sheet for the record of the image assessments. There are 159 images listed. Image # 5 has three parts. Each image has a sequence number, such as, #369 identifying the artist. Each artwork is indicated with a number, for example, 369-1, which means the artist and the artwork. The sequence of numbers on this sheet is precisely matched to the images and the order in which the assessment is to be conducted.

This is an analysis of the artwork compositions following fundamental artistic principles. The intent is to assess the compositions in an *overview manner* primarily considering the main compositional items. Seven examples are provided of spatial divisions to provide an

aid in the assessment. Some of the images are not the same size as the examples but the concepts of the spatial divisions are universal. These spatial divisions start geometrically simple and become progressively more complex. Most of the images are simplistic but some are more complex. Each clear plastic example is labeled with the specific spatial division.

$1/2$  = a division of the picture frame in half vertically or horizontally or both

$2/3$  = a division of the picture frame in half vertically or horizontally and a division of the picture frame in thirds vertically or horizontally

$3/3$  = a division of the picture frame in thirds either vertically and horizontally

$3/4$  = a division of the picture frame in thirds vertically or horizontally and a division of the picture frame in fourths vertically or horizontally

$3/5$  = a division of the picture frame in thirds vertically or horizontally and a division of the picture frame in fifths vertically or horizontally

$4/6/9$  = a division of the picture frame in fourths, sixths or ninths vertically or horizontally

$9/12/16$  = a division of the picture frame in ninths, twelfths or sixteenths vertically or horizontally

This assessment procedure examines the composition of these artworks. If, the composition can be defined as a description the subject matter of the intention of the artist whether by line, spacing, alignment or ideation, then, it is a component of the composition. More than one spatial division may be demonstrated in the composition, please note up to just two.

Please indicate the vertical and horizontal spatial division type, such as, an image that is spatially divided into thirds vertically and in half horizontally is referred to as a **V1/3 and H1/2** or if the composition aligns to a vertical division of fifths and a horizontal division of thirds, it is a **V1/5 and H1/3**. Other examples are a vertical one half **V1/2 and HNF** (horizontal not found) or an image that is the vertical sixths divisions **V1/6 and H1/9** horizontal ninths. These spatial divisions can be visually assessed. There is a ruler to use if you choose to use as an aid.

Label the images with the degree of alignment of the artwork compositions to the spatial division, for example, a **strong (S)** representation (aligns closely to the specific spatial division horizontally and vertically), **moderate (M)** (aligns to a good degree to the vertical and horizontal spatial divisions) or **low (L)** (the spatial arrangement is generally indicated vertically and horizontally), **inconsistent** (there are spatial divisions but they are unclear) or **not found (NF)** (there are no spatial divisions in the image that follow the

seven listed divisions). The degree of alignment can be visually assessed. There is a ruler to use if you choose it as an aid.

Sequence Number of Artwork	Type of Spatial Division	Degree of Alignment
Example	_____ V1/2 and H1/3 _____	_____ M _____
1. 369-1	_____ V2/3 _____	_____ M _____
2. 369-2	_____ V3/5 _____	_____ S _____
3. 369-3	_____ V4/6/9 _____	_____ L _____
4. 369-4	_____ V3/4 _____	_____ M _____
5. 369-5	_____ L_ V1/2, R H3/5 _____	_____ S/M _____
369-5a	_____ H3/3 _____	_____ S _____
369-5b	_____ H3/4 _____	_____ M _____
6. 369-6	_____ V2/3 _____	_____ M _____
7. 369-7	_____ V4/6/9 _____	_____ M _____
8. 369-8	_____ H & V1/2 _____	_____ S _____
9. 369-9	_____ H3/5 _____	_____ L _____
10. 369-10	_____ H1/2 & V1/2; H2/3 _____	_____ M _____
11. 369-11	_____ H3/3 _____	_____ S _____
12. 370-1	_____ V3/5 _____	_____ M _____
13. 370-2	_____ V3/5 _____	_____ M _____
14. 370-3	_____ H3/5 _____	_____ M _____
15. 370-4	_____ V3/5 _____	_____ M _____
16. 370-5	_____ V3/4 _____	_____ L _____
17. 370-6	_____ V4/6/9 _____	_____ M _____
18. 370-7	_____ V2/3 _____	_____ M _____
19. 370-8	_____ V3/4 _____	_____ M _____
20. 370-9	_____ H3/5 _____	_____ L _____
21. 370-10	_____ H2/3 _____	_____ S _____
22. 370-11	_____ V3/5 _____	_____ L-M _____
23. 370-12	_____ V3/4 _____	_____ L _____
24. 370-13	_____ H&V1/2 _____	_____ S _____
25. 370-14	_____ H3/4 _____	_____ S _____
26. 370-15	_____ H3/5 _____	_____ M _____
27. 370-16	_____ V3/4 _____	_____ S _____
28. 370-17	_____ V4/6/9 _____	_____ L _____
29. 370-18	_____ V3/3 _____	_____ L _____
30. 370-19	_____ V3/4 _____	_____ S _____
31. 370-20	_____ V3/3 _____	_____ M-S _____
32. 371-1	_____ H4/6/9 _____	_____ L _____
33. 371-2	_____ V4/6/9 _____	_____ L _____
34. 371-3	_____ H3/4 _____	_____ S _____
35. 371-4	_____ V3/4 _____	_____ S _____

36. 371-5	V2/3	M
37. 371-6	-	NF
38. 372-1	V2/3	S
39. 373-1	H3/5	S
40. 373-2	V2/3	S
41. 373-3	V3/5	L
42. 374-1	V9/12/16	L
43. 374-2	V3/5	S
44. 374-3	V1/2	M
45. 374-4	V3/3	M
46. 374-5	V9/12/16	very L/almost I
47. 374-6	H3/5	L
48. 374-7	H3/3	S
49. 374-8	V2/3	S
50. 374-9	V4/6/9	M
51. 374-10	H3/4	S
52. 374-11	H3/4	S
53. 375-1	-	NF
54. 375-2	H3/5	M
55. 375-3	V3/4	M
56. 375-4	V3/4	M
57. 375-5	V3/4	S
58. 375-6	V4/6/9	M
59. 376-1	V3/4	M
60. 376-2	-	NF
61. 376-3	V3/5	I
62. 376-4	-	NF
63. 376-5	V4/6/9	L
64. 376-6	V2/3	M
65. 376-7	V3/4	M
66. 376-8	H4/6/9	L
67. 376-9	V3/5	M
68. 376-10	H3/3	M
69. 376-11	H2/3	L
70. 376-12	V4/6/9	L
71. 377-1	V3/4	very L
72. 378-1	-	I
73. 378-2	-	NF
74. 378-3	H3/4	L
75. 378-4	V3/4	M
76. 378-5	V3/4	M
77. 379-1	H3/4	M
78. 379-2	H3/4	L
79. 379-3	V4/6/9	M
80. 379-4	H3/3	S

81. 379-5	V3/3	M
82. 379-6	H&V1/2	M
83. 379-7	H3/4	M
84. 379-8	H3/3	L
85. 379-9	V4/6/9	S
86. 380-1	V3/4	M
87. 380-2	V3/3	M
88. 380-3	H3/4	M
89. 380-4	V3/4	M
90. 380-5	V3/4	M
91. 380-6	V3/5	M
92. 380-7	H3/3	L
93. 380-8	V4/6/9	M
94. 380-9	H3/3	M
95. 380-10	H3/3	L
96. 380-11	V&H3/4	S
97. 380-12	-	NF
98. 380-13	V4/6/9	M
99. 380-14	V3/4	M
100. 380-15	V1/2	S
101. 380-16	V3/4	M
102. 380-17	H&V3/3	M
103. 381-1	H3/5	M
104. 381-2	V4/6/9	M
105. 381-3	H3/3	S
106. 381-4	V4/6/9	M
107. 381-5	V3/3	S
108. 381-6	-	NF
109. 381-7	V3/5	M
110. 381-8	V3/4	M
111. 381-9	H3/5	M
112. 381-10	V3/5	L
113. 381-11	V3/4	S
114. 382-1	H3/3	L
115. 382-2	H1/2	I
116. 382-3	H1/2	M
117. 382-4	H3/3	M
118. 382-5	V3/4	I
119. 383-1	V3/3	S
120. 383-2	V4/6/9	L
121. 383-3	H3/5	L
122. 383-4	V3/5	S
123. 384-1	H3/3	M
124. 384-2	H4/6/9	M
125. 384-3	V3/5	L
126. 384-4	H3/5	I weak
127. 384-5	V3/5	L

128. 384-6	H9/12/16	M-S
129. 385-1	H9/12/16	L
130. 385-2	H3/4	M
131. 385-3	H3/4	L
132. 385-4	V9/12/16	L-M
133. 385-5	H4/6/9	M
134. 385-6	H4/6/9	M
135. 385-7	H4/6/9	I
136. 385-8	H4/6/9	M
137. 385-9	H4/6/9	M
138. 385-10	V2/3	M
139. 385-11	V3/3	L
140. 385-12	H3/3	I
141. 386-1	V3/5	M
142. 386-2	H3/4	M
143. 387-1	-	NF
144. 388-1	V1/2	S
145. 388-2	H3/3	I
146. 389-1	H9/12/16	M
147. 389-2	V4/6/9	S
148. 389-3	V3/5	M
149. 389-4	H4/6/9	M-S
150. 389-5	V4/6/9	M
151. 389-6	V4/6/9	S
152. 389-7	V3/4	M
153. 389-8	H4/6/9	M
154. 389-9	H4/6/9	M
155. 389-10	H3/3	M
156. 389-11	H4/6/9	L
157. 389-12	H4/6/9	M
158. 389-13	V3/5	S
159. 389-14	H3/5	S

## Comparison to Research Analysis of the Images

Sequence Number of Artwork      Spatial Division      Comparison to Research

Exact = the lines of the HR-RT ratio are in the Photoshop analysis and stated by IRR rater

Agree = the lines of the HR-RT ratio are very similar in describing the composition i.e., ext, 1/2 to 3/4 means the 1/2 ratio is an extension of the 3/4 ratio and describes the same items.

Disagree = the lines of the HR-RT ratio do not describe the composition in the same manner

Disagree\* = there is agreement in the low level of accuracy for the HR-RT ratio.

1.	369-1	___ V2/3 _____	___ Exact _____
2.	369-2	___ V3/5 _____	___ Exact _____
3.	369-3	___ V4/6/9 _____	___ Agree ext. 1/3 to 1/6 _____
4.	369-4	___ V3/4 _____	___ Agree ext. 1/2 to 1/4 _____
5.	369-5	___ L_ V1/2, R H3/5 _____	___ Exact _____
	369-5a	___ H3/3 _____	___ Agree ext. 3/3 to 3/5 _____
	369-5b	___ H3/4 _____	___ Exact _____
6.	369-6	___ V2/3 _____	___ Disagree _____
7.	369-7	___ V4/6/9 _____	___ Agree ext. 1/3 to 1/6 _____
8.	369-8	___ H & V1/2 _____	___ Exact _____
9.	369-9	___ H3/5 _____	___ Agree ext. 3/4 to 3/5 _____
10.	369-10	___ H1/2 & V1/2; H2/3 _____	___ Exact _____
11.	369-11	___ H3/3 _____	___ Disagree _____
12.	370-1	___ V3/5 _____	___ Exact _____
13.	370-2	___ V3/5 _____	___ Exact _____
14.	370-3	___ H3/5 _____	___ Exact _____
15.	370-4	___ V3/5 _____	___ Disagree _____
16.	370-5	___ V3/4 _____	___ Disagree _____
17.	370-6	___ V4/6/9 _____	___ Disagree _____
18.	370-7	___ V2/3 _____	___ Exact _____
19.	370-8	___ V3/4 _____	___ Agree ext. 3/4 to 3/5 _____
20.	370-9	___ H3/5 _____	___ Agree ext. 3/4 to 3/5 _____
21.	370-10	___ H2/3 _____	___ Exact _____
22.	370-11	___ V3/5 _____	___ Exact _____
23.	370-12	___ V3/4 _____	___ Exact _____
24.	370-13	___ H&V1/2 _____	___ Exact _____
25.	370-14	___ H3/4 _____	___ Exact _____
26.	370-15	___ H3/5 _____	___ Agree ext. 3/4 to 3/5 _____
27.	370-16	___ V3/4 _____	___ Disagree _____



28. 370-17	V4/6/9	Disagree
29. 370-18	V3/3	Disagree
30. 370-19	V3/4	Agree ext. 3/4 to 3/5
31. 370-20	V3/3	Disagree
32. 371-1	H4/6/9	Disagree
33. 371-2	V4/6/9	Agree ext. 2/3 to 4/6/9
34. 371-3	H3/4	Exact
35. 371-4	V3/4	Agree ext. 3/4 to 3/5
36. 371-5	V2/3	Exact
37. 371-6	-	Disagree
38. 372-1	V2/3	Exact
39. 373-1	H3/5	Exact
40. 373-2	V2/3	Exact
41. 373-3	V3/5	Exact
42. 374-1	V9/12/16	Disagree
43. 374-2	V3/5	Exact
44. 374-3	V1/2	Agree ext. 1/2 to 1/4
45. 374-4	V3/3	Disagree
46. 374-5	V9/12/16	Disagree
47. 374-6	H3/5	Exact
48. 374-7	H3/3	Agree ext. 3/3 to 3/5
49. 374-8	V2/3	Exact
50. 374-9	V4/6/9	Agree ext. 4/6/9 to 9/12/16
51. 374-10	H3/4	Exact
52. 374-11	H3/4	Exact
53. 375-1	-	Disagree*
54. 375-2	H3/5	Disagree
55. 375-3	V3/4	Agree ext. 3/4 to 3/5
56. 375-4	V3/4	Agree ext. 2/3 to 3/4
57. 375-5	V3/4	Exact
58. 375-6	V4/6/9	Agree ext. 4/6/9 to 9/12/16
59. 376-1	V3/4	Agree ext. 3/4 to 3/5
60. 376-2	-	Disagree*
61. 376-3	V3/5	Agree ext. 3/4 to 3/5
62. 376-4	-	Disagree*
63. 376-5	V4/6/9	Agree ext. 3/5 to 4/6/9
64. 376-6	V2/3	Exact
65. 376-7	V3/4	Exact
66. 376-8	H4/6/9	Agree ext. 2/3 to 4/6/9
67. 376-9	V3/5	Agree ext. 3/4 to 3/5
68. 376-10	H3/3	Disagree
69. 376-11	H2/3	Exact
70. 376-12	V4/6/9	Agree ext. 3/4 to 4/6/9
71. 377-1	V3/4	Disagree
72. 378-1	-	Disagree*

73. 378-2	-	Disagree
74. 378-3	H3/4	Agree ext. 2/3 to 3/4
75. 378-4	V3/4	Agree ext. 2/3 to 3/4
76. 378-5	V3/4	Exact
77. 379-1	H3/4	Exact
78. 379-2	H3/4	Disagree
79. 379-3	V4/6/9	Disagree
80. 379-4	H3/3	Exact
81. 379-5	V3/3	Exact
82. 379-6	H&V1/2	Exact
83. 379-7	H3/4	Exact
84. 379-8	H3/3	Disagree
85. 379-9	V4/6/9	Disagree
86. 380-1	V3/4	Exact
87. 380-2	V3/3	Exact
88. 380-3	H3/4	Exact
89. 380-4	V3/4	Agree ext. 3/4 to 3/5
90. 380-5	V3/4	Agree ext. 2/3 to 3/4
91. 380-6	V3/5	Disagree
92. 380-7	H3/3	Disagree
93. 380-8	V4/6/9	Agree ext. 2/3 to 4/6/9
94. 380-9	H3/3	Disagree
95. 380-10	H3/3	Disagree*
96. 380-11	V&H3/4	Exact
97. 380-12	-	Disagree*
98. 380-13	V4/6/9	Disagree
99. 380-14	V3/4	Exact
100. 380-15	V1/2	Exact
101. 380-16	V3/4	Exact
102. 380-17	H&V3/3	Exact
103. 381-1	H3/5	Agree ext. 3/4 to 3/5
104. 381-2	V4/6/9	Agree ext. 3/3 to 4/6/9
105. 381-3	H3/3	Disagree
106. 381-4	V4/6/9	Agree ext. 3/4 to 4/6/9
107. 381-5	V3/3	Agree
108. 381-6	-	Disagree*
109. 381-7	V3/5	Disagree
110. 381-8	V3/4	Agree ext. 2/3 to 3/4
111. 381-9	H3/5	Agree ext. 3/4 to 3/5
112. 381-10	V3/5	Agree ext. 3/4 to 3/5
113. 381-11	V3/4	Disagree
114. 382-1	H3/3	Disagree
115. 382-2	H1/2	Exact
116. 382-3	H1/2	Exact
117. 382-4	H3/3	Disagree
118. 382-5	V3/4	Agree ext. 1/2 to 3/4

119. 383-1	V3/3	Exact
120. 383-2	V4/6/9	Agree ext. 2/3 to 4/6/9
121. 383-3	H3/5	Disagree*
122. 383-4	V3/5	Agree ext. 3/4 to 3/5
123. 384-1	H3/3	Exact
124. 384-2	H4/6/9	Agree ext.2/3 to 4/6/9
125. 384-3	V3/5	Disagree*
126. 384-4	H3/5	Exact
127. 384-5	V3/5	Disagree
128. 384-6	H9/12/16	Agree ext. 3/4 to 9/12/16
129. 385-1	H9/12/16	Agree ext. 2/3 to 9/12/16
130. 385-2	H3/4	Disagree
131. 385-3	H3/4	Disagree
132. 385-4	V9/12/16	Agree ext. 3/5 to 9/12/16
133. 385-5	H4/6/9	Disagree
134. 385-6	H4/6/9	Agree ext. 3/5 to 9/12/16
135. 385-7	H4/6/9	Disagree
136. 385-8	H4/6/9	Disagree
137. 385-9	H4/6/9	Agree ext. 3/4 to 9/12/16
138. 385-10	V2/3	Exact
139. 385-11	V3/3	Disagree*
140. 385-12	H3/3	Disagree
141. 386-1	V3/5	Disagree
142. 386-2	H3/4	Agree ext. 2/3 to 3/4
143. 387-1	-	Disagree
144. 388-1	V1/2	Exact
145. 388-2	H3/3	Agree ext. 2/3 to 3/4
146. 389-1	H9/12/16	Agree ext. 3/5 to 9/12/16
147. 389-2	V4/6/9	Agree ext. 2/3 to 4/6/9
148. 389-3	V3/5	Disagree
149. 389-4	H4/6/9	Agree ext. 2/3 to 4/6/9
150. 389-5	V4/6/9	Agree ext. 2/3 to 4/6/9
151. 389-6	V4/6/9	Agree ext. 2/3 to 4/6/9
152. 389-7	V3/4	Agree ext. 2/3 to 3/4
153. 389-8	H4/6/9	Agree ext. 2/3 to 4/6/9
154. 389-9	H4/6/9	Agree ext. 2/3 to 4/6/9
155. 389-10	H3/3	Exact
156. 389-11	H4/6/9	Agree ext. 2/3 to 4/6/9
157. 389-12	H4/6/9	Exact
158. 389-13	V3/5	Agree ext. 3/4 to 3/5
159. 389-14	H3/5	Agree ext. 3/4 to 3/5

### Calculation of Kappa as a Measure of Concordance in Categorical Rating

The inter-rater reliability (IRR) assessment to determine (yes or no) did the artists use the examples of geometric patterns in the composition of the artwork.

Number of categories = 2

Basis for weighting: imputed relative distances between ordinal categories, successive ordinal categories

Data entry: Case 1: 159/yes; 2/no

Case 2: 153/yes; 8/no

159	2	161
8	153	161
167	155	322

Kappa with Quadratic Weighting: Observed Kappa: 0.9379; Standard Error: 0.016

Confidence Intervals: 0.95% of Observed- Lower Limit: 0.9065

Upper Limit: 0.9693

Proportions of Agreement: Maximum Possible: 0.9641/0.9627; Composite: 0.9814

Chance Expected: 0.3415/0.3249; Composite: 0.5

Observed: 0.9408/0.9387; Composite: 0.9689

Confidence Intervals: 0.95% of Observed-

Lower Limit: 0.8909/0.887; Composite: 0.9418

Upper Limit: 0.9697/0.9685; Composite: 0.9841

Frequencies of Agreement: Maximum Possible: 161/155; Composite: 316

Chance Expected: 83.5/77.5; Composite: 161

Observed: 159/153; Composite: 312

## Calculation of Kappa as a Measure of Concordance in Categorical Rating

The inter-rater reliability (IRR) assessment to determine if there was there agreement or disagreement of the various concordant ratios used in geometric patterns of the compositions of the artworks.

Number of categories = 2

Basis for weighting: imputed relative distances between ordinal categories, successive ordinal categories

Data entry: Case 1: 159/yes; 2/no

Case 2: 110/yes; 51/no

159	2	161
51	110	161
210	112	322

Kappa with Quadratic Weighting: Observed Kappa: 0.6708; Standard Error: 0.0327

Confidence Intervals: 0.95% of Observed- Lower Limit: 0.6068

Upper Limit: 0.7348

Proportions of Agreement: Maximum Possible: 0.7667/0.6957; Composite: 0.8478

Chance Expected: 0.3947/0.2581; Composite: 0.5

Observed: 0.75/0.6748; Composite: 0.8354

Confidence Intervals: 0.95% of Observed-

Lower Limit: 0.6851/0.5965; Composite: 0.7893

Upper Limit: 0.8056/0.7448; Composite: 0.8733

Frequencies of Agreement: Maximum Possible: 161/112; Composite: 273

Chance Expected: 105/56; Composite: 161

Observed: 159/110; Composite: 269