

Pre-print of

Jennifer A. McMahon: **Perceptual Constraints and Perceptual Schemata: The Possibility of Perceptual Style.**

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## 1. Introduction

If we assembled a group of visual artists, limited them to the same materials, say oil paint and brushes, and asked them to paint a picture of a model placed in front of them, they would each produce a unique version of the same model. This is not very surprising; but it should be. It is not surprising because we have become accustomed to the endless variety of pictorial representations possible of any one object. From the 30 different versions of the bowl of flowers produced by a children's art class to the conscious development of ways of representing which constitute art movements in the art world, variety is what popularly defines artistic endeavour. Furthermore, within any artistic movement, even when the artists involved treat the same subject matter and proclaim to share the same artistic aims, they will each portray individual differences in their method of depiction.<sup>1</sup> This should be surprising, because all the objects depicted by artists generate standard concepts common to all of us who are able to communicate verbally with each other about them. That is, we communicate about these objects in ways which assume that we all share a common concept of the object. In addition, we all recognise the object as though we all have a common schema for the object in Long Term Memory. How is it possible then to have endless varieties of pictorial representations of the same object/concept? Whether or not a resulting pictorial representation is the result of lack of skill in drawing or painting, the fact remains that

the unskilled drawing represents a pictorial possibility in terms of a particular use and combination of pictorial elements as do more skilled drawings. It is also the case that any particular pictorial representation reflects the possibilities allowed by the medium used but the interest of this author does not extend in that direction. The significance system that I will be employing as my framework involves the ways in which visual elements can be selected, represented and combined; and the determination of these various possibilities by the constraints of the human perceptual apparatus. That such a significance system is significant, I will not argue here. Suffice it to point to my motivation which is the belief that the perceptual aspect of art works is the key to understanding the pleasure which is peculiar to the aesthetic realm.<sup>2</sup>

In this paper I will carve out a space between the concept of "the object" and the seemingly endless ways in which "the object" can be represented pictorially. I will call the aspect of the pictorial representation which is made possible by this space, the pictorial representation's "style". I will explore this space by drawing upon theories of pictorial representation, leaving out, for the sake of my purposes here, a consideration of the artist's intention. That an attribution of "style" can be comprehensive while leaving out a consideration of artists' intentions, I will argue by adopting the conceptual framework of Paul Thom's theory of interpretation.<sup>3</sup> Before embarking on my project, I begin with a brief overview of the rather slippery notion of "style".

## 2. The Concept of Style

The notion of "style" is central to art history practice; if not to the philosophy of art history.<sup>4</sup> This may seem like a safe place to start when examining the meaning of "style" but unfortunately it is about the only uncontroversial statement that one can make concerning the concept of "style". Consider that at one time "style" referred only

to an artwork's compositional structure. "Style" was considered only one of a set of elements which together constituted an artwork. According to Raymond Macdonald<sup>5</sup>, the 17<sup>th</sup> century painter Nicolas Poussin analysed what he called the grand manner of painting into subject matter, thought, structure and style; the *action* of the subject matter being the most central feature. This analysis of an artwork into its conceptual elements originates in Aristotle's *Poetics*, where tragedy is divided into plot, character, thought, style, spectacle, and song. In these authors, as in Cicero's *De Oratore*, Quintilian's *Institutes*, Horace's *Ars Poetica*, Longinus's *On the Sublime*, and St. Augustine's *On Christian Doctrine*, Macdonald argues that "style" is treated as a process rather than an entity. That is, it picks out the "how" of an art work rather than also the "what", "why", "when" and "where".

In more recent times, "style" has been transformed into the central concept of classification through which an artwork is perceived, understood and interpreted. As such, the concept of "style" subsumes many aspects of the art work from the artist's intentions, historical context, subject matter, choice of art/perceptual elements, compositional structure and so on. According to Macdonald, "style" has been so employed in art history since the art historian J. J. Winckelmann treated "style" in this broad manner in his *History of Ancient Art* (1882). However, this broadening of the meaning of "style" has fractured the use of the term into a number of uses, some of which are overlapping, while others are incompatible. In some contexts the term is meant to refer to all the artistic aspects of an artwork, in other contexts it is used more exclusively.

Consider that "style" can be used to mean alternatively: (i) a period in history like the Early or High Renaissance; (ii) an artistic movement like Mannerism or Futurism;

(iii) various developmental stages in an artist's oeuvre; (iv) the artist's point of view which may be ascertained from other than discernible properties in the artwork<sup>6</sup>; and (v) a set of formal characteristics which cuts across periods, movements and individual oeuvres. At a coarse-grained level, these formal characteristics might be grouped as a general class such as expressionist, realist, formalist, conceptual etc. But more typically, this notion of "style" is more fine-grained level. The formal characteristics perceived as a "style" can differentiate one artist's "style" from another within a more general class, such as the formal features which differentiate one artist's version of say expressionism from another. Some of the "style" names can be used in more than one of the above categories of "style", but used in a different sense in each case. For example, there is the German Expressionism movement (early to mid 1900s),<sup>7</sup> the expressionist phase in Kandinsky's work, and the expressionism which is a "persisting tendency peculiarly characteristic of Nordic and Germanic art from the Middle Ages until today."<sup>8</sup> While the first four uses require a consideration of historical context and artists' intentions in order to classify a given art work according to a particular style, the usage described in (v) does not. The fifth usage is ahistorical in that it does not treat the work as an historical artefact. To do so would involve only attributing a style to a work which could have been so attributed by the artist who made the work. On the other hand, the fifth usage of "style" could be said to be historical in that it recognizes that a perceiver's grasp of an art work will be shaped by their canonic schema<sup>9</sup> which they have formed in Long Term memory presumably during their own life time and hence determined by the ideas, theories, conceptions of art history and so on to which they have been exposed. For example, a perceiver of Frans Hals, Gericault and Daumier might classify them all as expressionists in the light of German Expressionism and more

contemporary but isolated expressionist movements around the world since<sup>10</sup>. If I were to leave the conception of "style" in the fifth sense there, I would view this meaning of "style" as weighted more towards an historical understanding of the art work, though based upon the perceiver's history rather than the artist's. However, the other aspect of "style" in the fifth sense, is its reference to the selection, treatment and various combinations of perceptual elements. To detect these selections, treatments and combinations of perceptual elements, we do not need to address what is alleged to have been the explicit aims of the artist. Furthermore, while we can develop habits of perceiving artworks which may involve combining some perceptual elements in certain ways and not others, the possibilities that define this use of "style" are constrained by the human perceptual apparatus rather than political or cultural contexts. It is in this sense, that the fifth usage of "style" can be claimed to be ahistorical. I will refer to the fifth usage of "style," which is the meaning of style that I adopt, as Perceptual Style.

The idea is that Perceptual Style can be attributed to art works in retrospect. This is at odds with the notion of what constitutes a good interpretation of an artwork. When interpreting an artwork it is commonly argued that one cannot attribute to the work a meaning that could not have been a part of the cognitive stock of the artist. By "cognitive stock" is meant the art theories, histories, ideas and conceptions of art history available to the artist at the time of the artwork's creation. This is to count as necessary to an interpretation of an artwork, a consideration of the artist's intentions.<sup>11</sup> Noel Carroll argues that this understanding of what constitutes a good interpretation of an art work, which he and Arthur Danto (among others) endorse, is inconsistent with holding that an attribution of "style" need not involve a consideration of artistic intentions; at which point he parts company with Danto.<sup>12</sup> Carroll recognizes that the extent to which

artistic intentions are relevant to an account of stylistic features will vary according to the nature of the account.<sup>13</sup> For example, when the account is of the relation between the stylistic features of various art works within a particular period, Carroll thinks that a consideration of artistic intentions may be less important than other perceptual features but he does not rule out the relevance of artistic intentions completely even in this case.

It is unclear to me on what grounds it is argued that the attribution of style to a work must bear the same constraints as the construction of an interpretation of an artwork. Carroll claims that to attribute a style to a work in retrospect is to suggest the possibility of backward causation.<sup>14</sup> The answer to this objection is two-pronged. On the one hand it involves exploring the constraints of perceptual processes and the extent to which such constraints can be assumed to have operated in the same way in the creation of art works regardless of the “cognitive stock” of the artist. On the other hand, it involves the extent to which a particular engagement in art from any period can be recognized to be embedded in the interests and passions of the culture of the perceiver. These two sides of the answer will be explored in sections 4 and 5 respectively. In doing so, the question I will be pitching back to the intentionalists, and attempting to answer, will be: "Could it not be possible that there is more than one set of features that can be selected from the art work to act as the object of interpretation?" In the case of Perceptual Style attribution, this set might be constrained in such a way that artists' intentions are not included; and this might be a comprehensive selection of features of the artwork within the significance system of perceptual strategies and standard denotational schema. I will argue this point by demonstrating that the artwork can be represented in more than one way and that it is the “artwork-as-represented-as-canonic-

schema-and-perceptual-form” which is categorised according to Perceptual Style rather than the “artwork-as-historical artefact”.

### 3. The "Artwork-as-Represented."

To draw this distinction between the object of style attribution and the object of interpretation as it is conceived by Carroll and Danto, I draw upon Paul Thom's theory of interpretation (2000). Thom's broad understanding of what constitutes "interpretation" can subsume style attribution as I will demonstrate, but his conceptual framework also allows the distinction between Perceptual Style attribution in my sense and artistic interpretation *a la* Carroll and Danto to be maintained. Thom conceptualises "interpretation" according to three terms: the "object-of-interpretation", the "object-as-represented" and the "governing concept". The "object-of-interpretation" is the object in its original state, understood, as far as possible, according to the significance system within which it was created. The “object-as-represented” refers to what one takes to be the relevant and salient features of the object within a particular significance system. This may be selective, according to Thom, but as long as the interpreter is aiming for a comprehensive representation of the object and one that imbues the object with significance within a particular significance system, then the grounds for a successful interpretation are laid. The last term in Thom's trilogy, the "governing concept", is the concept under which the “object-as-represented” is subsumed in order to make sense of it (in the sense that the meaning is uncovered) or in order to give the object meaning (in the sense that the meaning is invented).

Thom is a classicist regarding the stability of the object of interpretation, and a post-structuralist regarding what counts as interpretation. Accordingly, he must admit the possibility that any one object of interpretation, stable though it be, can have

multiple (yet possibly incommensurable) successful interpretations; some of which may feature the artist's cognitive stock as central and some which may not. I am not attempting here to treat the attribution of Perceptual style as synonymous with interpretation, even though according to the first four usages of "style" outlined in the previous section, "style" attribution is indeed treated as encompassing many of the broader aspects of the artwork relevant to its interpretation. Instead, Perceptual Style attribution is a subset of interpretation. Perceptual Style denotes the "how" of the perceptual processing of the artwork and as such represents a return to understanding "style" as just one of a number of "guiding concepts" under which an artwork can be interpreted. As such, in the attribution of Perceptual Style, the "artwork-as-represented" (derived from the second term in Thom's conceptual framework), consists of a more rigidly defined selection of base features from the "original artwork" (derived from the first term in Thom's framework) than would an interpretation which sought to subsume the "original artwork" under the "guiding concept" of historical artefact. Within the significance system of Perceptual Style, this more limited selection of relevant features is comprehensive even though it leaves out original context and artist's intentions.

On the face of it, this may read like a circular argument for the possibility of Perceptual Style. However, my characterisation of Perceptual Style is not stipulative, but rather an accurate description of how the term "style" is employed in many art theory/historical texts. It also captures a way of talking by artists themselves about the "style" of their own work and the "style" of the work of their contemporaries. The "original artwork", then, is represented according to a perceptual representational system. Because such systems are a description of, or a consequence of, a system which is a natural kind (the human perceptual apparatus), a definition of "style" which flows



from it is not circular. Furthermore, the explanatory framework for Perceptual Style which such systems provide, grounds this conception of style independently of any historical considerations.

As an example, take van Gogh's study of his bedroom at Arles. The "artwork-as-represented" when the "guiding concept" is historical artefact is the painting that van Gogh painted in 1888 with the cognitive stock available to him including familiarity with the work of artists like Frans Hals, Gericault, Daumier, Manet, Monet, Gauguin, and a particular fascination with Japanese prints. He had as part of his art theory the idea that painting styles were established largely by convention and that he need not be constrained by the convention of realism or romanticism. He also conceived of painting as a very different enterprise than was the conception of photography at the time (the latter was very constrained by the time lapses required to capture an image). Given his historical context, I think we can safely say that the brute conscious fact of self-expression would not have guided his choice of colours, subject matter, arrangement or treatment of visual elements. This is why he is normally classed as a Post-Impressionist. His Perceptual Style would not have been possible before Impressionism that is certain. But his work became more appreciated in the light of the kind of Perceptual style of painting which followed it and was inspired by it. It is only in this light that he came to be perceived as an expressionist. Without the experience of the expressionism which followed in his wake, his work may never have been raised to the high level in the public's estimation that it now enjoys.

From his letters to his brother Theo<sup>15</sup> we can derive the fact that van Gogh understood himself to be attempting to capture (usually unsuccessfully in his own view) the essence of nature through colour and line. He believed not that the correct depiction

of nature was beautiful but that a depiction which was beautiful was also correct. His discussion of Frans Hals, Delacroix and Daumier suggest that he believed painting should reflect a passion for one's subject. And in this one can identify his point of departure from Impressionism proper.

The "artwork (van Gogh's bedroom at Arles) -as-represented" when the process which it initiates is the attribution of Perceptual Style, is an artwork defined by his choice of colours and subject matter, and his arrangement and treatment of visual elements like colour, line, shape, form and texture. These features of the object would fit nicely under the "guiding concept" of expressionism; categorizing the "artwork-as-represented" as the expression of the artist's feelings toward his subject matter results in an appreciation of the agitated lines, brilliant contrast of colour and distorted perspective. Choosing another guiding concept for this last step in the process, say the attribution of the Perceptual Style realism, would result in a less appreciative response by the viewer. The exclusion of the artist's intention in the attribution of style is valid because when considering the work according to Perceptual Style, we seek to categorize the work according to: (i) the selection, treatment and combination of visual elements; and (ii) the matching of subject matter with the canonic schema available to the perceiver at a particular point in history. Attributing Perceptual Style to the work, then, is treating the work as a living, dynamic artwork which is acting upon the perceiver. This acknowledges the fact that to aesthetically experience an artwork, the artwork needs to have the kind of perceptual properties which will engage a perceiver in the kind of involvement which is peculiarly aesthetic. To consider how certain art works might achieve this, we will start with a theory of pictorial representation.

4. The "Artwork-as-Represented" according to the selection, treatment and combination of visual elements.

John Willats' analysis of the range of pictorial representational systems available to us, given our perceptual apparatus, provides an example of the kind of explanatory framework necessary for identifying the basis of an attribution of Perceptual Style.<sup>16</sup> Willats draws a distinction between drawing systems (mapping spatial relations) and denotational systems (mapping scene primitives onto picture primitives). Spatial relations are described in terms of various kinds of perspective while scene primitives are understood to be the basic elements of form recognition such as silhouettes, stick figures and volumetric primitives. Drawing systems are analysed further into primary (optical) and secondary (artificial) geometry. Primary geometry is explained in terms of the kind of visual elements which constrain, within the human perceptual system, the perception of space in the world, even though it can include both the kind of geometry which is orthogonal (object-centred) as well as perspectival (viewer-centred). Secondary geometry is a consequence of primary geometry and is explained in terms of the most elementary but general types of spatial properties such as touching, separation, spatial order and enclosure. Such spatial properties can be combined in ways which violate what would be possible according to primary geometry. Naïve perspective as is typically found in the drawings of young adolescents; and inverted perspective as seen in van Gogh's chair, many of Cezanne's tables, and the thrones and altars in Byzantine art, can be described using the terms of secondary geometry but not according to the terms of primary geometry. In this distinction between primary and secondary geometry, Willats has provided a basis for describing style which does not involve a

consideration of the artist's intentions but focuses only on what is evident in the artwork in terms of representational systems.

Willats analysis suggests that there is a natural connection between a pictorial representation having the form that it has and the way perceptual processes operate in the course of perceiving objects in the world. Just how fine-grained our exploitation of perceptual processes can be in the creation and perception of art works depends on the flexibility of the perceptual system. David Marr's evolutionary argument from good design<sup>17</sup> and the persistence of perceptual illusion (noted by Fodor<sup>18</sup> and others) suggest that early perceptual processing is modular; albeit in Marr's case, made up of a series of smaller modules. According to Fodor's theory, early vision which consists of the processing of visual elements like colour, line, shape, form and texture is not penetrable by high level systems. On the face of it, this leads to a notion of early vision which is not conducive to variations in pictorial representations. However, according to more recent descendants of Marr's theory of vision, this modularity is weak in the sense that perceptual processing does involve feedback loops from higher to lower perceptual operations. The coarse grain of visual processing is the level at which edges, shapes, textures, colour and information from other perceptual systems (including feedback from motor systems) are combined to construct a form within a spatial layout. The fine grain of visual processing is the processing of the elements themselves, such as edges, shape from shading, texture from shade/light density gradients, depth from binocular disparity and shape from movement (parallax). The coarse grain of visual processing is weakly modular and can be influenced by expectation and cultural learning. The fine grain of visual processing is strongly modular in the sense that the processing of each visual element operates independently of other modules and the only learning that can

influence this processing is learning that occurs through the specialised perceptual channels (which limits learning to changes in the system due to interaction with the physical properties of the world).<sup>19</sup>

This distinction roughly corresponds to Willats' distinction between secondary and primary geometry. Secondary geometry can exploit, distort and violate the natural combinations of these visual elements. Secondary geometry is a result of feedback systems within the visual system while primary geometry is constrained by the strong modularity of fine-grained visual processes.<sup>20</sup>

Another way to point to the distinction I am attempting to make is between the processing of global visual stimuli as defined by Patricia Churchland et al (1994) as "broad regions of the visual field" as opposed to the processing of "local" factors, defined as "very small regions such as the receptive fields of cells in the parafoveal region of V1 ... or V4".<sup>21</sup> These small regions process the visual elements as listed above. Churchland et al employ the term "top-down processing" to mean the processing of "broad regions of the visual field" rather than to mean the implementation of explicit theory (cultural knowledge). However, according to Churchland et al's theory of Interactive Vision, learned expectations and memory play a role in determining what we see because there are richly recurrent networks instead of a rigid hierarchy. Churchland et al do point out, however, that there is evidence from neuroanatomy which is consistent with a loose, interactive hierarchy<sup>22</sup>. This finding vindicates the distinction between coarse and fine-grained visual processing (or secondary and primary geometry).

The processing of the finest grained visual elements may be impenetrable to top-down influences, but this does not preclude the possibility that they can be selected and

combined variously. This is the kind of perceptual flexibility postulated by Churchland et al, and it is the kind of perceptual flexibility sufficient to account for the possibility of multifarious artistic styles.<sup>23</sup> I will use the term "perceptual strategy"<sup>24</sup> to refer to pictorial elements which deploy secondary geometry (coarse-grained perceptual constructs) and "perceptual elements" to refer to visual elements, the processing of which, deploy primary geometry. Accordingly, perceptual strategies consist of various combinations of visual elements.

The idea of Perceptual Style is that the perception of certain configurations involves the deployment of various perceptual strategies in the perceiver. For example, a perceptual strategy deployed by van Gogh's *Bedroom at Arles* is inverted perspective; another is the treatment of surface as volume and texture; another is the treatment of edges as lines; and the description of changes in surface orientation in terms of lines; yet another is the use of saturated local colour in place of colour effected by light and shade. All of these strategies rupture the immediate perceptual process of object recognition, where we would simply content ourselves with engaging in the literal meaning conveyed by the work. This rupture directs our attention instead to the pictorial elements and, ipso facto, to the perceptual strategies deployed in us by the perception of the work. A perceptual strategy is then, a non-typical deployment of visual processes.

The suggestion underlying the possibility of Perceptual Style is that when these perceptual strategies (visual processes deployed in non-typical ways for normal perception) are deployed in the perceiver, our ordinarily purposeful attention is arrested so that we become aware of perception itself. The idea is that in the course of normal perception, our attention is automatically drawn to the literal meaning of a work or

object. When, on the other hand, perceptual strategies are exploited within an art work, our attention can be drawn to a focus on what seems like visual phenomena as an end in itself. Certain artists may unwittingly exploit these perceptual possibilities for their own sake. For example, Jackson Pollock's abstract expressionism phase can be understood as an exploitation of the human perceptual apparatus's propensity for picking out fractal patterns,<sup>25</sup> even though Pollock himself did not have such an explanation at his disposal.

When artists concentrate on structure at the expense of texture, or shading instead of line, or colour at the expense of form, or they juxtapose colour in their complementary pairs to create the illusion of receding planes as Cezanne does; what the artist is doing is isolating one or a few perceptual processes of the perceptual system. In a nice twist to the usual 'artistic creation verses scientific explanation' polemic, we can understand artistic creation, in some cases, to be about isolating principles that underpin perception, and consequently principles that underpin what we take to be the world (given that perception has evolved under adaptive pressures imposed by the environment on the human perceptual system). Artists who exploit perceptual strategies and contrive perceptual manoeuvres can be understood as exercising a kind of meta-perception; which in turn can induce such a mental state in the perceiver.

To demonstrate the way an artist might unwittingly exploit such normally unconscious perceptual operations consider, in terms of perceptual strategies, the sculpture *Recumbent Figure* 1938 by twentieth century English sculptor Henry Moore. Consider that when the "guiding concept" is historical artefact, the "artwork-as-represented" is embedded in formalist theories of art such as Clive Bell's and Roger Fry's notion of "significant form". When, on the other hand, the "guiding concept" is Perceptual Form, the "artwork-as-represented" consists of the sculpture's undulating

surfaces and occluding contours from whose curved outlines, varying volumes are suggested. These outlines and volumes change as one moves around the sculpture. Intermittently one mentally constructs a dominant axis which runs through the length of the various shapes in spite of the fact that some of these shapes have unexpected hollows. The axis is mentally constructed in order to create a mental description of the object which is not viewer-centred, otherwise we would not be able to form the kind of description to which a concept can be applied. But this object-centred description<sup>26</sup> is constructed via a series of viewer-centred frames. Normally, in day-to-day object recognition, we are not aware of these viewer-centred frames; we are only conscious of the object via its object-centred description. But the subtle distortions and unexpected violations of Moore's sculpture deploys our perceptual processes in such a way that normal perceptual imperatives are suspended; and we are inclined to focus on what each viewer-centred frame affords us. Each frame provides an array of variously curved surfaces which define solids, hollows, gentle dints and occasionally pronounced bulbous spheres. The perception of the sculpture involves an intensity of processes not normally called into play in such rapid succession in normal perception.

The sculpture represents a figure and this representation, in the context of a perceptual focus on the part of the perceiver, gives rise to the experience of aesthetic ideas, the notion of which will be explained more fully in the next two sections. Had the sculpture not represented the kind of object for which we have a rich storage of associations in memory, the sculpture would have succeeded only to tantalise perceptually. The concomitant experience of aesthetic ideas usually results in a more moving and satisfying experience; and this is what I turn to now.



5. The "Artwork-as-Represented" according to the canonic schema available to the perceiver at a particular point in history.

When Robert Solso discusses the development and use of art schema, the mechanics of which he eloquently explains through connectionist networks,<sup>27</sup> he explains that when we store information in Long Term Memory (LTM) we organise it according to structure, scenes and/or ideas. For example, when we look at a street scene we activate our "street schema" in LTM which informs us of the features we might expect to see and how they interact. He then applies this to art styles. We become accustomed to various stylistic details grouped together and when we perceive, for example Egyptian art, our "Egyptian Art Schema" is activated. Accordingly, we expect to see "lack of linear perspective, unique eyes, faces drawn in profile, and hieroglyphics in the background".<sup>28</sup> Ruben's art will activate our Baroque schema. This might consist of figures "shown well muscled and in agonising poses" according to Solso, and typically depicting religious themes.<sup>29</sup> Renoir's schema activates our Impressionism schema with its "feeling of vibrancy and intimacy"; its "dreamlike, florid" mood with "a hint of fantasy."<sup>30</sup> Andy Warhol activates our pop schema with his multiple copies and so on.

The schema idea is that over time we form units of information in LTM. A unit of information is a set of related facts, images and responses which we have experienced together a number of times. This then becomes a unit such that when certain combinations of elements present in the unit find a match in the external stimulus, the unit as a whole comes into play and directs action or recognition, saving time and neuronal space. Presumably the contents of such units are also influenced by the collective interests and passions of particular cultures. Such units or schema speed the process of recognition and response in day-to-day life by applying expectations to what

is being viewed. Now, this suggests that only the details of a scenario which fit the particular schema activated, will be noticed. This is the interpretation Solso supports. He provides the results of an experiment which involved college students who were led through a University Professor's office and then asked to list what they had seen. He reports that they listed what they expected to see in a University Professor's office whether it was there or not. While this finding supports his application of the schema idea, we also need to know whether the college students noticed anything incongruous with the idea of the contents of a Professor's office. According to theories of information processing, we will notice in our environment the very things which are unexpected. These are the items which are high in information content because they do not comply with the perceiver's current schema. An egg beater on a University Professor's desk should be recalled sooner than a stack of papers piled beside it. If the application of schema to art as Solso explains it were the whole story, the recognition of art styles would make most art redundant after a short time. There would be nothing to arrest our attention. Furthermore, if the artists did the unexpected only in terms of incongruent objects, this would also quickly pall after familiarity with the art work in question. Some art does pall; but there is art whose fascination for us endures and this incorrigibility is not explained by Solso's canonic schema theory or information - processing theory. I am suggesting here that Perceptual Style attribution involves not just a process of recognition, which Solso's theory would explain, but also an aesthetic involvement on the part of the perceiver.

Solso explains that the representations in an image activate canonic representations which are stereotypical images abstracted from a number of exemplars of various instantiations of an object with their particular peculiarities. This means that

it is the idealised image, or prototype that is stored in our LTM.<sup>31</sup> Solso claims that there are visual and conceptual prototypes:

Our memory for a person, say a woman, is not based on a series of "cerebral snapshots" of women we have neatly filed away in memory stores, but on salient and meaningful features of women that are stored, in memory, as an abstract representation of that class. For each person these storage systems contain some unique elements, but there are remarkable similarities between people. Your cerebral woman and mine are not identical but are probably very similar.<sup>32</sup>

Even Picasso's cubist work, according to Solso, abounds with basic, canonic forms. Solso thinks that regardless of the distortions introduced by Picasso, there remains a theme that holds the entire picture together. He says that our collective memory is of the most representative form, which embodies all of our impressions.

I think Solso's explanation of canonic forms in LTM is very relevant to "style" recognition when style is understood according to the first four usages of style (see section 2 of this paper) but it is not the whole story for the attribution of Perceptual Style. If the unproblematic matching of Picasso's forms with our canonic forms were the dominant process activated in us by the perception of a Picasso cubist painting, as Solso suggests, then his painting would be very dull. It suggests that we simply engage with the work according to the schema that we have formed around Picasso's style (or any one of a number of styles in which he painted). This is probably what we do when we are categorising art work according to established norms of art categorisation. But this does not constitute an aesthetic engagement with the work. On the contrary, the excitement, torment or intrigue of Picasso's synthetic cubist works seem to me to have a

lot to do with the violation of the canonical images of everyday-objects that we have in LTM. Picasso provides enough triggers to stimulate such canonic memories but not enough for a flattering match. We are thrown around in a turbulent swirl, mixing and matching but in a way that is never permanently resolved. When we come back to such a Picasso the process starts over such is the incorrigible nature of our real-world based schema. This is the very basis of Picasso's allure. We don't tire of his images because they violate (synthetic cubism), sometimes flatter through epitomising stereotypes (his classical figures) and at other times achieve a canonic form through ways unprecedented in the world and hence perennially new to our perceptual apparatus (analytical cubism). It is this rupture with real-world schema that puts our engagement with the representational content off-line and sets our experience of perceptual strategies on-line.<sup>33</sup> Perceptual Style attribution, then, would involve different mental processes than "style" recognition in the first four senses.

Solso adds to this idea of the canonic schema, the notion of aesthetic ideas which he claims are aroused by an image. He uses a connectionist network to explain how the semantic content of an image can trigger multifarious associations, nuances and ideas which he refers to as the hidden content of art. There is a common input (proximal stimulus) and a common output (schema) but in between the connections trigger multifarious associations peculiar to the perceiver's own background knowledge, memory and sensitivities. This is distinct from the kind of reasoned thinking that might follow on from and include the output. Solso writes:

artists do not invent art, but find expressions of reality that are compatible with basic structures of the mind ... Art, physics, physiology, and even scientific psychology are worlds waiting to be

discovered by a mind. And valid discoveries (in art, science, and psychology) are those that are exquisitely calibrated to stimulate the human neural system in ways consistent with its sensory/cognitive architecture, acquired through the course of evolution.<sup>34</sup>

According to Solso, the human brain has a proclivity to organise information in terms of categories, prototypes, and schemata.<sup>35</sup> He refers to this proclivity as contributing the hidden content of art because the multifarious ideas are stored with these schemata.

This is a Kantian account of aesthetic ideas given a connectionist framework. However, while Kant explains why this experience is prompted by aesthetic perception (the free play of the imagination and understanding), Solso does not. If one were to seriously consider the possibility of aesthetic ideas, one would need to explain what it is about the perception of an artwork which prompts an experience of aesthetic ideas considering that they are not prompted by more literally minded mental states. One avenue to explore might be the possibility, as outlined in the previous section in relation to Moore's sculpture, that once an art work's Perceptual Style arrests one's attention to itself, this state of "meta-perception" provides the cognitive space for the retrieval from memory of the kinds of associations, nuances and intimations not normally brought to consciousness in the normal course of perception.

## 6. Perceptual Style

Now with the concept of the "artwork-as-represented" in mind, let us choose a hard case to test the usefulness of this idea of Perceptual Style. Art works which exaggerate and distort lend themselves easily to a selection of features relevant to the attribution of Perceptual Style as was evidenced in the Henry Moore example. What can we say

though about the Perceptual Style of art works which achieve a realistic<sup>36</sup> rendition of some object or scene in the world? Is realism in pictorial representation a matter of deploying all the perceptual processes that we would normally deploy in the course of viewing the scene in the world? Well possibly. But think about the variation of interest and attention aroused by different paintings of equal realism. Some are of interest simply because they depict an interesting topic, so that all attention is drawn to the literal level of engagement. One can imagine a painting say of one's favourite public figure or actor arousing interest regardless of artistic style, just as the most unremarkable photograph of her/him might interest simply for voyeuristic reasons. This is not an example of the exploitation of perceptual strategies; it is rather an exploitation of other human susceptibilities not of concern here. Another reason a realistic type of art work might arouse interest is because of admiration for the artist's skill, but this is akin to the kind of attention we might pay to athletic prowess – nothing to do with perceptual proclivities in the sense meant here.

Consider the case of Pieter de Hooch, a Dutch painter of interiors in the 1600s, and a contemporary of Jan Vermeer. He enjoyed considerable popularity which did not survive his epoch while Vermeer, who also painted Dutch interiors, has enjoyed an increasing and enduring popularity. Both painted in what is categorised as Dutch Baroque Realism. Baroque represents the epoch, while Realism represents the artistic movement characteristic of seventeenth century Dutch painting. It was a movement in as much as it involved the kind and manner of depiction favoured by the new and rising middle classes. I will attempt to show, however, that de Hooch and Vermeer did not both paint in the same Perceptual Style. If we examine the Perceptual Style of both

works, we find that Vermeer achieves a coherence of form, not present in de Hooch's work.

According to vision scientists Glyn Humphreys et al<sup>37</sup>, there are principles of coherence which the visual system employs to detect whether the relationship between visual elements indicates that these elements cohere within the one form or whether the elements belong to separate objects. This can be understood as an explanatory framework for the idea of Gestalt principles. To cut a long story short, the visual system detects the relations which hold within objects, and processes these relations quite separately from the relations which hold between objects (different specialised cells for each). The actual processes involved in each are also understood quite differently.

The idea is that once the one form description of an object (consisting of within-object relations) is constructed and then stored in memory, it can be drawn upon to recognise the particular object from any angle (this is the idea of an object-centred description discussed previously). The detection of 'between-object-relations', on the other hand, is viewer dependent in the sense that only what the eye receives from the particular view at any one time is relevant. That is, each new view requires a separate description. For between-object relations, no construction involving the components of the space is necessary; nor the processing of the spaces as they would look from any other angle. Consequently we can think of what goes on, when 'between-object relations' are detected, as something like a calculation regarding the kind of information we need in order for us to get around in the world without bumping into things. By comparison, the recognition of a form does require a construction from visual elements.

Now, what if some realistic painters contrived unwittingly to reproduce the kind of relations between objects that are normally reserved for within objects, such that the art work portrayed an overall cohesiveness which in the perception of the world is normally reserved for individual objects. In this manner, the painting would stand apart quite distinctly from the scene it depicts. It would exploit perceptual strategies in such a way that our attention would be arrested away from object recognition and directed instead towards the relations which hold within the picture.

Take the painting by Vermeer sometimes known as *The Milkmaid*. In this painting there are gentle tensions between light and dark, cool and warm colours. The minutely detailed food-laden table on the bottom left-hand side is contrasted diagonally with the relatively large expanse of clear, bright flat colour on the top right side. The carefully defined, small but rather sullen looking wooden box on the bottom right side is diagonally opposed to the rough textured but tightly woven wicker basket hanging on the wall on the top left hand side. The copper pot hanging behind the basket is echoed in the similar shape and orientation of the wooden box. The central and dominating vertical of the work consists of the rounded bulky forms of the woman in the centre. The curve of the woman's once starched headdress is echoed throughout her form, from her round broad forehead, the firm wholesome rotund shapes of her shoulders and breasts to the curves of folded drapery in her top skirt. It is further continued in the strong line created by the movement of her arms towards the jug, which is held by both hands. In the dark round hollow of the jug the movement is temporarily stopped so that for a moment all is completely still: silent and empty. Then we enter back into the rhythms of the work through the light that cascades over the crisp and grainy bread. Finally the yellow glow of light typical of Vermeer's work gently gradates around and



over the forms, falling into dark shadows here and great flat expanses of light there. Its source is a window on the left whose pane is broken up into small regular rectangles in the manner of lead light windows.

The forms and the relations between them, as discussed above, can all be expressed in terms of principal axes, volumetric primitives and shape primitives. The global axis unites the elements of the picture: and in a gradual descent into the finer scaled levels, the subsidiary axes are detected in relation to the global axis. The volumetric and surface primitives involve a range of kinds: elliptical, circular, rectangular, hollow and solid forms of varying sizes. Most of the primitives are solids and this is perhaps partly why the hollow of the milk jug arrests our attention for a moment.

The painting is so designed that axes can be detected which connect one side of the work with the other. That is, we detect principal axes (unconsciously and automatically) through the spaces between the objects depicted in the work. When this occurs between the components of our world, we perceive the components as making up a discrete object. Yet in the painting, we recognise distinct objects while still experiencing the total as the kind of unity which in the world is reserved for objects. The arrangement of forms within the work, suggests that their axes connect to the one global axis. For example, there is a dominant axis that runs parallel to the picture plane behind the woman's back, from the wicker breadbasket to the wooden mousetrap. Then an axis which originates on the same plane as this one, runs from the top of the woman's head, curving down through her upper torso, round through her arms into and along the table. This creates a curved axis that swings dynamically towards the viewer through a

number of planes, effectively defining a broad sweep through three-dimensional space. Another less dominant axis runs from the inwardly sloping window to the inwardly sloping plane created by the woman's upper torso and face. These all connect up at a point behind the woman's abdomen.

Here is an example perhaps in which, the way the perceptual strategies are deployed in the course of perceiving the painting, leads the viewer to construct the one form-description for the painting, even though on a literal level, the painting represents many discrete forms such as a jug, a person and so on. This constitutes an unusual deployment of perceptual strategies. Perhaps that explains why the painting has endured many cultural shifts and fashions and continues to engage the attention of the layman, artists and philosophers alike. In this case, our canonic schemas are not the source of the perceptual disruption, but the spatial relations represented in the picture are. This disruption leads to a heightened perceptual awareness, and this conceptual space, if you like, leaves room for the experience of the kind of nuance and feelings that characterise what Kant (and Solso) referred to as an experience of aesthetic ideas. For example, the thoughts that flood my mind when contemplating this painting relate to servitude, resignation to one's lot, idealisations of honest physical toil, simple rewards, the solace of hard work, traditional female roles, and the security and certainty of older cultures weighed against their rigidity and emphasis on conformity. At the same time this painting conjures up feelings and memories associated with home-baked food, cold crisp air, hand-woven cloth, the smell of damp stone, and the clatter of wooden shoes on terracotta floors. Here I have listed these thoughts and feelings one by one as complete separate thoughts and feelings but this is not how they are experienced as aesthetic ideas. As aesthetic ideas they are experienced partially, simultaneously flooding

together, such that the ideas experienced are different from simply the sum of these stated thoughts and feelings. There is an intensity, a sense of experiencing something fundamental: a sense of the richness of felt experience, such that one has an overwhelming sense of engaging with the object of the painting. The intensity seems to originate in the way the various thoughts and feelings interact, so that the thoughts and feelings which emerge are altered, fuller, more fertile somehow. The phenomenology of aesthetic ideas in this case is that they (i) occur all at once, overlapping; (ii) cannot be captured adequately by verbal description; and (iii) arouse an unusually intense sense of engagement with the object of contemplation. The analysis of an artwork according to Perceptual Style, leaves room for an explanation of the possibility of aesthetic ideas. Aesthetic ideas are made possible by the suspension of a literal involvement in the work which a focus on Perceptual Style allows.

According to this explanatory framework, in de Hooch's paintings by comparison, the various objects and their relations to each other more closely mimic the difference between "within-object perceptual relations" and "between-object perceptual relations" as we apply them in our perception of the world. This might explain why the reception of de Hooch's work since his own epoch has been limited mainly to historical interest. On this score, his work does not arrest our attention any more than the actual scene would in the world (apart from its historical interest and possibly some admiration for his ability to portray the structural description of objects). The painting, then, does not encourage anything but a literal engagement with it.

It may be that Vermeer's popularity is due to stimulating a kind of meta-perception (through activating predominantly "where" systems in the visual brain at the

expense of the "what" systems in the visual brain). De Hooch's work by comparison might activate the "what" system in the visual brain, which possibly precludes the experience of aesthetic ideas because once this literal focus is taken, access to aesthetic ideas are thwarted (neuronal competition). De Hooch's success in his own day might have been based on other than perceptual factors. His contemporaries were perhaps flattered by the subject matter, painting as he did the trappings of their successful trade and travels. His popularity need not be despised, however. It is simply an example of the many extra-perceptual roles that art can fulfil and against which it can be judged to be good according to the cultural interests of the time. The comparison between Vermeer and de Hooch may also highlight the fact that once cultural interests and passions cannot be relied upon to recommend an art work, what is left are perceptual interests (apart from anthropological and historical ones).

#### Conclusion: A Prediction and a Recommendation

Perception has evolved to recognize objects and allow us to get around in the world without bumping into things. The processes that the system has evolved are rich in various operations which can be selected, combined and exploited in various ways in the perception of art works. There is a sense in which the Perceptual Style of an artwork, as explained in this paper, can be understood to be about the possibilities and constraints of perceptual processes. In discovering new ways of deploying perceptual strategies by combining visual elements in new and unusual ways, it may be that this sets up habits of perceiving (strengthens certain neural connections) which then influence perception in the day-to-day. This would suggest that over a life time, perception can develop not only a set of canonic schematic forms in Long term Memory, but also new perceptual strategies which combine visual elements and

construct form in new ways.<sup>38</sup> On the other hand, perhaps only those with certain perceptual sensitivities to begin with can be so affected at least to significant degrees. After all, if art could affect us all so powerfully, the art lover should be able to forego the art gallery (except for historical purposes) in favour of more mundane scenes like demolition or construction sites or any mundane object for that matter. Art lovers, with their art induced perceptual strategies, should be able to see as the artist sees and create van Goghs when looking at their bedrooms or Pollocks when looking up at fractal patterns in dense overlapping branches. Perhaps, to some extent, this *is* what occurs in the appropriately sensitive and perceptive experienced perceiver of art.

If the possibility of Perceptual Style leads to the above prediction, then the fact of its multifariousness, leads to a recommendation. The more plastic perception is, the more conducive it is to variations in Perceptual Style. Consequently, the existence of multifarious Perceptual Styles look good for theories of Interactive Vision such as the one proposed by Churchland et al.

In sum, configurational aspects of artworks constitute Perceptual Style. This understanding of style necessarily involves the notion of a dynamic perceptual involvement on the part of the perceiver. The Perceptual Style attributed to an artwork will reflect an interaction between the perceiver's perceptual apparatus, with its own cultural history, and the objective properties of the artwork. This is not backward causation in the case of perceiving art works from earlier periods. This is human perception at work in all its glorious richness and variety. The variety of Perceptual Styles of pictorial representations can be explained by the apparently endless ways in which perceptual strategies can be exploited.<sup>39</sup>

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- <sup>1</sup> Even the examples of analytical cubism by Georges Braque and Picasso which at first look identical, can, with some familiarity with their work, be told apart on the basis of differences in methods of composition.
- <sup>2</sup> A parallel treatment of style in music can be found in Leonard B. Meyer, "Toward a Theory of Style" in Berel Lang (1979), *The Concept of Style*, University of Pennsylvania Press.
- <sup>3</sup> Paul Thom (2000). *Making Sense. A Theory of Interpretation*. Lanham: Rowman & Littlefield.
- <sup>4</sup> I refer to Arthur Danto's philosophy of art history according to which, art history has ended. See his "The Transfiguration of the Commonplace", *Journal of Aesthetics and Art Criticism*, 33, 1974.
- <sup>5</sup> Raymond A. Macdonald (1993). "The Styles of Art History: Entities or Processes?" *The Journal of Speculative Philosophy*, Vol.VII:1, pp.48-63.
- <sup>6</sup> Arthur Danto, *op.cit.* For a helpful discussion of this aspect of Danto's philosophy of art see Noel Carroll, "Essence, Expression, and History: Arthur Danto's Philosophy of Art" in Mark Rollins (Ed.) (1993), *Danto and his Critics*. Oxford: Blackwell. pp. 79-106.
- <sup>7</sup> Harold Osborne (ed), *The Oxford Companion to Twentieth Century Art* (1981), Oxford University Press; 218-19.
- <sup>8</sup> *Ibid.*, p.180.
- <sup>9</sup> Schema is used, not in the philosophical sense of an established inference, but in the related psychological sense of an internal model or representation of a unit of knowledge which corresponds, roughly, to a domain of interaction with the world. These units might include objects in the usual sense, but also other things "from some attention-riveting detail of an object all the way up to some sophisticated domain of social or linguistic interaction for purposeful beings." Richard L. Gregory (Ed) (1987). *The Oxford Companion to the Mind*. Oxford: Oxford University Press. p.696. These units encompass related knowledge to a given context or purpose such that our knowledge storage and retrieval can be as economical as possible, in terms of real time and use of neurons. This means that we store units of related knowledge which when triggered by related items in the environment set off prescriptions for responses. This is what is meant by the claim that expectations and prior learning will influence what you notice and how you respond.
- <sup>10</sup> Every artistic community probably has their equivalent to the young Roar Studio painters of Melbourne from whom a collective roar of colour and animation burst forth for a limited time in the early 1980's before they were picked up and tamed by more mainstream art world practices.
- <sup>11</sup> W. K. Wimsatt and M. C. Beardsley wrote a very influential article entitled "The Intentional Fallacy", in which they argued that the intention of the artist was irrelevant to an interpretation of an art work (published in Morris Weitz (Ed) (1959), *Problems in Aesthetics*, New York: Macmillan). After much published debate, Beardsley conceded that intentions which were explicit and visible in the art work were relevant to the art work's interpretation. See Mary Mothersill (1984) for a summary of the debate (*Beauty Restored*, Oxford : Clarendon Press pp.14-21). This debate, while timely in the face of formalist theories of art, is superseded in the light of ready-mades like Duchamp's *Fountain* which Danto responded to with his theory of indiscernibles according to which the artist's intentions, and the art world's readiness to accept a particular object as an art work, is what defines an object as an art work. See Arthur Danto "The Artistic Enfranchisement of Real Objects: The Artworld" in George Dickie, R. J. Sclafani (Eds) (1977), *Aesthetics: A Critical Anthology*. New York : St. Martin's Press. pp.22-35.
- <sup>12</sup> This is Danto's theory of a style matrix. For Carroll's argument that Danto is inconsistent in holding that artists' intentions are relevant to interpretation while not to attribution of style, see Noel Carroll (1995), "Danto, Style, and Intention", *The Journal of Aesthetics and Art Criticism*, 53:3 Summer, pp.251-257.
- <sup>13</sup> *Ibid.* p.254.
- <sup>14</sup> *Ibid.* p.256.
- <sup>15</sup> *The Letters of Vincent Van Gogh*, edited by Mark Roskill (1963), London: Flamingo.
- <sup>16</sup> John Willats (1997). *Art and Representation*. Princeton: Princeton University Press.
- <sup>17</sup> David Marr (1982). *Vision*. New York: W. H. Freeman & Co.
- <sup>18</sup> Jerry Fodor (1983). *The Modularity of Mind*. Cambridge, MA: MIT Press.
- <sup>19</sup> Marr *op.cit.* and see the various perceptual strategies explored in Richard Gregory, John Harris, Priscilla Heard and David Rose (eds) (1995), *The Artful Eye*, Oxford University Press.
- <sup>20</sup> Another way to make this distinction is between structural (primary) and denotational (secondary) descriptions; only the latter involves semantic content. See J.A. McMahon (forthcoming) "An

explanation for normal and anomalous drawing ability and some implications for perception and imagery" in *Visual Arts Research*.

<sup>21</sup> Patricia S. Churchland, V. S. Ramachandran, & T. J. Sejnowski (1994). "A Critique of Pure Vision" in C. Koch & J. Davis Eds. *Large-scale Neuronal Theories of the Brain*. Cambridge MA: MIT Press. p.29.

<sup>22</sup> Churchland et al, *op.cit.* p.39.

<sup>23</sup> That such a separation of the visual experience from semantic content is possible see M.A. Peterson, J.F. Kihlstrom, P. Rose & M.L. Glisky (1992), 'Mental Images can be Ambiguous: Reconstruals and Reference-Frame Reversals', *Memory and Cognition*, 20: 102-23

<sup>24</sup> This paper began as a response to Mark Rollins suggestion that the perception of certain artworks might, in effect, isolate, select and combine perceptual strategies in various ways. See Mark Rollins (2001), 'The Invisible Content of Visual Art', *JAAC* 59:1, 19-27, p.25.

<sup>25</sup> Richard P. Taylor, Adam P. Micolich & David Jonas (2000). "Using Science to Investigate Jackson Pollock's Drip Paintings", *Journal of Consciousness Studies*, Vol. 7, No.8/9, pp.137-50.

<sup>26</sup> Viewer-centred means that our focus is centred on just the particular view we have at any one moment. It is like framing the particular view that you have and noticing the relations between objects just as much as the shape of the objects themselves. Object-centred means that you bring to bear all the assumptions you have about the solidity of objects, and the fact that there are relatively few connected surfaces, and you register the shapes you perceive as connected variously sized volumes *ipso facto* objects. See Marr *op.cit.* for a more detailed explanation. Or for a very introductory text see Part II of Ilona Roth and Vicki Bruce (1995), *Perception and Representation*. Philadelphia: Open University Press.

<sup>27</sup> Robert L. Solso (1994). *Cognition and the Visual Arts*. Cambridge (MA); Bradford, MIT Press. Ch. 5 & 9.

<sup>28</sup> *Ibid.* p.118.

<sup>29</sup> *Ibid.*

<sup>30</sup> *Ibid.* p.119.

<sup>31</sup> *Ibid.* p.237.

<sup>32</sup> *Ibid.* p. 245.

<sup>33</sup> Solso writes: "Artists throughout the ages have chosen to emphasize one or another aspect of the rules of visual perception in the way they portray their impression of the world and its people"(p.230). His examples: Peter Max: illumination, colors, and a hint of visual perspective; Roy Lichtenstein: linear perspective, occluded objects, diminishing size; M.C.Escher: shadows, linear perspective, exploits the saccadic nature of our eye movement during visual perception, and top-down expectations; Picasso: (analytical cubism) exploits linear perspective, shapes from shading, occluding contours, orientational and volumetric primitives; Cezanne: motion parallax; binocular disparity; colour as tone; Van Gogh: distorted laws of linear perspective; Monet: atmospheric perspective, colour as tone (to show depth), occluded objects, diminishing detail in texture to show depth; diminishing size, elevation and linear perspective; Leonardo's Last Supper: linear perspective, gestalt groupings (4 groups of heads); Massacio's The Holy Trinity in Santa Maria Novella: linear perspective, elevation, occluding figures; Jan van Eyck's The Betrothal of Arnolfini: linear perspective, occluding objects, diminishing size, shape from shading, atmospheric perspective.

<sup>34</sup> *Ibid.* pp.246-248.

<sup>35</sup> *Ibid.* p.250.

<sup>36</sup> I use "realistic" as though it is an unproblematic style category. It is not. For an example of the issues involved, see Ernst Gombrich's *Art and Illusion* (Oxford: Phaidon Press, 1977) and Nelson Goodman's *Languages of Art* (Indianapolis: Bobbs-Merrill, 1968).

<sup>37</sup> See Glyn Humphreys and Dietmar Heinke (1998). Spatial Representation and Selection in the Brain: Neuropsychological and Computational Constraints. *Visual Cognition*, vol.5: 1-2, 9-47.

<sup>38</sup> This would be an example of ontogenetic, not phylogenetic, evolution.

<sup>39</sup> I would like to thank Michael Davis (PhD scholar, Australian National University) for his research assistance which was funded by an Australian Research Council small grant, awarded to me by the University of Canberra, 2001.