Conditions Variable:
Assemblage Theory and Systems Theory
in Creative Practice

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Abstract

This dissertation will situate the twenty-first century phenomenon of Assemblage theory, which originated in the field of philosophy, within the last 100 years of creative practice. Drawing from Manuel DeLanda's application of Assemblage theory, I will devise a means to discuss creative practice without reducing its analysis to 'structured fields' or 'closed systems'. Rather, comparisons will be made between a system and an assemblage to illustrate how the two part ways, and find common ground.

To better understand the way in which systems have been applied in artistic practice, an investigation of two major twentieth-century paradigm shifts will be examined. The first example is the Bauhaus school and its post-European formal offshoot in America, the New Bauhaus, and how it adapted its European predecessor's principles of design. The second is the technological revolution, which engendered Jack Burnham's Systems Esthetics, Experiments in Art and Technology (EAT) and the Center for Advanced Visual Studies (CAVS) at the Massachusetts Institute of Technology (MIT). In light of these developments, I argue that a flexible, descriptive, Assemblage theory is needed to better articulate how art (the work and its making) functions within an expanded field of practice as it now exists. The adaptable and transmutable nature of Assemblage theory is also illustrated through example. In the process this dissertation will offer new ways to articulate and understand creative practice and propose a new strategy for art to be understood. Finally, I will employ Assemblage theory to analyze my own creative endeavours.

Acknowledgements

First and foremost I would like to thank the members of my committee who have helped me though the process of writing this dissertation. This paper would not have been completed without their guidance, goodwill and critical engagement. Each member of the committee brought different skills and ideas to the work in its written form, and as an exhibition, and for that I am forever grateful. I would also like to thank the staff at the Getty Research Archives, in Los Angeles, for their assistance in gathering pertinent documents regarding Experiments in Art and Technology. Without these I would not have been able to conduct the primary research necessary to assess the importance of this organization within the larger schema of art historical discourse. Thanks also to Jeremy Grubman, project archivist of MIT's Center for Advanced Visual Studies Special Collection, who was an invaluable resource, and to Mary Baxter for her careful attention in proofreading this paper. I would like to acknowledge the support of my partner Melanie Townsend whose unfailing belief in my practice has allowed me to sustain my vocation. Lastly, I dedicate this work to my late mother-in-law Ada MacPherson for being a model of strength that seemed to know no bounds, even in her last days.

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Introduction

In positioning Assemblage theory I want to first preface that this dissertation is limited in its scope in that it primarily references Anglo-American traditions and Continental philosophy. Here I will argue the evaluative process within the visual arts can be made more rigorous with the application of Assemblage theory because the latter allows for readings of art to extend beyond current anthropocentric limitations. Structuralism and poststructuralism have emphasised Eurocentric, anthropocentric and linguistic concerns quite distinct from those of Assemblage theory, which stresses the interconnectedness of events and entities.

My hope is that the application of Assemblage theory will aid in the understanding of artistic practice, resulting in a functioning, 'open system' to invite wider debate. Such discourse will be based on the ontic principle, which stems from Alfred North Whitehead's 1929 'ontological principle'. In this instance, Whitehead was concerned with addressing the place of mind in nature.[1] For Whitehead, the reason for an actual entity is simply expressed in the nature of its being: whatever exists is actual and "in potency everywhere."[2] More recently speculative realist philosopher Levi Bryant invoked the ontic principle when he remarked that, "There is no difference that does not make a difference."[3] In keeping with one of the main tenants of speculative realism (the companion philosophy of assemblage), Bryant suggests that humans do not occupy a privileged status at the centre of philosophy. According to the ontic principle, all things

[1] Alfred North Whitehead, "Whitehead on Mind and Nature," The Philosophy of Alfred North Whitehead. P.A. Schilpp ed., New York: Tudor Publishing Co., 1951. p. 389
[2] Alfred North Whitehead. Process and Reality: An Essay in Cosmology. D.R. Griffin and D.W. Sherburne, eds., New York: Free Press, 1929. p. 40
[3] Levi Bryant, "The Ontic Principle: Outline of an Object Oriented Ontology," The Speculative Turn: Continental Materialism and Realism. Levi Bryant, Nick Srnicek, and Graham Harman, eds., Melbourne: re.press, 2009. p. 263

interact and have a life, a history and a potential trajectory to effect and affect either living or non-living entities.[4] Such a notion is of particular interest to artists because, as makers of things, we inevitably consider their potential impact, their place in history and their relation to other forms of knowledge. Such differences manifest themselves in the work of artists by way of poïesis, which will be discussed in Chapter 3.

Some Theoretical Challenges

At present, a York University studio-based PhD degree is comprised of a textual description of one's practice and thought process as well as the creation of a body of work related to this research. The rationale for this structure is to provide a context for the production of new knowledge within a creative field that lacks a voice. One of the difficulties in the application of Assemblage theory to creative practice resides in the lack of precedent for its implementation within a cultural context**.** The impoverishment of theoretical accounts of creative practice derived from 'actual' practice, constitute a further challenge. Habitually, artworks are situated within psychological, philosophical, sociological and curatorial constructs, rarely finding a home in research emanating from the act of making, whether it is done in the studio or 'out in the field'. Unless artists are actively engaged in naming what it is they do, others will continue to determine research trajectories. Self-determination is at stake: the artist's ability to create the epistemologies that circumscribe the discipline as it relates to other fields, namely: philosophy, psychology, ecology and technology.

Increasingly, artists find themselves hamstrung by the expectation to make their

[4] One of the criticisms of object-oriented ontology is that if everything is reduced to an object, then one would have trouble thinking and discussing a subject. See Slavoj Žižek, "Interview with Ben Woodard," The Speculative Turn: Continental Materialism and Realism. pp. 406–15. Assemblage theory circumvents this limitation by suggesting that objects and materials are only one part of a larger equation for analysis.

work fit within a closed schema of theoretical inquiry. In its stead, Assemblage theory operates as a springboard for myriad ways of understanding creative forms. I consider this dissertation as co-functional rather than *autopoietic*—that is to say, a tautological system that grows out of itself. Creative practitioners absorb ideas from other disciplines—conceptual art, sound art and environmental art are examples of how artists use knowledge from other fields to enhance their own production. In a generalized sense the subgenres of conceptual art elucidated our relationship to the invisible world, sound art gave rise to our understanding that the artificial division of creative expression (visual, gestural etc.) was more integrated than we ever thought possible. Environmental art described the inherent interactions between living and non-living entities. These cross-disciplinary developments have been evident in other disciplines for much longer than in the visual arts. As philosopher and sociologist Manuel DeLanda remarks, "ecology borrows methodology from other fields in order to express the characteristics of natural systems."[5] For example, adaptation may be understood through frameworks as divergent as Chaos theory and material expression.

The merging of various fields, in the last 150 years fostered a rich diversity of ideas, particularly in light of technological advances, and has helped to bridge many disciplines once thought to be exclusive territories within academic institutions. Bearing this in mind, it is important to retain a sense of a lineage in relation to the artistic paradigms that have adapted to new forms of knowledge and world events. Unless we understand such lineages, the complex relations between socio-political, economic and cultural organizations will be clouded in terms of how art might function in the coming

[5] See Manuel DeLanda's lecture "Population Thinking" delivered in 2011 at the European Graduate School. http://www.youtube.com/watch?v=5HSMTUZ64bY, accessed 10 February 2013.

century.

It is crucial that we understand the historical relations between art and other disciplines. In this dissertation an acknowledgement of past art-making practice, with the proviso that art can no longer exist solely as a singular discipline, is interwoven with Assemblage theory because of the complex relationships that foster intellectual pursuits. It is one of the reasons why I have shifted the focus of art criticism beyond anthropocentric analysis to include ecological and scientific fields. All of these areas are engaged in their own reflexive questions regarding authenticity, legitimacy and the critique of objectivity.

Assemblage theory raises questions, as do the works mentioned here, regarding the nature of an actual physical system and that of a constructed institutional system. As a theory, it asks how these different types of systems are absorbed and influenced by one another, and as we encounter invisible phenomena through detection, we discover other dimensions to our reality and existence. Many of the questions the technoscience sphere has raised in relation to physical phenomena extend into artistic practice. Assemblage theory can mediate our understanding of the various disciplinary positions, which play out in myriad ways just as our perspective regarding these relations is mediated by our proclivities to accept historical interpretations and accounts. We can think of institutionalized replicators in this way, from Bauhaus principles of design to the list structures of Systems Esthetics. Both models exist as forms of pedagogical instruction, which attempt to promote and establish self-preserving tendencies. We must also understand however that things, living organisms and material interactions have a life

beyond an anthropocentric reading. Creative practice speaks to these phenomena, more often than not, by way of relation rather than through function and intentionality.

In Chapter 1, I will discuss the antecedent histories, which laid the groundwork for formal Bauhaus Gestalt design principles. An examination of the New Bauhaus in America and a series of subsequent techno-art collaborations follows in Chapter 2. Twentieth-century organizations, including the Center for Advanced Visual Studies (CAVS) and Experiments in Art and Technology (EAT), helped bridge science and the humanities inasmuch as they attempted to close the resource gap between these disciplines, facilitated by the encouragement of bifurcation and specialization in American academia during the 1960s and 70s.

My instruction in the Fine Art Program at Fanshawe College in the late 1980s came out of the Bauhaus tradition. Both the Bauhaus preliminary course and the introductory Fanshawe Fine Art programs began with colour and design theory and included the exploration of materials and techniques with the final year dedicated to independent study. It is a pedagogical approach that I have witnessed in the five post-secondary educational institutions I have attended and taught at, and yet one that has been steadily eroded in favour of the theories and philosophies of academics working outside of the field of studio practice.[6] My interest in design, which includes both schooling in marketing and advertising and a professional life as a graphic designer, has prompted me to consider the historical relationship between form and function within artistic traditions. The relationship between art, design and functionality seems to resonate more than ever

[6] See Troy David Ouellette, "A Study of Institutional Studio Practice Part One: The New Bauhaus in America and the Influence of György Kepes," 2010, unpublished manuscript, p. 2

in the psychological underpinnings of New Materialism as well as in Affordance, Affect and Actor Network theories. These theories, together with Assemblage theory, will be discussed in relation to my own work in the final chapter.

What is An Assemblage?

At the start of the twentieth century, assemblage shared a kinship with a process such as collage, in which inert printed materials were juxtaposed to activate a political or sociocultural dimension. In visual art an assemblage is comprised of objects signifying differences in time and space. Each object has had a previous life that takes on a new life when placed in combination with another. In the publication The Art of Assemblage, art historian and curator William Seitz argues that an assemblage may function as something that "dispels an aura of authority, profundity and sanctity." He further comments that some objects, such as some of the works by the artist Man Ray, "were designed to amuse, annoy, bewilder, mystify, inspire reflection but not arouse admiration for any technical excellence usually sought or valued in objects classified as works of art."[7] Assemblage theory operates in a similar fashion by virtue of the fact that its material expression and coded relationships encourage critique and simultaneously exist as something playful and beguiling. In collage art, while such critiques are sometimes political, such as in the work of Hannah Höch or Helmut Herzfeld, the visual and material elements of assemblage always draw attention to the possibility of multiple material meanings. This is evident in such works as Man Ray's *Le Cadeau*, (a flat iron with metal tracks), as the work becomes something anti-utilitarian and confounded.

[7] William C. Sietz, The Art of Assemblage. Garden City: Doubleday and Company, 1961. p. 6

Seitz's text, The Art of Assemblage, was produced in conjunction with a 1961 Museum of Modern Art (New York) exhibition of the same name, which showcased the work of early twentieth-century European artists, such as Georges Braque, Marcel Duchamp and Pablo Picasso, alongside Americans such as Man Ray, Joseph Cornell and Robert Rauschenberg**.** It was, perhaps, the most comprehensive reflection on assemblage to that date. According to Seitz, assemblage first appeared as a European avant-garde invention as early as 1912 in Picasso's guitar constructions.[8] Yet, informally, such juxtapositions can be found much earlier in objects such as relics or ritual items that radiated spiritual power through collective intentionality and belief systems. What is absent from Seitz's text, however, is the relationship between assemblage and anthropology—that is, a study of objects in relation to their previous life as either utilitarian objects or decorative items. Ritual objects are situated within a context of mystical beliefs whereas assemblage—and even collage for that matter—focuses on secularizing objects of contemplation by positioning them within networks, such as the art market and display culture, while highlighting their symbolic meaning and materiality. Ironically, the value of a readymade or visual art assemblage is intensified by the obsolescence of its components and the context within which these elements are placed. For example, discussions surrounding the 'found' object are problematized because they deny the former life of the object. The excessive focus on the new life of objects through juxtaposition takes precedence. Acknowledgement of the historical life of the object is nonexistent in Seitz's text. Here, the complexities of the designed object take a back seat to the semiotic reading of an artefact, but then again, Seitz was writing with specific

[8] Ibid., pp. 9-10

regard to the art object within the territorializing context of an art exhibition, so such an omission is not surprising.

When we investigate the three-dimensional iteration of collage, assemblage, we see that it dealt with a wide range of subjects including mechanization (Raoul Hausmann's *Mechanical Head*, 1920), consumerism (Arman's *Accumulation rasoirs*, 1968), psychoanalytic theory (Méret Oppenheim's *My Nursemaid*, 1936), scientific study, objectivity and fantasy (Joseph Cornell's, *Untitled (Solar Set),* shadow box construction, 1956-58), authorship, functionalism and design (Marcel Duchamp's, *Bicycle Wheel*, 1913). Just as assemblage in visual art practice was able to describe broader forms of coded social history and material practice, in its more sociological valence Assemblage theory can bridge the political, environmental and social aspects of artwork within the larger schema of cultural and social spheres. The radicality of Assemblage in visual arts, and the connections it has with frottage, montage and collage, is enhanced through its pluralistic tendencies and in its relation to the artist's life, which emphasizes these complex relationships. As art historian Barbara Stafford remarks,

> Collage, as the process of transforming ephemera by cutting and pasting it into momentarily stable configurations, is, therefore, a particularly effective technique for capturing the chimera of consciousness in action. Originating with the cubists and expanded by the dadaists and surrealists, this 'gluing' of transitory detritus extends into montage, film editing, and, now, computer manipulation. Compounding incongruous parts and provisionally joining farfetched elements in space and time break duality-establishing boundaries, whether in art or in science.[9]

When applying this idea to analytic cubism, one can see through the making and observation of the fragmented parts a picture that is composed of discrete renderings.

[9] Barbara Stafford, "Combinatory Aesthetics of Neurobiology," Aesthetic Subjects. Pamela R. Matthews and David McWhirter, eds., Minneapolis: University of Minnesota Press, 2003. p. 252

Different positions of observation attempt to designate detached moments yet offer up to the viewer a larger picture that cannot fully account for various instances or connections.

What is Assemblage Theory?

Manuel DeLanda first articulated the concept of social assemblage in his 2006 book A New Philosophy of Society: Assemblage Theory and Social Complexity. It should be noted, however, that DeLanda's Assemblage theory is derivative of Gilles Deleuze's philosophical notion of *agencement,* translated as assemblage it looses some of its initial meaning, which is more suggestive of agency, human or otherwise. According to DeLanda, assemblages are comprised of aspects of coding, which have a territorializing and deterritorializing axis as well as material and expressive components. These elements cannot be reduced to their constituent parts, since they are also heterogeneous assemblages in their own right. For DeLanda, assemblage is criteria-based; it is also an open and flexible system. Any attempt to grapple with how to theorize art's contemporary iterations therefore should be made, at least to some extent, through Assemblage theory.

In A New Philosophy of Society, DeLanda discusses the nuances of social and historical organizations from the individual to the community, and from the city to the nation state. He does this without applying the stringent macro and micro distinctions often made in categorization, asserting that an assemblage consists of five criteria:

1. It must have expressivity: each entity in an assemblage has a material expressivity. Certain flowers, for instance, reflect a particular spectrum of light. A crystal may have a specific structure, which emerged in relation to the geologic process that formed it.
2. It will also possess coded relationships: everything that exists in our imaginations usually has a coded aspect of a language to explain phenomenon or there may be

coded relationships between things that communicate or have an inherent set of instructions within, such as RNA.

3. There will be a process of territorialization: entities will retain their identities as autonomous units. For example, a city-state may maintain its sovereignty through the use of borders or a species may assert control over territory to stabilize its position in competition with others. In this sense territorialization therefore may involve physical barriers and conditioned or evolved behavioural activities.
4. Deterritorialization also plays a part as something that destabilizes a system such as an invasive species of plant acting on a population that has evolved within a defined area for longer durations or a theory, a coded discord that weakens or subverts an ideology or paradigm. Without deterritorialization there can be no complexity.
5. Finally, material qualities play an important part: all things, living or non-living, human or non-human are materially based. For DeLanda, even language has a material component, as spoken it involves a physical apparatus and pulses of air to produce sound.

Consistent throughout DeLanda's text is the notion that assemblage is complex, and comprised of multiplicities.

During the twentieth century, philosophers and scientists first became preoccupied with notions of complexity with the advent of databases and the development of information-gathering technologies. With regard to artistic practice, Assemblage theory provides a model able to account for the intricacies of creative thought and poïesis, or more specifically the studio cycle of research involving learning through doing—process, reflection, and action. Given that DeLanda is using Assemblage theory in a sociological context, might it also be used to describe the relationship between creative production and the multiple relations of political, social and—especially crucial to my work—environmental dimensions of everyday life? What Assemblage theory promises for art is a new way of understanding reality and artistic practice, enriching its methods and processes by accessing other fields. Consequently the interactions between creative endeavours and disciplines, as diverse as political and social science, and economics among others, will foster a more open exchange of ideas.

What is a System?

A system has many more implications, meanings and historical resonances than the short history of assemblage allows. Unlike Assemblage theory, which relies on the external and internal relations of an entity, a system is often conceived of as a structure of autonomous repeatable units. There is no system without a structure and there is no structure without a system. In an ecological construct a system may evolve from selective pressures within an environment such as within an adaptive process, or through morphogenesis.[10] In other words, the complexities of interactions produce change or adaptations in everything from organisms to weather events.

More specifically when we consider systems within conceptual art practice we may observe two distinct iterations. Systems Esthetics, as postulated by artist Jack Burnham, combined information, software, and instructional models in order to understand and theorize artwork, such as Sol Lewitt's geometric constructions. Divergently, the organizational complex of bureaucracies and institutional power, which we find in philosopher Giorgio Agamben's notion of the apparatus is connected to the earlier concerns of artists such as Hans Haacke, whose work was engaged in a critique of corporate and political power as well as the art market.[11] Burnham's opinion however was that the conceptual focus, rather than material limits, defined the system. For

[10] Morphogenesis is the birth of form, meaning all the spaces of possibility, which occurs not only in nature but also in art. According to DeLanda, an artist may impose a systematic or conceptual framework on the artistic creation or it can be met half way by letting the materials or the process of gravity play out in the work. European Graduate School Lectures. https://www.youtube.com/watch?v=5HSMTUZ64bY accessed 21 February 2013.

[11] If we take philosopher Giorgio Agamben's meaning of an apparatus literally, it is "anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviours, opinions, or discourses of living beings" In contrast to Agamben's more anthropocentric notion, Assemblage theory may involve non-living and non-human entities as important aspects of networks—things that relate, reinforce and direct future iterations of variable systems. Giorgio Agamben, What Is an Apparatus? and Other Essays. David Kishik and Stafan Pedatella, trans., Werner Hamacher ed., Stanford: Stanford University Press, 2009. p. 12 For more information concerning university bureaucracies see Benjamin Ginsberg, The Fall of the Faculty: The Rise of the All-Administrative University and Why It Matters. New York: Oxford University Press, 2001.

example, Burnham cites how painter, photographer, and Bauhaus instructor László Moholy-Nagy envisioned fabricating steel paintings by telephoning precise instructions, as described in his 1938 text The New Vision.[12] Highly influenced by new trends in constructivism, Moholy-Nagy argued for a 'new vision' through the integration of art technology and industry. America's role, as a new civilization, he reasoned, was to cultivate and industrialize. "It is the ideal ground on which to work out an educational principle, which strives for the closest connection between art, science, and technology," he argued.[13] These early experiments by Moholy-Nagy foregrounded the disembodiment of the maker from the object, foreshadowing the turn from holistic labour to prescribed labour. The idea that a set of instructions could have such an influence on commerce and production is now seen in the transactions carried out everyday via the telematics and informatics of the stock market and Internet. According to philosopher Frank Popper there are six main characteristics of telematics: it stages physical presence at distance; it telescopes the immediate and the delayed; it focuses on inter-activity; it combines real-time with memory; it advances planetary communication; and it promotes a detailed study of human social interactions. In a larger sense, telecommunication art provided a new lens with which to see technological developments such as 3D printing, where authorship resides in the recipe rather than the meal.[14]

Moholy-Nagy's unique combination of texts, photographs and sculptures were a marker of change in the art world—not only were artists critical of institutions in general, but art itself was becoming integrated with other systems of organization and disciplinary

[12] Jack Burnham, Great Western Salt Works: Essays on the Meaning of Post-Formalist Art. New York: George Braziller, 1974. pp. 16-17
[13] László Moholy-Nagy and Walter Gropius, eds., L. Moholy-Nagy. The New Vision. New York: Norton and Company, Inc., 1938. p. 5
[14] Frank Popper, Art of the Electronic Age. New York: Harry N. Abrams, Inc., 1993. p. 127

pursuits.[15] We see this in the commercialization of art and design schools and also in the attempt by art instructors to promote art-techno-scientific collaborations. But it was Moholy-Nagy's work in America that came to shape a new generation of artists, such as György Kepes and CAVS fellow Jack Burnham, who helped to inaugurate a paradigm shift from traditional studio practice to applied technical and scientific partnerships. Later, these interdisciplinary endeavours developed in schools such as MIT and in most art and design schools in Canada and the United States.

The notion of what a system is, and how it functions, is comprised of a multiplex of specialized concepts including ones that derive from Complexity theory, Chaos theory, Set theory and adaptive systems. And although many of these theories share commonalities with Assemblage theory they often cannot account for emergent or unpredictable phenomenon since most systems are designed to describe and focus on one part of determined reality (eg. political, social, cultural, economic, mathematical etc.) Assemblage theory is much more organic and variable, suppressing the disciplinary straightjackets that often circumscribe how a system should function or even how it should be learned and tested. Weather, as an example, has become emblematic of something highly complex and dynamic due to human intervention coupled with natural phenomenon.

By applying Assemblage theory to my own work in Chapter 3, I will generate a multiplicity of ideas regarding artistic practice citing weather as its locus. I will also

[15] After taking over the directorship of the Bauhaus in 1928, Hannes Meyer said that he found, "A Bauhaus whose potential exceeded its achievements by orders of magnitude and which was the product of an unprecedented amount of advertising." Frederic J. Schwartz, "Utopia for Sale," Bauhaus Culture: From Weimar to the Cold War. Minneapolis: University of Minnesota Press, 2006. p. 125

examine poïesis as a generative act and introduce assemblage as a central thread that runs through my recent drawings, sound recordings and sensory work. My practice will be contextualized within a broader matrix of artists whose interests include atmospherics, energy, electricity and the environment. By introducing how Assemblage theory may be integrated into creative endeavours I hope to offer a way to illuminate the importance of the field for practitioners and non-practitioners.

Chapter 1

The Bifurcation of Early Art Systems: Arts and Crafts to the Bauhaus

The tendency to reflect on complex social organization through the lens of visual culture first began in the late nineteenth century. With the advent of colour theory, psychology, psychoanalysis and behaviourism, the culture of making things offered new opportunities for reading social structures and organizations. This coincided with the diversification of materials and machine technologies that were unprecedented until this time. The artists of both the Aesthetic and the Arts and Crafts movements wanted artistic practice to be more integrated into wider economic, political, and social spheres.[16] William Morris, the leading champion of the Arts and Crafts movement, vehemently opposed the mechanization of the creative process. In its stead, he advocated for a revival of collaborative practice, in the industrial crafts, between designers and craftsmen.[17] Morris's philosophy expressed the importance of knowing through doing, a methodology later emphasized in the curricula of both the Leeds School of Art and Design and the Edinburgh College of Art, at the beginning of the twentieth century.[18] The advocacy of collaboration between craftsmen and artists in Britain soon caught on in other European

[16] The Aesthetic movement has no specific date of inception although some historians suggest it came into being in the mid-nineteenth century. William Paxton's Crystal Palace is one example of the architectural innovation of the period, which expressed a desire for a new design standard. Whatever the case, the formulation of design coupled with aesthetics and everyday use, is one of the hallmarks of creative innovation.

[17] Ironically, Morris has come under some scrutiny, as of late, in part because of his affiliation with the use of arsenic in green wallpaper pigments. Morris inherited his father's mining company, Devon Great Consols, which was the largest arsenic producer of its age. He was a shareholder and director. On the one hand, Morris was a capitalist and yet he also advocated a socialist agenda of hand-labour over mechanization, even refusing to use synthetic dyes because he believed that natural ones needed less human intervention. See Philip Ball, "William Morris made poisonous wallpaper," Nature News. http://www.nature.com/news/2003/030612/full/news030609-1. accessed 12 June 2013.

[18] Another precursor to the *Deutscher Werkbund* existed in England under the banner of "the Unity of Art." This organization was comprised of artists, architects, sculptors and painters as The Art Workers Guild of 1884. See Alan Crawford, "Ideas and Objects: The Arts and Crafts Movement in Britain," Designing the Modern Experience, 1885-1945. Design Issues. vol. 13, no. 1, Spring, Boston: MIT Press, 1987. p. 16

countries. In 1907, the *Deutscher Werkbund,* Germany's iteration of the Arts and Crafts movement was inaugurated. To strengthen its markets, Germany incorporated a standard system for design, architecture, manufacturing and craft, which became the German Work Federation. Germany looked to other countries for ideas to strengthen their export commodity markets, sending 'envoys' to Britain to observe examples of industrial production. In the book Bauhaus Culture: From Weimar to the Cold War, author John Maciuika noted that "a 1904 government decree was prompted by the overwhelming evidence that German manufacturing was falling behind." The decree consequently "introduced practical workshops where students would develop their design projects in tandem with hands-on materials and construction oriented design processes."[19] Maciuika contends that Bauhaus founder Walter Gropius as well as his mentor and predecessor, Henry Van de Velde, drew on this decree, both as a model and argument, for deriving funding from the Weimar republic to initiate the Bauhaus.[20]

Educational reform was underway, not just at the Bauhaus but in schools throughout Germany, prompted by a convergence of ideas and European avant-garde movements, such as constructivism. At the Bauhaus, educational innovation included the introduction of student workshops that were overseen by master craftsmen under the direction of artists (painters more often than not), while 'industry' became an integral part of the artistic equation.[21]

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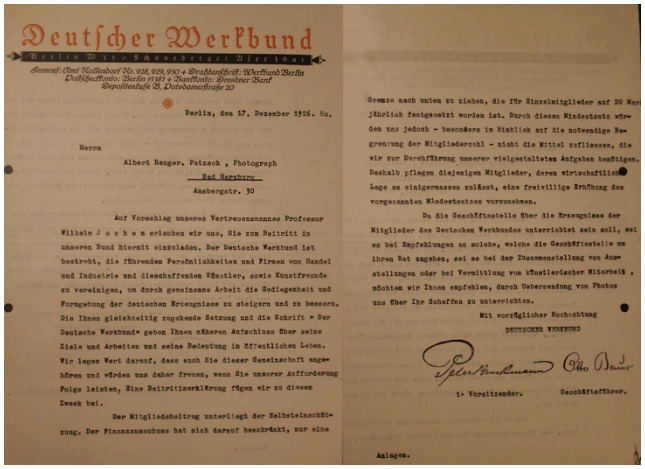
[19] John V. Maciuika, "Wilhelmine Precedents for the Bauhaus," Bauhaus Culture: From Weimar to the Cold War. Minneapolis: University of Minnesota Press, 2006. p. 11

[20] Henry Van de Velde was a mentor and predecessor of Walter Gropius in two ways: firstly, he established the Grand-Ducal School of Arts and Crafts, a predecessor to the Bauhaus, and secondly, although he opposed standardization in favour of the individual artist, he played an important role in the *Deutscher Werkbund*.

[21] In this way, the *Deutscher Werkbund* fundamentally and philosophically differed from the Arts and Crafts movement, which came to reject any industrialization of the creative process. See Kathleen James-Chakraborty, ed., Bauhaus Culture: From Weimar to the Cold War. Minneapolis: University of Minnesota Press, 2006. p. 3

The *Deutscher Werkbund* was uniquely interested in partnering, in any way possible, with artists throughout the world in order to promote German industry. In 1926, American-based photographer Albert Renger-Patzsch wrote to express his desire to collaborate with the *Deutscher Werkbund*.[22] In response to his offer, Managing Director Otto Bauer wrote,

> The German Work Federation is dedicated to leading personalities and companies, uniting industry, creative artists and art lovers and to enhance joint working by improving the solidity and design of German products. The *Deutscher Werkbund* will give you detailed information about its aims and work and its importance in public life. We insist that you also belong to this community and therefore we would be delighted if you make at our invitation a membership application.[23]



Deutscher Werkbund

Berlin W 15, Schöneberger Ufer 36a

Fernruf: Amt Uhlandorf Nr. 928, 929, 930 • Drahtanschrift: Werkbund Berlin
Postscheckkonto: Berlin 41371 • Bankkonto: Dresdner Bank
Depositenkasse B, Potsdamerstraße 20

Berlin, den 17. Dezember 1926. Ho.

Herrn
Albert Renger. Patzsch , Photograph
Bad Harzburg
Amberstr. 30

Auf Vorschlag unseres Vertrauensmannes Professor Wilhelm J o c h e m erlauben wir uns, Sie zum Beitritt in unseren Bund hiermit einzuladen. Der Deutsche Werkbund ist bestrebt, die führenden Persönlichkeiten und Firmen von Handel und Industrie und dieschaffenden Künstler, sowie Kunstfreunde zu vereinigen, um durch gemeinsame Arbeit die Gediegenheit und Formgebung der deutschen Erzeugnisse zu steigern und zu bessern. Die Ihnen gleichzeitig zugehende Satzung und die Schrift » Der Deutsche Werkbund« geben Ihnen näheren Aufschluss über seine Ziele und Arbeiten und seine Bedeutung im öffentlichen Leben. Wir legen Wert darauf, dass auch Sie dieser Gemeinschaft angehören und würden uns daher freuen, wenn Sie unserer Aufforderung Folge leisten. Eine Beitrittserklärung fügen wir zu diesem Zweck bei.

Der Mitgliedsbeitrag unterliegt der Selbsteinschätzung. Der Finanzausschuss hat sich darauf beschränkt, nur eine Grenze nach unten zu ziehen, die für Einzelmitglieder auf 20 Mark jährlich festgesetzt worden ist. Durch diesen Mindestsatz würden uns jedoch - besonders im Hinblick auf die notwendige Begrenzung der Mitgliederzahl - nicht die Mittel zufliessen, die wir zur Durchführung unserer vielgestaltigen Aufgaben benötigen. Deshalb pflegen diejenigen Mitglieder, deren wirtschaftliche Lage es einigermassen zulässt, eine freiwillige Erhöhung des vorgenannten Mindestsatzes vorzunehmen.

Da die Geschäftsstelle über die Erzeugnisse der Mitglieder des Deutschen Werkbundes unterrichtet sein soll, sei es bei Empfehlungen an solche, welche die Geschäftsstelle um ihren Rat angehen, sei es bei der Zusammenstellung von Ausstellungen oder bei Vermittlung von künstlerischer Mitarbeit, möchten wir Ihnen empfehlen, durch Uebersendung von Photos uns über Ihr Schaffen zu unterrichten.

Mit vorzüglicher Hochachtung
DEUTSCHER WERKBUND

1. Vorsitzender. Geschäftsführer.

Anlagen.

A letter dated 17 December, 1926 from the *Deutscher Werkbund* to Albert Renger-Patzsch. From the Albert Renger-Patzsch Papers. 1924-1966. Getty Library and Archives. Los Angeles.

Although the letter reads somewhat like a propagandistic form letter, the exchange did result in the commission of a photographic survey of German industry in the 1930s by Renger-Patzsch.[24] This significantly predates Bernd and Hilla Becher's survey of German steel mills and mining companies in the late 1950s. Such collaborations created a new

[22] Albert Renger-Patzsch was a photographer who, after the First World War, became a photojournalist with the Chicago Tribune during the 1920s.
[23] A letter 17 December 1926 from the *Deutscher Werkbund* to Albert Renger-Patzsch. From the Albert Renger-Patzsch Papers. 1924-1966. Getty Library and Archives. Los Angeles. Translated from German by Corinna Ghaznavi.
[24] Unfortunately the archive of his work was completely destroyed during the Second World War.

paradigm for art, craft and industry and proved to be extremely successful as part of a national economic agenda.[25] In this case the impetus was to foster economic competition with other industrialized powers including America as a way to territorialize and centralize economic trade.

According to Maciuika, two precedents set the course for the partnering of art and industry in Germany. The first was a national renewal in artistic and design quality fostered by the influence of the Arts and Crafts movement. The second arose when the Prussian state government reformed the system of design education to accommodate the coming competitive modern economies of mass industrialization.[26] By the end of World War I, standardized utilitarian design in everything from architecture to flatware became the norm.

Social and cultural re-organization played out in a climate of increasing urbanization and secularization, and the Arts and Crafts movement helped to deploy innovative and creative strategies for production in the face of rising industrialization, Taylorism and the advent of assembly-line production—strategies which, perhaps unintentionally, laid the groundwork for the integration of industry and arts at the Bauhaus. The shift in pedagogical imperatives at the Bauhaus—away from the ideals of the Arts and Crafts movement and towards more industry-focused initiatives—are illustrated in Achim Borchardt-Humes' account of the transition in teaching methodologies from those of Johannes Itten to those of Moholy-Nagy, who took over the

[25] The *Deutscher Werkbund* suffered the same fate as the Bauhaus when National Socialists came to power in Germany. It too closed, and eventually reinvented itself again after World War II.
[26] John V. Maciuika, "Wilhelmine Precedents for the Bauhaus." p. 2

foundations course in 1923.[27] "The evolution of the Bauhaus," he writes, "reflected that of the Weimar republic itself."

> The arts-and-crafts ideal of the economically depressed post-war years soon made way for an alignment with the rising demands of industry, the first Bauhaus exhibition in 1923 under the title 'Art and Technology. A New Unity' marking the pivotal turning point. Many of the first generation of Bauhaus teachers resisted this paradigmatic shift, and Itten and Moholy stand for two distinct positions within this historic moment, the former highlighting continuities, the latter programmatic change.[28]

In America, this change was realized in the production laboratories where manufacturing and design were improved upon through the creation of specialized departments, such as those utilized in Edison's Menlo Park invention factory. Unique in its design, Edison's laboratory combined arts and crafts processes with scientific experimentation under one roof. Producing a dizzying diversity of contrivances, ranging from phonography to an electric car, Edison's main innovation was to include the bureaucratic systems of business (patents and trademarks), which would safeguard and control the rights to each new invention.[29] Edison's laboratory was a practical space for testing materials. Designs, drawings and physical models explained how inventions functioned, and the process exemplified poïesis (invention) and praxis (functionalism) in action by combining diverse methods as new technologies came to fruition and materials became available. Electricity and light became major influences in the way cities and nations operated; supplying populations with electricity extended work hours and changed the nature of prescribed

[27] It is important to note that Itten who, together with Paul Klee and Wassily Kandinsky, created the foundation course and was an elementary school teacher before coming to the Bauhaus. His methods were heavily informed by the work of German pedagogue and educational reformer Friedrich Wilhelm August Fröbel.
[28] Achim Borchardt-Humes, Albers and Moholy: From the Bauhaus to the New World. New Haven: Yale University Press, 2006. p. 68
[29] Wyn Whahhorst, Thomas Edison: An American Myth. Cambridge: The MIT Press, 1981. pp. 152-153

labour. These changes would have profound implications on art's relationship to industry when we consider the speed of manufacturing through automated processes.

Against this backdrop, a binary with increasingly divergent components is evident, one component being the new capitalist production of Edison's laboratory and the other the penchant for style and design foregrounded in the European Aesthetic movement**.** The former is an instance of American pragmatism while the latter combines utility and aesthetic ideas of beauty fused into a social contract between the user and the manufacturer. In this example the assemblage of manufacturing determines the aesthetic characteristics of the design, while the consumer benefits from the social cachet of being current and fashionable. This duality of practical functionalism and aesthetic responsiveness to forms of social and political organization is something that has continued to characterize the discipline of visual arts practice where the pressure to be 'productive' is leading many art and design school directives to bridge aesthetics and functionalism.[30]

In the same way, the Arts and Crafts movement was uniquely instantiated in North America by way of praxis where the intention to create utilitarian commodities or products for the art market of wealthy patronage was of the utmost concern. Subsequently a 'new' Bauhaus was born by way of collaboration, exhibition, publication and with the arrival of European faculty and students who were absorbed into North American schools.

[30] It should be noted that Bauhaus ideas were not very well received in Canada, even up until the late 1960s. In a recent text on Andor Weininger (a Bauhaus student who immigrated to Canada in the 1950s) he is quoted as saying, "I believed that in Canada, a new country, I would have success. I tried to teach, but was rejected. I tried to do furniture design, but there was no interest in modern furniture in Canada. So I painted, but I couldn't exhibit my works. I was rejected each time." Weininger was expressing thoughts about his experience in Toronto rather than Canada in general. He later recounted that he should have moved to Montreal instead. See Oliver A.I. Botar, A Bauhausler in Canada: Andor Weininger in the 50s. Oshawa: Robert McLaughlin and Gallery One One One, School of Art, University of Manitoba, 2009. p. 180

The result of these transactions was such that the Bauhaus deterritoralized Canadian and American arts and craft schools by importing the seeds of European avant-garde instruction. More clearly stated, this deterritorialization supplanted other forms of observational learning through the introduction of structured foundational years with an emphasis on materials and experimentation. This deterritorialization was also much broader and nuanced in scope than was previously thought. In The Bauhaus and America: First Contacts: 1919-1936, writer Margret Kentgens-Craig recounts how the influence of the Bauhaus spread through American and European exchange. Such exchanges built the pedagogical bridges necessary for a sustained influence in America.[31] These connections were also made through collectors such as Katherine S. Dreier, herself an artist, who early on acquired works by Bauhaus masters. What Kentgens-Craig brings to the fore is that the world was already globalized and the Bauhaus influence was not simply a regional trend. The intricacies of how Bauhaus instruction became diffused throughout North America is likely to be found in the smaller exchanges between individuals than in the larger formats of international exhibitions. For example, as early as 1925 the German-born Renger-Patzsch, a freelance photographer based in Chicago, contacted Moholy-Nagy about working together on a collaborative publication. Moholy-Nagy's reply, however, surprisingly reveals that, even in its early years, the Bauhaus school was in financial distress. We find ourselves in "very uncertain times" Moholy-Nagy replied,

> We are hoping for a positive turn of events; we have negotiated with different towns with regard to taking over the Bauhaus but with no success… Now to business: I returned two photographs to you, and now am returning the third copy. With this letter I am sending an advance of 5 mk, since I don't know when we will be publishing. The Bauhaus press

[31] See Margret Kentgens-Craig, "The Dissemination of Bauhaus Ideas: Paths of Communication," The Bauhaus and America: First Contacts: 1919-1936. Cambridge: MIT Press, 2001.

> has declared bankruptcy… Here too we are receiving minimal salaries. Instead of the X-XI salary we are receiving level VII and these have also been cut. Therefore I'm also experiencing financial difficulties, and, due to the demands of the Bauhaus, don't come to either selling or sending my pictures. This will have to change in the future.[32]

Growing conservatism, communist suspicion and economic uncertainty conspired with other forces to call the School's methods and objectives into question. State support waned within only a few years and ceased entirely by 1923, just four years after the Bauhaus opened, when director Walter Gropius began to seek out a new location for the School.[33] When the Bauhaus moved to Dessau it became increasingly production-focused introducing more rigorous architectural programs, and producing a series of worker-houses funded by Dessau's town council. Under the direction of Swiss architect Hannes Meyer (1928-30), the School dangerously came to be associated with leftist politics at a time when National Socialism was on the rise.

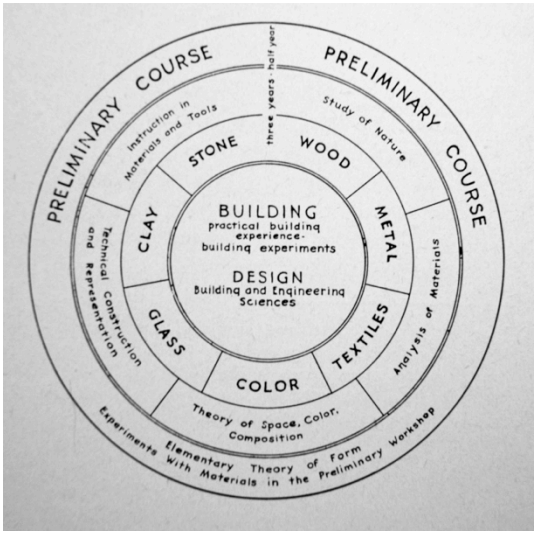
By 1928 it was clear that the focus of the Bauhaus had changed from one more aligned with Gestalt psychology to one of practical functionalism. Workshops became more like laboratories that provided visionary prototypes, not so different from Edison's laboratory, described earlier, but differing in the way social interaction played out in more complex ways.[34] As an early approximation of social Assemblage theory, and in accordance with Meyer's new vision, all of the social structures of everyday living were to be incorporated as part of the design process. "1. sex life, 2. sleeping habits, 3. pets, 4.

[32] Letter dated 18 February 1925, from László Moholy-Nagy to Albert Renger-Patzsch, From the Albert Renger-Patzsch, Papers. 1924-1966. Getty Library and Archives. Los Angeles. Translated from the German by Corinna Ghaznavi.
[33] The Weimar Bauhaus closed in 1923 and eventually reopened in a custom-built facility, designed by Gropius, in 1925 in the industrial town of Dessau.
[34] Wallis Miller, "Architecture Building and the Bauhaus," Bauhaus Culture: From Weimar to the Cold War. Kathleen James-Chakraborty, ed., Minneapolis: University of Minnesota Press, 2006. p. 84

gardening, 5. personal hygiene, 6. weather protection, 7. hygiene in the home, 8. car maintenance, 9. cooking, 10. heating, 11. exposure to the sun, 12. services—these are the only motives when building a house," he argued.[35] "We examine the daily routine of everyone who lives in the house and this gives us the functional diagram—the functional diagram and the economic programme are the determining principles of the building project."[36] Meyer's position straddled the divide between socialist politics—or perhaps more accurately his communist sympathies—and capitalism, a business model that would unite art and manufacturing while sustaining the School financially. After Meyer was removed from his position, as the result of Nazi political pressure, the profits that he helped the School accrue were ironically usurped by "the newly appointed Director Mies van der Rohe, in Berlin, to privatize its operation."[37] What Meyer was able to realize during his tenure was the integration of socially planned urban areas and built environments. To some extent this mandate for sustainable urbanization resembled an assemblage rather than a system, because it intuited the integration of social factors and adaptable living spaces as part of a larger equation.

[35] Theo van Leeuwen, Introducing Social Semiotics. New York: Routledge, 2005. p. 71
[36] Ibid
[37] "Bauhaus Pedagogy: Hannes Meyer's Holistic Design Research," a lecture by Dara Kiese presented at the 101st Annual College Art Association Conference, New York, 15 February 2013.

The Bauhaus and the Formal System of Art Instruction



A diagram outlining the Bauhaus Curriculum from a 1938 exhibition catalogue. Herbert Bayer, Isa Gropius, Walter Gropius, eds., Bauhaus 1919-1928. Boston: Charles T. Branford and Company, 1952, p. 23

Early standards set out by competing European and American powers to attain economic dominance and to supply consumers with the functional and aesthetic designs of the 'modern' age, helped to shape art and design instruction. One of the reasons I have focused on the Bauhaus construct is that, for the most part, it is a model that continues to shape foundational studio instruction today. While the early instructors at the Bauhaus were aware of other fields and the standards set forth by the *Deutscher Werkbund*, adherence to these concerns was limited in scope and influence. Rather, the principles of Gestalt psychology were most readily incorporated into other Bauhaus forms of instruction including dance, design, painting, metalwork, theatre and textile fabrication among other disciplines. Moreover, the Bauhaus and New Bauhaus established a formal system through which artists would be aware of how visual composition operated by way

of human psychology in relation to colour and material expressivity.[38]

The most important educational advancement of the Bauhaus, however, was in the institution of a basic course in design.[39] The general six-month course introduced each student to the Bauhaus method and its facilities, and included the exploration of composition through the principles of colour theory, design, material, texture and structure. Students were encouraged to embrace different ideas, fuelled by the avant-garde instructors, as a kind of utopian educational reformation. Courses at the Bauhaus also inspired students to develop and demonstrate their inherent abilities through hands-on work in a multitude of workshops. The poïesis of handcraft and the psychological insight gained by imagining a work in the process of being realized was something students engaged with on a daily basis.[40] And the method was designed to narrow the conceptual gulf between fine art and fine craft. As Dr. Lauren S. Weingarden notes,

> Gropius expanded these themes when he wrote for the Work Council for Art and then for the opening of the Bauhaus in April 1919. He invoked artists and architects to shed their socially useless professional artistic attitudes and return to *handwerk*—or, literally, hand-labor—and in this way, become 'builders' again. Addressing his colleagues as 'artist-workmen' and 'working people' Gropius, like Morris before him, charged them with the socially useful task of reviving craft techniques to create art forms comprehensible to all and to break the boundaries between the fine arts and applied arts, and between art and life.[41]

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[38] Colour theorist and Nobel prize-winning chemist Wilhelm Ostwald was invited to speak with the students at the Bauhaus in 1919, and agreed to join the board of trustees at the school shortly thereafter. See Philip Ball and Mario Ruben, "Color Theory in Science and Art: Ostwald and the Bauhaus," Angewandte Chemie International Edition. 2004. pp. 4842-4846

[39] The '*Vorkur*' or Basic Course was initiated by Itten, with contributions from his colleagues Klee and Kandinsky. In 1923 Moholy-Nagy ushered in new and experimental courses in photography, which were perceived to threaten the dominance of painting. There were also tensions regarding the inequality between men and women who were applying with greater frequency to the foundations course, with most women being encouraged to pursue studies in textiles. Although the female students in craft-related disciplines, such as metalwork and textiles, were promised that they were coequal with their male colleagues, the reality was quite different. See Rose-Carol Washington Long, "From Metaphysics to Material Culture," Bauhaus Culture: From Weimar to the Cold War. Kathleen James-Chakraborty, ed., Minneapolis: University of Minnesota Press, 2006. p. 44

[40] See Anita Cross, "The Educational Background to the Bauhaus," Design Studies. vol. 4 no. 1. January 1983. p. 44

[41] Lauren S. Weingarden, "Aesthetics Politicized: William Morris to the Bauhaus," Journal of Architectural Education. vol. 38, no. 3. Blackwell Publishing, 1984. p. 10

Thus Gropius reasserted the value of functional, everyday objects. Weingarden goes on to argue that 'the architect' Gropius also promoted architecture as something that could be used to enhance function in new ways. So, while he publically declared that art, craft and design were on equal footing, he simultaneously positioned modern architecture as superior to other forms of creation. Such an assumption, however, presumes that style and function supersede aesthetic concerns. It seems to me to be a significant contradiction because stylization fits within a schema or system just as any artwork does and must be comprised of aesthetics.

If Assemblage theory is applied to the art-making process, then everything 'functions'—from colour frequencies to form, line and materials. Each aspect produces affects, which in turn influence other phenomena through thought and action. In this way the aesthetic components are aligned with the study of cognition and perception and is akin to the architectural functionalism, championed by Gropius, where the efficient use of modernist materials superseded aesthetic considerations.[42] It is also the case when art 'functions' to either critique institutions or emphasize concerns over the ways in which we live drawing attention to its coded relationships with social or economic organization.

In the early days of the Weimar Bauhaus the administration was reticent to express any political affiliations. Yet even an 'apolitical' stance is political, for it is an endorsement of the current state of affairs. But in the early years, tolerance of the Bauhaus soon turned to hostility when the local population and government insisted that the School shed its Bohemian activities and socialist sympathies. As a result of these pressures Gropius issued a statement that Bauhaus students and faculty renounce all

[42] In opposition to the balance of architectural form I am calling attention to Vitruvius' *De Architectura libri decem* or his ten books on architecture, in which he asserted that architecture must incorporate: beauty, function and strength.

political affiliations. This 'edict' created a dichotomy; on the one hand liberal arts are by their very nature charged with creating a multitude of expressions, yet the political and economic ideologies continue to resist this inherent freedom even to this day. In a post-WWI bankrupt Germany, a period of economic deflation combined with the paranoia of revolution inevitably placed officials at the Bauhaus into a defensive position.[43] In the early years of the Dessau Bauhaus foundational instruction lacked a sense of historicity. The program advocated for a 'pure' aesthetic based solely on formal considerations and functional handwork, where principles of design were stressed, rather than a relation to political, economic, social or cultural phenomenon and interaction. The socialist leanings of the students carried over from the Weimar Bauhaus through the student body in opposition to both the instructors and the State. In his text "Utopia for Sale" Frederic J. Schwartz identifies the contradiction between the early socialist leanings of the fledgling Bauhaus and the growing conservative ideology of the Weimar Republic.

> Certainly the school started in a mood and mode that would have to be termed expressionist anti-capitalism. Its second director, Hannes Meyer was a committed socialist, one more interested in providing good products to those with little disposable income than in producing luxury items with a high profit margin. And many of the projects associated with the school and its avant-garde circuit were placed in the service of local Social Democratic authorities in order to provide public housing that would circumvent capitalist real estate speculation. But regardless of this radical or left-wing cachet, it is abundantly clear that in the years following the turn to 'art and techniques,' the Bauhaus was as much implicated in consumer capitalism as it was its victim.[44]

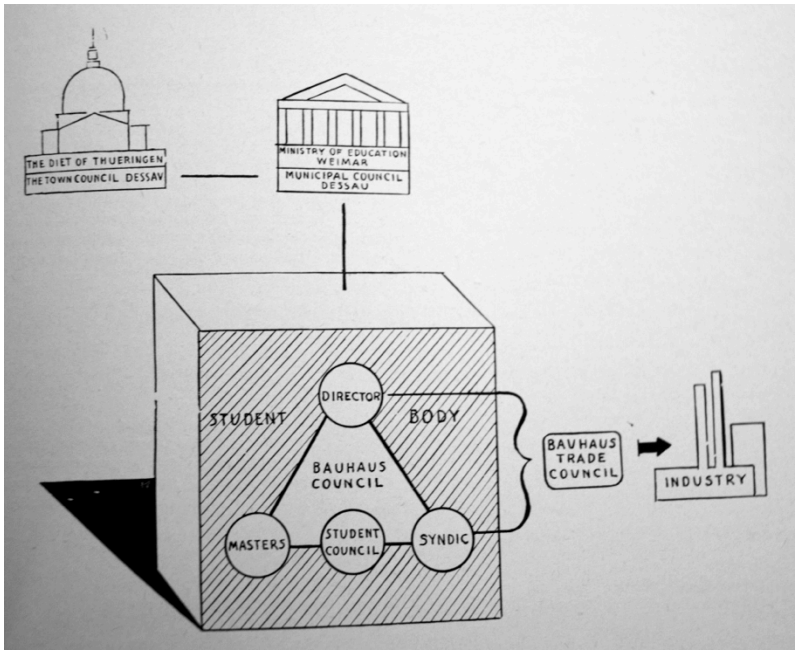
Art schools exist, at least to some extent, to deterritorialize the status quo of political opinion, social norms and public consensus, and yet are undermined by pressures to

[43] In times of economic and political instability populations tend to retreat into conservative ideologies as a means to establish a sense of security. Equally it is a strategy that nation states use as a means of territorializing power by nullifying opposition. This is characterized more recently with the "you are either with us or against us" mentality characterized by the post-911 Bush administration in America.
[44] Frederic J. Schwartz, "Utopia for Sale," Bauhaus Culture: From Weimar to the Cold War. p. 120

conform to the art market and the consumer market. This notion of political and apolitical positions will be clarified in Chapter 2 in relation to the New Bauhaus and its battle to assert itself in a world of capitalism, materialism and militarism. The net result of the School's response to increasing pressures from the State was to confuse the relationship regarding the cultural capital generated by art and the economic wealth immediately evident in commercial production. Indeed the initial drive, even for the Dessau Bauhaus, was to merge the plastic arts and reintegrate them into social and cultural life.[45]

The socialist underpinnings of the Dessau Bauhaus differed greatly from its Weimar forerunner, in which courses emphasizing technical virtuosity were jointly taught by master artists and master craftsmen. In Dessau however a new mandate established a link between industry, production and the arts, with only one master artist at the helm. This shift occurred for a number of economic reasons, resulting in a series of corporate agreements, which helped to finance the School and ultimately influence its curriculum. The push to shape students into a pragmatic hybrid of artist, craftsman, and scientist is a legacy of modernity, where value is determined by efficiency—an inheritance of the Protestant work ethic and the age of Enlightenment. From modernity onward, the triad of government, benefactor, and corporate partner became the de facto formula for post-secondary institutional support.[46] In Germany state sanctioned support became more common in the early part of the twentieth century.

[45] By the 'plastic arts' I am referring to any materials that may be shaped, designed and manufactured.
[46] In nineteenth-century Europe, educational institutions were funded privately or through the State in combination with tuition revenue, which often favoured class division.



This diagram, from the 1938 Museum of Modern Art (New York) exhibition catalogue, illustrates the way in which the Dessau Bauhaus was sanctioned by labour and local government. Bauhaus 1919-1928, p. 23

The diagram above illustrates the relationship between state and local government and the Dessau Bauhaus. The ministry of education and municipal council supplied smaller professional organizations with the power to institute educational directives.[47] The School then supplied industry with a skilled workforce through the trade council, which issued journeyman certificates to graduates. The system envisaged was fundamentally a heterotopic assemblage, where the creative institution offered a means of escape from authoritarianism, at the same time industry was the net beneficiary of educational output. But this diagram fails to adequately describe the complexities of its subject because it does not account for the relationship between culture, government, industry and society as something more integrated and diffuse. Today, we may refer to such a complex model as having 'transparency' from which we may infer how power relationships exist,

[47] The diagram was published in an exhibition catalogue by Herbert Bayer, Isa Gropius, Walter Gropius, eds., Bauhaus 1919-1928. Second edition. Boston: Charles T. Branford and Company, 1938.

function or fail.

The 1938 Bauhaus exhibition at New York's Museum of Modern Art introduced Bauhaus theory and curriculum to the 'general public' in the United States. The publication gatefold notes list nine reasons why the Bauhaus was important. Among them, number four stipulated that it "…bridged the gap between the artist and the industrial system."[48] What is evident in the text is that the Bauhaus, particularly in its Dessau incarnation, was caught between the pedagogical imperatives of technique and creative innovation. By its very nature, creative innovation is much more difficult to foster than technical application because it involves the ability to see things in a new light as opposed to skill development which may be honed through manual dexterity and rote rehearsal. This opposing binary relationship is further expressed in the current incarnation of the art school, which offers courses in both art and design, although it is important to note that these areas have historically remained independent of one another.

Gestalt Psychology and its Relation to Expression

It is no coincidence that with the rise of advertising and promotion, Bauhaus design principles would be used in the commercial applications that aligned it with mass capitalism.[49] Such collaborations are evidenced in early trade shows and advertisements at Dessau and again at the New Bauhaus in Chicago through its affiliation with Walter Paepcke and his Container Corporation of America, which helped to finance the fledgling School. Moreover, both the Bauhaus and New Bauhaus established formal systems

[48] Bayer, Gropius, and Gropius, eds., Bauhaus 1919-1928.
[49] There is not only the tie with gestalt and advertising, but with psychoanalysis, which was employed as a persuasive technique in advertising, mainly within the United States. See Adam Curtis, dir. The Century of the Self. BBC Four, 2002. DVD. http://www.imdb.com/title/tt0432232/ accessed 31 July 2012

through which artists would be aware of visual composition and how it operated in human psychology.[50]

The Gestalt principle of naming separate elements that compose the structural symphony of visual language grew directly from colour theory.[51] The model helped to define the discipline of visual art as well as several of its companion fields including theatre, dance and design. The influence of the Gestalt psychologists on the Bauhaus and the New Bauhaus schools should not be underestimated. In his 1998 text, author Roy Behrens notes that

> None of the gestalt psychologists were artists, much less designers, but early on there were signs of a mutual interest between the two disciplines. In 1927, for example, gestalt psychologist Rudolf Arnheim visited the Dessau Bauhaus, then published an article in *Die Weltbuhne* praising the honesty and clarity of its building design. Soon after, gestaltist Kurt Lewin commissioned Peter Behrens (teacher of Bauhaus founder Walter Gropius) to design his home in Berlin, but, after a disagreement, Bauhaus furniture designer Marcel Breuer was asked to complete the interior. In 1929, Köhler declined a Bauhaus invitation to lecture because of a scheduling conflict, so his student Karl Duncker spoke instead. In the audience was the painter Paul Klee, who had known about Wertheimer's research as early as 1925.[52]

The Gestalt school of psychology, founded in 1910 by three German psychologists, Max Wertheimer, Kurt Koffka and Wolfgang Köhler, provided the foundation for the modern study of perception and simultaneously the formal rules of composition that artists continue to use. Rudolf Arnheim, referred to by Behrens, was a student of both Wertheimer and Köhler. After immigrating to the United States he taught at Sarah Lawrence College, the New School for Social Research, Harvard University, and the

[50] See Ball and Ruben, "Color Theory in Science and Art: Ostwald and the Bauhaus." pp. 4842-4846
[51] See Roy R. Behrens, "Art, Design and Gestalt Theory," Leonardo. vol. 31, no. 4. Boston: MIT Press, 1998. pp. 299-303. This tradition of using social, psychological and colour/form 'science', within the classroom, was part of the earlier curriculum at the Bauhaus. Instruction given by Paul Klee, Wassily Kandinsky, Joseph Albers and Johannes Itten was crucial in establishing the foundation program. See Ball and Ruben, "Color Theory in Science and Art: Ostwald and the Bauhaus."
[52] Ibid

University of Michigan. His texts, including Art and Visual Perception (1954/1974), Visual Thinking (1969), Entropy and Art (1971), and The Power of the Center: A Study of Composition in the Visual Arts (1988), all predate the conclusions now coming out of social and cultural theories of Affect theory, New Materialism and Actor Network theory. I will discuss these links in the final chapter when I review the similarities between Arnheim's Gestalt theory and other philosophical assumptions promoted and discussed by Actor Network theory and Affect theory, which inform how Assemblage theory applies to visual art.

The main difference between Gestalt and Assemblage theory resides in the relationship between the whole and its constituent parts. Gestalt theory purports that the whole is greater than the sum of its parts while in Assemblage theory each part is as important as the whole. In Assemblage, complex systems emerge out of a multiplicity of interactions, at various scales, and at various times and places. DeLanda's notion of assemblage is refreshingly different from Gestalt theory. "This theory" of Assemblage, he argues, "was meant to apply to a wide variety of wholes constructed from heterogeneous parts. Entities ranging from atoms and molecules to biological organisms, species and ecosystems may be usefully treated as assemblages and therefore as entities that are products of historical processes."[53] And thus, DeLanda attempts to be rid of the reductionist tactics of macro and micro distinctions, which do not adequately account for the diverse interrelationships between entities.

The word 'gestalt' is used in modern German to mean the way a thing is 'placed', or 'put together'. Although there is no equivalent in English, 'form' and 'shape' are

[53] DeLanda, A New Philosophy of Society: Assemblage Theory and Social Complexity. New York: Continnum, 2006. p. 3

usually used as translations; in psychology the word is often interpreted as 'pattern' or 'configuration', suggesting a possible connection with multiplicity, complexity and Systems theory. Systems theory involves a structure that is repeatable with sustaining—attributes that are often used to describe social and cultural organizations as well as ecological, political and economic systems.

Arnheim was on the verge of first formalizing a version of object oriented ontology akin to Actor Network theory but failed to expand upon his assumptions. As early as 1949 his essay "The Gestalt Theory of Expression" stipulated that the notion of expression extends beyond human communication. He argued that Gestalt psychologists considered "it indispensable to speak of expression conveyed by inanimate objects, such as mountains, clouds, sirens, machines."[54] This statement predates contemporary notions of Actor Network theory, attributed to sociologist Bruno Latour, as it pertains to the potential networks of both people as well as objects. Latour often cites a bank as an example of an actor network. A bank, he argues, comprises a series of relationships between objects such as computers, desks, money counting machines, and telephones, and each is an important 'actor'—a crucial component—with its own expressive attributes that function in conjunction with human 'actors'. Similarly Arnheim argued that

> inanimate objects are said to convey direct expression. The aggressive strokes of lightning or the soothing rhythm of rain impress the observer by perceptual qualities that according to Gestalt psychology must be distinguished theoretically from the effect his knowledge exerts on the nature of these happenings. It is assumed, however, that practically every concrete experience combines factors of both kinds.[55]

[54] Rudolph Arnheim, "The Gestalt Theory of Expression," Toward a Psychology of Art: Collected Essays. Berkley: University of California Press, 1966. p. 52. Arnheim's text was originally published in Psychological Review. 1949. pp. 56, 156-171
[55] Ibid

We may observe this correlation in Bauhaus classroom instruction, but not necessarily in the interpretation of the School's mandate of handwork, industry and function. Writing on a lesson taught by Itten, Klee wrote,

> After walking to and fro several times ltten approaches the easel with a drawing board and scribbling pad. He picks up a piece of charcoal, his body tenses up as if becoming charged with energy and then suddenly goes into action—once, twice. One sees the form of two forceful lines vertical and parallel on the top sheet of the pad; the students are asked to repeat this. The master checks their work, asks some of them to demonstrate it, individually corrects their posture. He then, beating time, orders them to do it rhythmically, and then has them carry out the same exercise standing up. What is intended seems to be a kind of body massage to train the body machine to function sensitively…. He then talks about the wind and asks some of the students to stand up and express their feelings in the guise of wind and storm. Then he sets the task: Represent the storm. He allows them ten minutes to do it in then inspects the results. This is followed by critical assessment. Thereafter work continues. One sheet after another is torn off, flutters to the ground. Some students work with such élan that they use up several sheets at a time. In the end they all become a little tired and he sets his Basic Course students the same task as homework for further practice.[56]

Such theatrics encouraged students to conjure the experience of sound, intensity, and energy not only from their memory, but also from the 'social' storm created by the shared activity in the room. In these exercises, artistic expression was a conduit for the embodiment of a non-human event: the rain, the lightning and the sound of thunder. The storm as it is made up of these constituent parts is an assemblage, interrelated rather than conglomerated. Thus Gestalt principles are among many of the important functioning psychological components of an artwork.

This brief history provides a glimpse of how the unique teaching methods of the Bauhaus drew from, and integrated, a diverse range of fields that fundamentally shaped

[56] Johannes Itten, Design and Form: The Basic Course at the Bauhaus and Later. Revised Edition. London: John Wiley & Sons, Inc., 2003. p. 12

fine art instruction and the development of organizations in America, such as the New Bauhaus, the Center for Advanced Visual Studies (CAVS), and the artist-based enterprise Experiments in Art and Technology (EAT). From this, Chapter 2 will focus on Systems Esthetics, set in opposition to Gestalt principles, as it pertains to assemblage and the organizations noted above.

Chapter 2

Assembling the Structure, Assembling the System

As examined in Chapter 1, Bauhaus teachings focused first on psychology and handwork and later on the relationship between art and industry. In its final iteration, under the directorships of Hannes Meyer and Mies van der Rohe, the curriculum emphasized socialist co-operation, urban planning and architecture. Although North America benefited greatly from the intellectual capital of Bauhaus instructors who fled Europe before the outbreak of WWII, there was little consensus in the United States regarding the role of the artist in society. In turn, this would allow a receptiveness to avant-garde instruction and an experimental curriculum tied to industry and advertising. Many former Bauhaus instructors were invited to head departments or start new programs within American institutions although there was some suspicion of their intentions by government agencies in light of the impending war. The FBI, for instance, kept files on all German immigrants who were active in American institutions. For Walter Gropius, the founder of the Bauhaus, his entry into American life seemed to be a foregone conclusion. As art historian Margret Kentgens-Craig points out, "America exercised a great attraction as precedent and epitome of a new, entirely contemporary form of society and lifestyle unbalasted by history and untainted by any political and social bonds to the prewar period."[57] For many designers, architects and artists it was an open field.

Not all recruits found what they were looking for however; László Moholy-Nagy who was invited to start the New Bauhaus, in Chicago, was tormented by administrative and cash-flow problems. In spite of this, the New Bauhaus created a learning

[57] Margret Kentgens-Craig, "The Dissemination of Bauhaus Ideas: Paths of Communication," The Bauhaus and America: First Contacts: 1919-1936. Cambridge: MIT Press, 2001. p. 88

environment that integrated art, design, industry and science. This new pedagogical imperative laid the groundwork for the rise of environmental art and new theoretical ideas, (such as the artist as critic and social agent), which challenged traditional notions of the artist as decorator, designer, and illustrator within the American capitalist mindset.

By the late 1960s, two organizations shaped by American capitalism, Experiments in Art and Technology (EAT) and MIT's Center for Advanced Visual Studies (CAVS), solidified the understanding of the collaborations between art, technology, and science as a creative force. György Kepes, founder of CAVS, fostered creative collaborations with physics, engineering and environmental practices, among others, through a series of fellowships at the School and by way of numerous publications, most notably his Vision and Value series—a set of six anthologies. All, however, were inherently rooted within early gestalt Bauhaus (pattern-seeing) and the late, socially engaged iteration of the collaborative Bauhaus under its second director Hannes Meyer. It was American artist Jack Burnham whose ideas first challenged the ideology of gestalt pattern-seeing and the holistic approaches of his mentor Kepes, advocating instead for the importance of systems and data analysis in understanding the structures within different disciplines. Burnham understood the special place Systems theory would hold in the Information Age. Art would never be the same as it branched out into new technological and scientific territory.

Within technical institutions and departments across the United States and Canada, art studios began to function like the laboratories of the amateur tinker, inventor, and scientist of the late nineteenth century, where experimentation was encouraged. The primary difference was a new spirit of collaboration**.** Looking to many technological

fields for inspiration, CAVS and EAT embraced transdisciplinary practice where new complex interactions between systems could be interrogated through tabulation, measurement, and monitoring, and could be utilized for inspiration. By the late 1960s fellows at MIT were beginning to access machinery, electronics and computers interdepartmentally though time-sharing. The rise of technological advancements within polytechnical institutions was due to myriad factors. Many corporations and government agencies were attempting to deal with the social, political, and economic complexities of the postwar era and the increased competition of the Cold War as the United States entered onto the global stage as a superpower. This translated into the need to understand the complexities of America's new status and to retain and expand its global influence. Nationally there was a desire to showcase this power to the world as evidenced by all the major projects of modernist expression: World's fairs, architectural design innovations and bridge/road/dam construction among others. The computer played a key role in these massive undertakings from an organizational, as well as a design, point of view. Professor Reinhold Martin gives an account of the rise of the computer in America as it was linked to aesthetics in architecture, which I believe may also be extended to artistic practice. During WWII and thereafter, he argues,

> facilities housing sophisticated information-processing equipment manufactured by companies like IBM were crucial agents in extending the scope of the work performed by large, technology-oriented corporations into a domain previously reserved for educational institutions. Undistinguished as many postwar laboratories were, together they occupied a specific region of the organizational complex, in which the interests of the corporations and the military were combined increasingly with those of major research universities. [58]

[58] Reinhold Martin, The Organizational Complex: Architecture, Media, and Corporate Space. Cambridge, Massachusetts: MIT Press, 2003. p. 183

This creative territory, involving codes, semiotics, and administrative capacities, was laid claim to by conceptual art and Systems Esthetics and mandated less by their association with history than by interdisciplinary practice. Alternatively, DeLanda's Assemblage theory emerged from a 'sympathy' or interest in the wider interactions between culture, sociology, philosophy and the sciences of topology and biology. In contrast to Systems Esthetics, Assemblage theory presents a retort to the totalizing effects of political systems, historical paradigms and modes of power—suggesting instead that complex interactions shape our experience through differences between multiple actors. These actors go far beyond the scope of any one postulate, critique, or mode of expression. In the space of the global and the heterogeneous, labour, commodities, and art styles are thrust together in a fashion that is difficult to describe using ubiquitous, yet limiting terms, such as globalization, pluralism, neoliberalism, and marketization. In light of this shortfall, Assemblage theory may be used to describe, rather than foreshorten time frames and contingent relationships between cultural organizations, such as EAT and CAVS, through the application of its main criteria: material and expressive roles; territorialization and deterritorialization; and codes.

The charting of relations between art and other disciplines in this dissertation requires an acknowledgement of past art-making practice with the stipulation that art can no longer exist as a singular humanist discipline. The goal of my research is to move art criticism beyond linguistic and anthropocentric analysis by entering a field that foregrounds artistic practice as it relates to wider ecological and scientific fields and to do this, it is imperative to illustrate past pedagogical prototypes.

Precursory Pedagogical Systems of The New Bauhaus

To comprehend the innovations of Bauhaus instruction, we need first to understand the ways in which art, before the Bauhaus, was traditionally taught, replete with rote manual exercises intended to develop technical skill rather than originality. Systematic grading, a method of assessing handwork, stemmed from the Theory of the Educational Slöjd, a teaching method that originated in Finland in 1866 as part of a government sanctioned educational curriculum. Otto Salomon, an educational reformer, introduced the system at the Training College in Nåås, Sweden to grade woodworking exercises. The purpose for grading these hands-on exercises was to provide the skills necessary for students to increase their productivity, improve mental acuity, and build moral character.[59] To understand how these late-nineteenth and early-twentieth century educational reforms have influenced art instruction, we must consider the complexities of a pedagogical Assemblage theory. It must be noted that Bauhaus instruction was informed by Slöjd and Gestalt teachings and, as we shall see, was influenced by American philosopher John Dewey.[60] These various pedagogical systems influenced various ways of working and thinking about how artistic practice fits within the larger schema of social and cultural organizations.[61] Weimar Bauhaus instruction, stood apart from other institutions because it encouraged creative social activities outside of classroom instruction. This in part had

[59] Otto Salomon, The Teacher's Hand-Book of Slöjd: As Practiced and Taught at Nåås. Boston: Silver, Burdett and Co. 1892. pp. 9-17

[60] For information on early Bauhaus teachings and Joseph Albers' teaching methods see Margret Kentgens-Craig, "The Dissemination of Bauhaus Ideas: Paths of Communication," The Bauhaus and America: First Contacts: 1919-1936, p. 140

[61] As design historian Anita Cross suggests, "Major developments in the teaching of Handwork and its transition to the curriculum at educational levels beyond kindergarten stem directly from Finland. Uno Cygnaeus, a Finnish educator who was much influenced by the work of Fröebel, devised a system of Handwork 'training' which aimed to carry further the 'activity' principle in Fröebel's system. By teaching peasants some form of domestic industry in their school years, he hoped to provide them with the means of supplementing their incomes from farming. His system was quickly adopted by the Government of Finland and made part of the rural school curriculum in 1866." Anita Cross, "The Educational Background of the Bauhaus," Design Discipline. vol. 4, no. 1, Milton Keynes, UK: The Open University, January 1983. p. 47

to do with the different collaborative courses, such as theatre, and extracurricular activities, such as the Bauhaus band, which facilitated exchanges between students. In the introduction to Walter Gropius' "Programme of the Staatliche Bauhaus in Weimar," he acknowledged the use of American philosopher John Dewey's "cooperative social principle" and educational reformer Friedrich Fröebel's "unity" theme.[62] This integration of Dewey's pedagogical philosophy and the Slöjd method also found their way into instruction at Black Mountain College, in North Carolina, through the work of Bauhauslers Joseph and Annie Albers.[63] As design historian Anita Cross states, "Central to his [Dewey's] arguments is the idea that the individual is to be educated a social being, that education is a social process, and that society itself is a natural, organic and cooperative synthesis of individuals."[64] Thus Dewey's theory, as it related to social progress, was integrated into these educational systems, where the end goal was to produce acculturated students, a project that we see in Bauhaus pedagogy.

As discussed in Chapter 1, the Bauhaus embodied a social utopianism that was present in the desire to bridge art and life and was made manifest through functionalism and social projects. This was more widely pronounced in the social tendencies of the Dessau Bauhaus under the directorship of Hannes Meyer.[65] Despite a brief and unstable existence in Germany, the technical, stylistic and pedagogical innovations of the Bauhaus had far reaching and long lasting influences that were promoted in America through waves of European design and artistic migration from the 1930s onward. Many

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[62] Hans M. Wingler, "Programme of the Staatliche Bauhaus in Weimar," Bauhaus. Cambridge: MIT Press, 1969. pp. 31-48
[63] Hans M. Wingler, Bauhaus. Cambridge: MIT Press, 1986. p. 574
[64] Anita Cross, "The Educational Background of the Bauhaus," p. 44
[65] See Walter Gropius, "Systematic Preparation for Rationalized Housing Construction," Bauhaus. vol. 1, no. 2, 1927 in Wingler, Bauhaus. Cambridge: MIT Press, 1986. p. 126 and Bernardina Borra, "Hannes Meyer: Co-op Architecture," The City as a Project. A Research Program at Tu Delft. www.thecityasaproject.org/2013/05/hannes-meyer-co-op-architecture/ accessed 10 July 2013

instructors, notably Gropius and Moholy-Nagy, were among those that made their way to England before coming to America. By the time the New Bauhaus was established in Chicago in 1937, former Bauhaus instructors and alumni filled key positions in academia, territorializing art instruction in American and Canadian universities.[66] This allowed a vast network of expatriates to share information and publish new theories in support of Bauhaus instruction. The New Bauhaus, as it existed for a brief period, took on successive names, mandates and administrative structures that stemmed from the ebb and flow of influences surrounding it: war, commercialism, institutional and organizational conflicts, all of which tell a tale of a school subject to the pressures of social change, just as the Bauhaus had been subjected to these vagaries in all three of its incarnations from Weimar to Dessau and Berlin.[67] In the case of the latter, the state territorialized every aspect of social and cultural life, colonizing any ideological difference and unsettling any counter-cultural expression. These successive social, cultural and political pressures form the basis on which an Assemblage theory, relating to artistic practice, may be formulated taking into account the complexities of the Schools' closure from the vantage point of economic and political reforms. To a large extent some of the same modes of resistance to Moholy-Nagy's educational reforms were mirrored in the United States. Under-enrolment and interference by corporate and military agendas disrupted and destabilized its progressive mandate. Equally, the experimental teachings established at the New Bauhaus were dashed by Moholy-Nagy's untimely death in 1946. Scholar Alain Findeli gives a detailed account of the divide between the pedagogical imperative of

[66] Although Moholy-Nagy stayed in England for only two years there were plans to open up an English version of the Bauhaus with a circle of émigré artists. He had also missed an opportunity for a teaching professorship at the Royal College of Art in London. See Achim Borchardt-Hume, Albers and Moholy-Nagy: From the Bauhaus to the New World. New Haven CT: Yale University Press, 2006. pp. 87-88

[67] The New Bauhaus existed from (1937-9) it was then renamed the School of Design (1939-44), the Institute of Design (1944-9), and the Institute of Design at the Illinois Institute of Technology (1949 onwards).

experimentation and the commercial aspects of preparing one for industry as a 'productive' citizen. He cites a lecture by Moholy-Nagy noting:

> How often have I been told by the Board that I have to make up my mind whether I want to head my own peanut affair or an institution that counts. What a strange insecurity that measures the importance of an idea in square feet or occupied floor space, and the number of personnel… Our curriculum doesn't fit into the mood of an approaching post-war boom, because we refuse to promise a two-semester training for a bread-winning job... I shall keep on considering the process of education more important than the finished result.[68]

Despite all of these setbacks Bauhaus and New Bauhaus alumni went on to populate and influence many institutions in America, namely MIT, Yale, and Black Mountain College. Gropius and his Bauhaus protégé Marcel Breuer (formerly of the New Bauhaus) moved to Cambridge, Massachusetts to teach at the Harvard Graduate School of Design. Immigrants who came to teach at the New Bauhaus in Chicago included: architects Breuer and Ludwig Hilberseimer; artists László Moholy-Nagy, György Kepes and Marli Ehrman; and designers Herbert Bayer and Hin Bredendiec.[69] Soon everything including painting, furniture design, advertising, architecture, urban and landscape planning was shaped by former graduates and instructors that set new standards for art school instruction and evaluation.[70] Meanwhile, sustained contact between American and German architects and artists, both before and after the War, continued to fuel robust intellectual exchanges and give rise to new architectural styles in America, which responded to the innovations of modern manufacturing. A 'second wave' of immigration

[68] Alain Findeli and Charlotte Benton, "Design Education and Industry: The Laborious Beginnings of the Institute of Design in Chicago in 1944," Journal of Design History. Vol. 4, No. 2. Oxford University Press on behalf of Design History Society, 1991. p. 98

[69] The Houston native Robert Preusser, who had been taught by Kepes and Moholy-Nagy at the Institute of Design, was invited by Kepes in 1954 to become an art professor at MIT. Preusser had a long and distinguished career, later becoming director of education for the CAVS.

[70] Anita Cross, "The Educational Background of the Bauhaus," Design Discipline. p. 47 See also Anita Cross, "Design education: the relevance of the Fröebelian model," Design Discipline, no. 2, Milton Keynes: Open University, 1979. (mimeo)

that began in the 1950s included many 'Bauhaus converts' and professional acquaintances from other institutions across Europe, and helped to establish diverse pedagogical approaches to art production.[71] Meanwhile, these influences were perceived in North America as an intellectual invasion of sorts, made manifest in an enduring hostility in North America towards many Bauhaus emigrants who arrived from Axis nations.[72] The advancement of American technological inventions fuelled xenophobic sentiments because they supplanted Europe's claim as being more scientifically enlightened, and could therefore be used as evidence to assert America's cultural 'superiority' over its European counterparts. Yet America's postwar boom required the intellectual resources of its immigrants and with them came the skills and resources required to make it a superpower.

Technoscientific Predispositions: Moholy-Nagy, Kepes

Moholy-Nagy's preoccupations with science were percolating during his tenure at the Bauhaus long before he and Kepes arrived in America in 1937. In his early sculpture, *Nickel-Konstruktion* (1921), Moholy-Nagy fabricated a nickel coil that oscillated according to the vibrations of its location. Thus, the work simultaneously became an instrument, a sculpture, and a measuring device. Situated within the aesthetic of the scientific apparatus, it exemplifies the highly polished characteristics of a manufactured object, cementing the bond between industry and applied arts. Yet it is not a recording device. It produces no archive of seismic events and allows no future prediction of an

[71] As Art Historian Margret Kentgens-Craig explains in The Bauhaus and America: First Contacts 1919-1938, the acceptance of the Bauhaus in America was multifaceted, extending well beyond the mere appointment of émigrés to key positions within American academies. Rather, there was a concerted effort to promote Bauhaus ideas through publications, periodicals and catalogues.

[72] "United States Federal Bureau of Investigation, Walter Gropius File" (excerpts) The Bauhaus and America: First Contacts: 1919-1936. p. 238

event. It is an art object, an instrument of measurement marking an important moment in which culture, economics, politics and observation intersect.

László Moholy-Nagy, *Nickel-Konstruktion*, 1921,
Collection of the Museum of Modern Art, New York, Gift of Sibyl Moholy-Nagy.

Moholy-Nagy helped to foster the growth of Kepes' ideas regarding industry, science, and art. Both collaborated numerous times throughout the 1930s, first in Berlin**,** later in London and finally in the United States. In 1937, Moholy-Nagy invited Kepes to run the Color and Light Department at the New Bauhaus in Chicago (later the Institute of Design).[73] While working with Moholy-Nagy, Kepes met Walter Gropius in Berlin and science writer J. G. Crowther in London. The encounters sparked in him a life-long interest in the intersection of art and science.[74] In her doctoral dissertation Elizabeth Finch recounts that, "Kepes felt particularly indebted to Crowther because he introduced him to prominent British scientists, including Joseph Needham, Conrad Waddington, J. D. Bernal, and J. B. S. Haldane."[75] This exposure to Crowther's influence led Kepes to later

[73] Prior to working with Moholy-Nagy, Kepes had been educated at the Budapest Royal Academy of Fine Arts where he trained under impressionist painter Istvan Csok and later writer and theoretician Lajos Kassák. It was after this period that Kepes gave up painting for filmmaking, which he thought could better express his social and political beliefs. See György Kepes and Marjorie Supovitz, The MIT Years, 1945-1977. Cambridge: MIT Press, 1978. pp. 9-10
[74] J. G. Crowther, An Outline of the Universe. London: Kegan Paul, Trench, Trubner & Co., 1931. Both Moholy-Nagy and Kepes worked on the book design for this publication.
[75] Elizabeth Finch, "Languages of Vision: György Kepes and the 'New Landscape' of Art and Science." PhD Dissertation. New York: The City University of New York, 2005. p. 115

contemplate, among other things, how patterns in nature might offer cures for social ills such as urban sprawl, pollution and poor urban planning. However, during his early career in America, Kepes began designing advertising for the Container Corporation of America, Fortune magazine, and Atlantic Monthly, illustrating his intention to continue working between the disciplines of applied, commercial and fine arts; a practice that both Annie and Joseph Albers and Moholy-Nagy acknowledge in their work as well.[76]

By 1937, the systematic scholastic reforms at the New Bauhaus were well underway with a program of 'intellectual integration'. Courses at the school were augmented with lectures by university professors on the topics of "physiologic-anthropological and natural science," among others.[77] These reforms, instituted by Moholy-Nagy, provided a way forward for a well-rounded education. Before Kepes left for MIT, he acknowledged, in an early letter to Moholy-Nagy's wife Sibyl, a shift in his educational approach from that of his predecessors at the Bauhaus. In this letter, Kepes states that the main differences were

> that the Bauhaus emphasized the exploration of new materials, techniques and sensory fields such as the tactile, which was mainly a process of opening up the horizon; whereas I was more interested in organizing these new findings, and put the emphasis, as in my book, on the meaning of order in visual experience in its present social context.[78]

Kepes' pedagogical approach at MIT, which stemmed from the New Bauhaus, was also dramatically different, because it involved a shift from the study of the mechanics of things and knowledge integration to the study of systematic contextualization.

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[76] Moholy-Nagy's association with Walter Paepcke, the president of the Chicago-based Container Corporation of America, provided both the financial and organizational support needed to sustain the New Bauhaus in its early years.
[77] Hans M. Wingler, Bauhaus in America: Repercussion and Further Development. Berlin: Bauhaus Archive, 1972. p. 56
[78] Reinhold Martin, "Pattern Seeing." The Organizational Complex: Architecture, Media and Corporate Space, p. 64

By 1944 Kepes published his landmark text Language of Vision, which succinctly articulated the incorporation of Gestalt theory into his conception of visual language. In this text he addressed perceptual topics—such as "Plastic Organization," "Visual Representation" and "Dynamic Iconography" and incorporated knowledge from fields as diverse as advertising, psychology and semiotics. "The experience of every image," Kepes argued, "is the result of an interaction between external physical forces and internal forces of the individual as he assimilates, orders, and moulds external forces to his own measure."[79] The duality of internal and external, psychology and phenomenology, of which Kepes writes, is consistent with gestalt notions of cause and effect. "Overlapping planes," for example, were commonly used to illustrate how intersecting lines and hollow shapes contain distinct identities. Other readings of visual depth were explained through illustrations of the "figure-ground phenomena," whereby shapes of varying tones were used to create an impression of depth. Such attempts to illustrate illusion through visual representation are emblematic of an attempt within the visual arts to explain and create an awareness of the act of perception. But Kepes' gestalt interests of the 1940s were not his preoccupations in the 1950s and 1960s, when he began to move away from these principles in an attempt to understand new disciplines with the goal being to explain the imperceptible phenomena of the everyday—the invisible interaction of molecules, atoms, electricity and so forth—that have their analogs in the scientism of physics.[80]

[79] György Kepes, Language of Vision. New York: Dover Publications, 1944. p. 16
[80] This move away from gestalt and aesthetics also took place at the Ulm School where Max Bill's former Bauhaus teachings were eclipsed by Tomás Maldonado's focus on "operational science," a systems-thinking approach embodying art and science.

Kepes considered the 'modern age' (of the 1940s) to be chaotic, and regarded it the duty of the artist to provide "a way out from under the rubble" of WWII. "We are living in a formless age of transition, of chaos, incomparable to anything man has experienced before," he argued.[81] In the same section of Language of Vision entitled "Towards a Dynamic Iconography" Kepes wrote that,

> The task of the contemporary artist is to release and bring into social action the dynamic forces of visual imagery. As contemporary scientists are struggling to liberate the arrested energy of the atom, painters of our day must liberate the inexhaustible energy reservoir of the visual associations. To accomplish this, they need a clear grasp of the social field, intellectual honesty, and creative power capable of integrating experiences into a plastic form.[82]

Kepes understood the relationship between the human compulsion to control and manipulate political and social forces. His sense of social responsibility became a means to justify the artist's role in finding new knowledge and relevance within the larger social, cultural, and economic assemblage of the university, and eventually the greater Boston area with his "art in civic scale" initiatives. There also seems to be an aura of determinacy in the writing of Kepes as a reductionist undercurrent, particularly when he references the failure of social and cultural organization. In New Knowledge in Human Values, originally published in 1959, he writes,

> The present situation resembles that of a lost child. The order, and thus the surety of existence, seem to be lost. Industrial civilization has torn us out of the relatedness that people knew in a smaller world…. Confused and cornered by the impact of the complex world, we have lost the ability to perceive the world as a connected whole and to react to it with healthy openness.[83]

Assemblage theory however regards social and cultural dynamics as contingent and

[81] György Kepes, Language of Vision. p. 201
[82] Ibid
[83] György Kepes, "Comments on Art," New Knowledge in Human Values. Abraham H. Maslow, ed., Chicago: Gateway Publishing. 1971. pp. 86-87

variable, ascribing to their parts equal import. Thus, each component is dependent upon one another rather than lost in the vast complex world. At best, outcomes and interactions between social entities are probable rather than causally fixed. DeLanda's point is that human organization is a result of historical processes, a notion absent from Kepes' texts, which privileges ethical responsibility over the critique of free will and intentionality.

Physical phenomena, environmental conditions and urban social concerns feature prominently in Kepes' later practice and teachings at CAVS. As an administrator at MIT, and as an artist, he uniquely expressed the relationship between his practice and the wider world of his experience, yet he remained limited by his focus on pattern-seeing and urban planning as if natural patterns could offer up a way to organize humanity far from the social complexity DeLanda suggests in his text A New Philosophy of Society. And yet there is a dichotomy in Kepes' practice: a split between his interests in light and technology, and the more introspective paintings he produced that address a range of materials and engage more nuanced topographies of the picture plane. For example, his paintings, grounded in a traditional art medium, are contemplative and introspective while his technological projects radically advance transdisciplinary and socially motivated practice.

Kepes founded CAVS in 1967, which for more than four decades played a leading role in advancing the intersection of arts and technology.[84] One can see how he favoured visual learning and visual perception over other forms of expression before CAVS. According to Elizabeth Finch, when Kepes arrived at MIT in 1947 he completely replaced the School's foundational drawing courses with classes in visual design

[84] In 2009, CAVS merged with MIT's Visual Arts Program creating what continues today as the Art, Culture and Technology (ACT) program.

fundamentals and a Bauhaus-styled curriculum, a decision, in part, influenced by the growing prominence of design within North American schools.[85] But the move also marked a significant shift in art education in general, one that followed suit in other educational institutions as well. Art educator Nanyoung Kim acknowledges Kepes' lasting influence on American design, highlighting in his writings comprehensive coverage of the formal, representational, and symbolic aspects of the visual arts and its assumed authority as a science of visual organization.[86]

The pivotal period in Kepes' reformulation of art school instruction came in the mid-1950s when he actively began to network with other academics from further afield in an attempt to facilitate intellectual contact between visual artists and scientists who were beginning to explore the boundaries of the visible world by investigating previously hidden phenomena and invisible forces. His turn towards science, from the more formal concerns that occupied his photography and design work, is most evident in his 1956 publication The New Landscape in Art and Science. In this work he asserted that science and art not only influenced but inspired each other. For Kepes, science could not exist in isolation or it ran the risk of being detached from reality and social engagement. Together, the art/science partnership could alter the sensorium of human experience. Science, urban planning and social organization were also incorporated into Kepes' later practice when he drew on his early interests in large-scale projects. During WWII, for example, he envisioned a lattice of floating lights, a sort of urban camouflage, intended to mislead prospective enemy fighters into thinking the city of Chicago extended far out into Lake

[85] Elizabeth Finch, "Languages of Vision: György Kepes and the 'New Landscape' of Art and Science." p. 208
[86] Nanyoung Kim, "A History of Design Theory in Art Education," The Journal of Aesthetic Education, vol. 40, no. 2, Summer. Chicago: University of Illinois Press. 2006. p. 20

Michigan.[87] This project offered insights for Kepes regarding the plastic and adaptable nature of the visual medium where it could be combined with other disciplines to describe new possibilities. His attempt to bridge various disciplines, in some way, was also emphasized by the writers he attracted to the publications in the Vision and Value series, who included, among others, architect Walter Gropius and scientist Norbert Wiener, who was the originator of cybernetics and integral in the development of Complexity theory. New mathematical equations proposed by Wiener would come to influence Systems theory and artificial intelligence research. For Kepes, these theories dovetailed with his own interests—abstraction and pattern-seeing etc.—and in the process blurred the poietic boundaries between making and understanding, allowing visual explorations the possibility of taking on a whole new life.[88]

Kepes' attempt to ally art and science was an optimistic pursuit, one that persists with limited success today. His was an agenda, not only advanced through educational institutions, but also through professional organizations. As far as Assemblage theory is concerned such agendas create a territorialization that asserts one position over others. Assemblage theory attempts to come to terms with these power dynamics by analyzing the component parts of hierarchies, and by examining the coded assertions that accompany such agendas and the historical texts provide much more information than the less visible accounts regarding studio practice at CAVS.

In 1968 Kepes attended the American Association for the Advancement of

[87] Certified by the Army in 1942, the restructured New Bauhaus adopted a more militaristic agenda as a school for the study of urban camouflage. To dislocate the light landmarks of Chicago Kepes proposed to float a network of cables out into Lake Michigan to confuse potential raiders. Seven years earlier in a flight over Paris Kepes had realized the potential of large-scale urban and environmental art forms. See György Kepes and Marjorie Supovitz, The MIT Years: 1945-1977. p. 10

[88] It's only recently, in the late twentieth century, that terms such as affect, assemblage (in the Deluzian sense), chaos and complexity have entered the art lexicon with any force to expand our vision and future directions and where we may consider objects, processes and physical forces to be mind-independent.

Science meeting on "New Developments in Educational Technology," where panels were comprised of neuroscientists, anthropologists, politicians, psychologists, social scientists and other professionals. Kepes was interested in models that shaped course curriculum. He spoke on two panels: "Art and Science: The Analysis and Communication of Biological Form," and "Art and Science: Will There Be a Difference?" moderated by Billy Klüver of EAT. The first panel discussed the principles of emergent order within complex living systems; the second was tasked with examining where the disciplines of art and science meet and diverge.[89]

György Kepes, The American Association for the Advancement of Science (AAAS) Meeting Dallas, Texas, 1968, From the Experiments in Art and Technology Archives, Getty Library and Archives. Los Angeles.

One year later, in the publication Arts of the Environment, Kepes argued,

> It must be remembered that what has happened in art is itself a part of a very broad movement in which science has made the major contribution. Through its dynamics of rigorous logic twentieth century scientific understanding has come to the conclusion not unlike those of the artists. Scientists recognize that in the most precise ranges of observation that the observer and the observed interact. When observed with maximum precision, the environment in both its largest and its smallest realism cannot be considered an independent objective world anymore.[90]

[89] AAAS Annual Meeting, Dallas, Texas, 26-31 December 1968. See Science Magazine. vol. 162, p. 1158
[90] György Kepes, ed., Arts of the Environment. New York: George Braziller, 1972. p. 6. It is important to note that although Kepes was the editor of this text it included writings by important people and groups at the forefront of the

Here Kepes acknowledges the artist and scientist as interpreters of reality, a correlationist stance that maintains the humanist logic of the Enlightenment. In Assemblage theory, observation is made by any living entity as a response that works in conjunction with genetic factors, which shape our senses as well as our bodies. In other words, our bodies are shaped by the use of our senses and our senses are shaped by the use of our bodies. It is also the case that non-human actors factor into the complexities of such interactions. Thus, the old binary of subject (human perception) and object (that which is outside the body) begins to break down.

Kepes' publications emphasised reforming the arts into something that could produce social change through technology and interdisciplinary practice, not merely technological innovation. His Vision and Value series grew directly out of the 1944 formative work Language of Vision, with its three chapters summarizing concerns that can be traced directly to the formative principles of the Bauhaus. As a treatise for social engineering Kepes' ideas carry over from this earlier work; where they diverge, lies in his collaborations with fellows at MIT and his increasing acceptance of science and technology as generators of social change. The lineage of this integration of life and art is evident in more recent manifestations of art practice as a public issue and political tool, and within relational aesthetics. It can also be ascribed to the ways in which contemporary art colleges and institutions function as 'think-tanks' that foreground innovation through collaborations with corporations and industry. As Judith Wechsler, a CAVS fellow remarked,

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environmental field including city planner Kevin Lynch, Pulsa (researchers in programmed environments) and artist Robert Smithson.

> Though he [Kepes] was never a member of the Bauhaus, it was however, a significant model of communal effort between artists and artisans dedicated to developing a new aesthetic with societal ramifications. A similar spirit motivated the collaborative projects continued in the Chicago Institute of Design. In London, there was the friendship with scientists around Crowther. And there was Ruskin's and Morris's view of the artist's role in transforming the environment, which Kepes has said influenced him in the formation of the Center at MIT.

Yet, at CAVS, there continued to be contradictory administrative forces at work. On the one hand, Kepes wanted to embrace the new innovations being developed in other departments at MIT, while on the other hand, he vehemently opposed close cross-departmental relationships that might potentially introduce external influences over the future direction of his new enterprise. At MIT, particularly during the years of the Vietnam War, there was ongoing pressure to aid in the war effort. MIT received $108 million from the Pentagon in 1968 alone. The monies were intended to fund both on-and off-campus research into computer technologies as well as classified projects in surveillance and missile-guidance systems. Many faculty members and a large part of the student body resisted these overt political directives and instead pressured the university to divert resources for civic, domestic and social use.[91] Alain Findeli and Charlotte Benton's paper "Design Education and Industry," offers a detailed account of the rift between the pedagogical imperative of experimentation and the growth of new ideas, and the commercial pressure of preparing students for industry, to become 'productive' citizens.[92]

This schism between intellectual development and skills training is of particular interest to me because art institutions have been struggling with the perceived divide

[91] See "MIT and the Pentagon," Time Magazine, 7 November 1969, pp. 48-49 as quoted in Melissa Regain, *From Organization to Network: MIT's Center for Advanced Visual Studies.* http://x-traonline.org/issues/volume-14/number-3/from-organization-to-network-mits-center-for-advanced-visual-studies/ accessed 1 July 2013

[92] Alain Findeli and Charlotte Benton, "Design Education and Industry: The Laborious Beginnings of the Institute of Design in Chicago in 1944," Journal of Design History. p. 98

between art and life for centuries, a divide widened by the arguments of art versus craft, and form versus function. Such binaries have their antecedents in notions of the Protestant work ethic, which informed the ideals of the Arts and Crafts movement, as a socialist model for early manufacturing processes.[93] With the advent of Taylorist labour principles, specific timed activities as a series of repeated actions were prioritized over creative input. Humans are biological creatures and the accelerationism associated with manufacturing and industry fails to take into consideration a real understanding of how human activity intersects with other biological organisms and natural phenomenon, such as weather and geologic processes. For this reason, my work draws attention back to processes that function outside of human agency, such as the very low frequency recordings that foreground the processes of the Earth's magnetosphere.

In contrast, Kepes was more interested in the duality between studio process and social works. In his programmed light murals of the 1960s he hoped to demonstrate how artworks might operate within urban social environments. However, as he witnessed the extraordinary feats of space travel, the advent of miniaturization, cybernetics and genetics, he began to question the position of art and art-making within a broader schema of disciplines directly engaged with human perception and the interactions between the visible and invisible physical worlds. The affordability of technology and the increased transdisciplinary cooperation between university departments and individuals outside of institutions fostered a period of growth in the arts, and is the lasting contribution of the New Bauhaus in America. It was precisely this engagement, between civic and

[93] It is often Fordist production that receives most of the credit for the assembly line, but everything from Japanese sword making to the French furniture construction of the seventeenth century has been produced this way. As one process is finished it is passed to another to facilitate an efficient manner of manufacturing. The caveat is that the worker had some measure of input in changing the process or form. We see the differences in production more vividly today when we notice the contrast between Japanese car manufacturing process and the Taylorist methods of North American automobile manufacturing.

environmental responsibility that Kepes wanted to leverage to mitigate the effects of industry on living environments. In his writings the question of how technology is used and made persists. According to Kepes, in The Man Made Object, "The function of an object in our surroundings is too often treated only from the technical, scientific, or, let us say, architectonic point of view, instead of from a rigorously aesthetic point of view."[94] For Kepes the need to formulate an aesthetic theory of technology, to understand it in a larger context, was imperative.

Kepes and the Establishment of Transdisciplinary Universalism

Kepes observed the environmental divide between human organization and biological sustainability early on. Elizabeth Finch defines Kepes' visual language as exemplifying a universal order and wholeness, arguing that he "expressed order by categorizing the ways in which forms could be manipulated in a two-dimensional field and by finding salient examples of the visual approaches in the world of art."[95] In this sense Kepes was the consummate modernist and yet his interests, which encompassed other disciplines, became a means to break the bonds of modernist sensibilities such as formalism. But, American modernism was not only a reaction to the absurdity of war it was a response to a trauma caused by the destruction of Europe, and the pain inflicted on the populations of the world. In the United States 'legendary' charismatic figures of social reform such as architects Walter Gropius and Ludwig Mies Van der Rohe, designer Marcel Breuer and urban planner Kevin Lynch imagined the larger connected networks of social and cultural interactions where America was deterritorialized by the modernist aesthetic trends of

[94] György Kepes, The Man Made Object. Vision and Value Series. New York: George Braziller, 1966. p. 4
[95] Elizabeth Finch, "Languages of Vision: György Kepes and the "New Landscape" of Art and Science." p.126

European architecture and design. In many ways these figures engender a larger movement of postwar immigrants and returning veterans who wanted the chance to prosper. In many ways new immigrants to America fostered the cultural diversity necessary to prevent future international conflicts through greater social contact and understanding. In turn the deterritorializing aspects of the American 'melting pot' created social exchanges that would not have been possible through other means. For Kepes, an immigrant himself, art and technology became a means to cure social ills.

By the time The New Landscape in Art and Science was published in 1956, Kepes' beliefs were firmly grounded in the new universalism of finding relationships between patterns or systems that offered strategies for collaboration within MIT between disciplines once regarded as distinct. This new universalism was grounded in a more holistic regard for the inter-connectedness of art and science, which Kepes brought to the fore by citing historical examples that are peppered throughout his text. His ideas regarding the bridging of science and art were reinforced by the new imaging technologies of the day, which incorporated electron microscopy, high-speed photography and photomicrographs able to capture discrete moments and delineate micro and macro distinctions. Kepes had access to such technologies through the science labs at MIT, and the photographs that appeared in The New Landscape in Art and Science demonstrate this fact. Under the banner of transdisciplinary universalism Kepes, and the many scientists and artists he enlisted in his projects, used visual descriptions to assemble patterns or morphological comparisons as a way to spark the imaginative possibilities for

comprehending the elegance of the universe.[96] This line of inquiry in art follows a trajectory that was first set in motion with the use of sacred geometry and the golden mean. The difference between more ancient and modern methods of pattern-seeing is that new technologies could be deployed to more precisely analyse the micro and macro world and find analogs in data from diverse fields ranging from algebra to zoology. Sacred geometry, however, employed mathematical formulations and direct observation within nature itself as geometric constructs related to spiritual concerns. For Kepes this investigation of patterns, and other pragmatic forms of organization, paved the way for his Vision and Value series.[97] One text from the series, Structure in Art and in Science (1965), demonstrates how he territorializes a discipline through modernist tendencies of structures over complex systems. It also provides an indication of how tangential schemas of art writing can direct a practice. Kepes writes, "Indeed, in organic and inorganic nature as well as in human relations, structure has replaced the older concepts of form, order and system." He goes on to suggest that, "the world as a set of structural systems does not divide into the two territories of scientific knowledge and artistic vision. Rather, both our scientific understanding and our artistic grasp of the physical world exist within a common structure of motivation, communication and knowledge."[98] In other words, by the 1960s, Kepes was finding that information infrastructures took on a new role in shaping our understanding of reality. Unlike Kepes' artificial division between structures and systems, Assemblage theory suggests that a structure is more akin to an

[96] Comparisons and contrasts between the elements and scales of material is evidenced in Norbert Wiener's "Pure Patterns in a Natural World" and in Kepes' "Morphology in Art and Science." Both texts were published in The New Landscape in Art and Science. Chicago: Paul Theobald and Co., 1956.
[97] This series was comprised of: The Education of Vision; Structure in Art and Science; The Nature and Art of Motion; Module, Symmetry, Proportion Rhythm; Sign, Image, Symbol; and The Man-Made Object. All were published by George Braziller, 1965-66.
[98] György Kepes, Structure in Art and Science. Vision and Value Series, New York: George Braziller, 1965. dust jacket

attractor within a system. Metal is an example of a crystalline structure that may express itself sonically or through its tensile strength. An attractor is something recognizable (a pattern) or something replicating and deterministic within a larger field of material possibilities. Indeed, there can be no structure without a system and no system without a structure as mentioned earlier. Codes, according to DeLanda, may become attractors that trap and determine a space of possibilities and Kepes' publishing efforts became the great code for transdisciplinary intellectual pursuits. His Vision and Value series demonstrated his deep understanding of the strategic benefit of partnerships between departments at MIT and the broader community of intellectuals such as Robert Smithson, Buckminster Fuller and Rudolf Arnheim. This helped to solidify and territorialize a place within the academy as a force in the arts. Such efforts also included the ties Kepes made with the incoming and outgoing presidents of MIT.[99] Yet, aside from their political import, such relationships were equally influential in promoting the value and promise of the arts in general. When Kepes launched CAVS, in 1967, he had already established a framework for how artist-fellows would contribute and function within the institution. In a letter to then MIT President Julius Stratton, Kepes explained,

> I suggested, in rough outline, three themes for the initial seminars. The first was investigation of the role of the visual image—that is, of imaginative power in cognitive disciplines in general, and scientific discovery in particular. This seminar group, it was proposed, would be made up of physicists, perception psychologists, biologists, mathematicians, engineers, etc.; philosophers and historians of science; art historians concerned with the symbiotic relationship of art and science, and painters, sculptors, film makers, graphic designers, etc. Those men could explore the ways in which visual images can communicate aspects of scientific phenomena inexpressible by words or conceptual,

[99] There is a preponderance of evidence from the MIT presidential reports of 1967 and 1972-3 that CAVS was flourishing and supported by the university community. In both reports CAVS featured new funding and research initiatives as well as improvements to the Boston area, which included input by resident artists Juan Downey, Louis Frangella and Allan Sonfist.

> mathematical symbols, in order to discover, among other things, potential didactic uses of visual images in science education, and to augment the effectiveness of such new visual techniques as photography, motion pictures, animated motion pictures, three dimensional animated display devices, etc., as tools of information and communication. Collaborative thinking in this direction could, conversely, be seminal for releasing the potentials for developing esthetic sensibilities inherent in didactic or functional uses of visual images.[100]

By the early 1970s the mandate for artistic renewal through art-science collaborations gave sway to new urgent environmental civic scale projects. The only institutional requirement for fellows at CAVS was that they devote at least half of their time to their respective projects. A host of lectures, seminars, exhibitions and publications followed. In 1972, Bob Lewis, a former CAVS student, was tasked with documenting the *Charles River Project*. Envisioned as a means to explore new artistic ways of revitalizing Boston's Charles River, the project sought to transform the post-industrial banks of the river into a recreational area, as well as consider the environmental and civic possibilities of art. In Lewis' documentary footage Kepes remarked that, "There is an obvious and sometimes painful discrepancy between life, as it is, and life as it should and could be, but most of us, if we retain still our confidence in life, try to find ways to bridge this gap. Artists are among those who have a passionate commitment to the completeness of life."[101] Here, Kepes succinctly asserts that all-too-often indescribable 'force of will' that the artist has in shaping social interactions. The operative word he uses is "completeness." Such a notion resonates with ideas of transdisciplinary universalism in which the artist is an arbiter of change and

[100] György Kepes, "Letter to MIT President Julius Stratton." 17 June 1965. Print. CAVS Archives, MIT, Boston, Massachusetts.
[101] Bob Lewis, dir., *A Video Trilogy on the study of the Charles River at the Center for Advanced Visual Studies,* 1972. http://www.youtube.com/watch?v=Iie6JM2yBpA accessed 4 June 2012.

reform, but of course, this can only come from an overarching belief that an artist, and/or group of creative individuals, is able to enact social change for the social good.[102] Kepes' single mindedness and determination to integrate artistic practice with social projects is evident in the works he created during his tenure at CAVS. Among these works were significant pieces of light art: *Programmed Light Walls* (1969-75), *Photoelastic Walk* and *Flame Orchid* (both 1970). Each of these works was an attempt to revitalize urban centers or provide inspiration to viewers. *Flame Orchid* operated by way of a large box that emitted gas flames, which 'danced' to an electronic composition by Paul Earls.[103] In creating the work Kepes borrowed historical theatrical tricks for controlling light with sound and not only revived this method of flame control, but envisaged it as elemental sonification.

György Kepes, *Flame Orchid*, 1970, multimedia installation: gas container and sound speaker unit with musical composition by Paul Earls. Photo courtesy of Eric Atkinson.

My belief is that this nexus of culture and science is proclaimed in many of the works that Kepes produced from the late 1950s through the 1970s.[104] These projects seemed to

[102] Peder Anker, From Bauhaus to Ecohaus: A History of Ecological Design. Baton Rouge: Louisiana State University Press, 2010. p. 56. Anker's text provides a convincing case that the New Bauhaus, under the leadership of Moholy-Nagy, championed environmental and social restructuring through the arts and through corporate patrons such as Walter Paepeka's Container Corporation of America, suggesting early evidence of Kepes' notions of art for social good.
[103] This work was featured in John Grayson's 1975 text Sound Sculpture, and is attributed to Kepes and his collaborators, Paul Earls, William Walton and Mauricio Bueno.
[104] There is much evidence to suggest that Hans Jenny, a natural scientist who studied wave phenomenon, influenced Kepes' work at this time. Jenny's book on "Cymatics" was initially published in 1967 and again in 1972.

recognize the importance of more integrated ways of working with other disciplines, such as ecology and urban planning, and, as is the case with *Flame Orchid*, sound art and theatre. In many ways the projects that Kepes developed approximate Assemblage theory, not because they build on partnerships with other departments, but because they rely on, and develop from, a multiplicity of material expression and wider social and environmental conditions.[105] Moreover, Kepes was able to work with bureaucratic educational systems that allowed him, and the artist fellows, access to needed institutional supports. According to Elizabeth Finch, "At MIT Kepes came to embrace the postwar proliferation of 'systems theory' that emerged out of the critical environment that Wiener and his peers found so cathartic. This newfound preoccupation with systems over static structures—with dynamically interrelated, permeable entities—is particularly apparent in Kepes' use of scientific photographs, which he intensively collected, displayed, and featured in the books he made after his arrival at MIT."[106] Although I believe Kepes was interested in Systems theory, it seems that he was still very much grounded in Bauhaus Gestalt theory—a far cry from the analytic process and mathematical logic that Systems theory represented.

Creative Systems: Jack Burnham and Anton Ehrenzweig

The use of systems is usually applied to conceptual art practice and may be delineated in two distinct ways. Consider a system that utilizes information, software, instructional models and rule-making as a means to understand prescriptive ways of working, such as those exemplified in the work of Sol Lewitt or Mel Bochner. Systems may also be used

[105] As an example, Christopher Alexander who worked at MIT in transportation theory and computer science formulated a way to superimpose drawings to describe complex interactions and solve urban planning problems. In The Man-Made Object (1966), Alexander identifies 26 forces acting on the landscape from weather effects to noise pollution to interference during construction.
[106] Elizabeth Finch, "Languages of Vision: György Kepes and the "New Landscape" of Art and Science." pp. 176-177

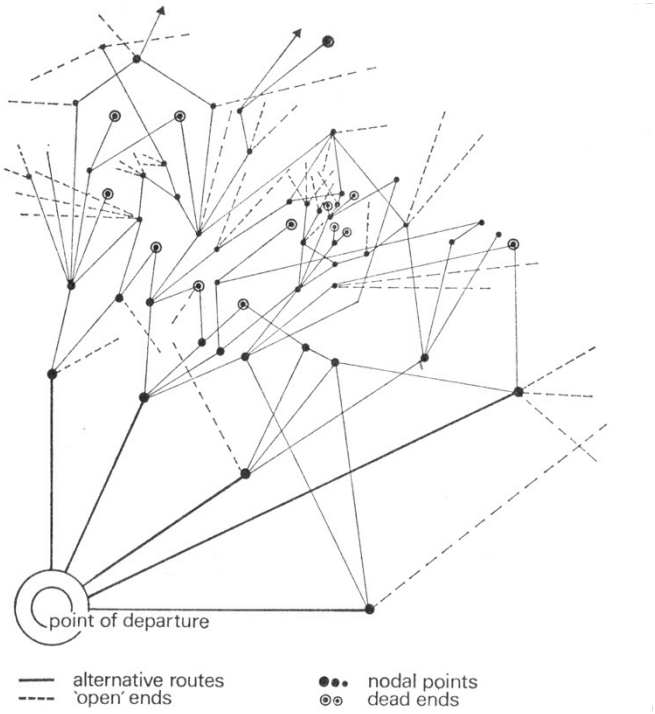
to critique or parody the organizational complex of bureaucracies and institutional power, which became more the domain of artists such as Iain Baxter and Hans Haacke.[107] In Great Western Salt Works, Burnham explains both types of Systems Esthetics, which he regards as "long-term information processing structures."[108] For Burnham, professionals in many fields have attempted to apprehend structural and systematic ways in which art can be examined, understood and qualified through the gallery system, critique and collection, among others. Moreover, this is exemplified in his 1968 writings on Joseph Kosuth's *One and Three Chairs* (1965), a work comprised of a photostat definition of the word chair, a photograph, and a chair positioned against a gallery wall. In this work, the gallery apparatus is deconstructed through a parody of display, the construction of meaning, and the differences in interpretation from text to image to object ad infinitum. Indeed, Kosuth begged the question—does the definition suffice in describing the chair's intrinsic complexity or how it is differentiated apart from all other chairs? Here, DeLanda's critique concerning reductionism comes into play as language has a tendency to reduce complexity to generalization just as Kepes' universalism tends to lump all similar patterns into categories. Yet, such attempts at reductionism fail to consider that all epistemic lines of enquiry are rooted in reductionism. A line of inquiry, by its very nature, excludes other lines that intersect and branch out into other trajectories, the sources of which are problematic and elusive. Those engaged in the creative process do not follow a singular line of inquiry because the poietic act responds to a multitude of material, semiotic and historical concerns. The psychologist Anton Ehrenzweig, for example, was

[107] More recently these political, social and environmental critiques have branched off into questions concerning everything from biopolitical to geopolitical problems, exemplified in the works of the Critical Art Ensemble and the practices of Tactical Media, respectively.
[108] Jack Burnham, Great Western Salt Works: Essays on the Meaning of Post-Formalist Art. p. 27

exploring the role of the unconscious mind in the creative process.[109] Unlike Burnham, Ehrenzweig was attempting to discover the ordered and layered structure of the mental processes that informed the creative act. The difference between them was that Burnham's interest resided in how open systems may be applied to various disciplines and instances; Ehrenzweig meanwhile explored the mental causality of the human condition as it pertained to creativity.

In his 1967 text The Hidden Order of Art, Ehrenzweig's third chapter on unconscious scanning includes a diagram of the creative search. Replete with nodal points, alternative routes as well as open and dead ends, the diagram bears a curious resemblance to a Deleuzian rhizome. "Any creative search, whether for a new image or idea," Ehrenzweig argues, "involves the scrutiny of an often astronomical number of possibilities. The correct choice between them cannot be made by a conscious weighing up of each single possibility cropping up during the search; if attempted it would only lead us astray."[110]

[109] Ehrenzweig died in 1966, yet his ground-breaking text on the workings of the human mind, as it related to creativity, marked an important contribution to the study of poïesis. See The Psycho-Analysis of Artistic Vision and Hearing. New York: George Braziller, 1953. (English Translation 1966).
[110] Anton Ehrenzweig, *Diagram of the Creative Search*, The Hidden Order of Art. Berkley: University of California Press, 1967. p. 36



Anton Ehrenzweig, *Diagram of the Creative Search*.
Illustrated in The Hidden Order of Art. Berkley: University of California Press, 1967. p. 36

Both Ehrenzweig and Burnham shared a similar disdain for the ordering principles of gestalt, which Ehrenzweig called "selective."[111] Ehrenzweig however seems to give no credit to the attempt by the Gestalt psychologists to name the principles and elements of a visual composition, or the Gestalt theories of Rudolf Arnheim who wrote on film, photography, painting and architecture.[112] In contrast to Arnheim, Ehrenzweig employed a Freudian psychoanalytic model, in which theories were based on the binary of conscious and unconscious thought, and the concordant triad of id, ego and superego. When talking about the law of closure he declared, "it is difficult to detect among a row

[111] Ibid, p. 11
[112] According to Arnheim, in an interview with Uta Grundmann, "The Gestalt psychologists, referring among other things to the arts, emphasized that there are common connections in human nature, in nature generally, in which the whole is made up of an interrelationship of its parts and no sum of the parts equals the whole. Every science has to work with the whole structure. Gestalt theory also says that the factual world is not simply understood through perception as a random collection of sensory data, but rather as a structured whole. Perception itself is structured, is ordered. This also concerns art. The work of art was a prime example of a Gestalt for my psychology teachers." Uta Grundmann. *The Intelligence of Vision: An Interview with Rudolf Arnheim*. Cabinet Magazine. Issue 2, Mapping Conversations, Spring 2001.

of perfect identical circles that one imperfect circle which shows a small gap in its circumference. The 'law of closure' postulated by Gestalt theory will always tend to round off and simplify the images and concepts of conscious thought. It makes it difficult, if not impossible, for rational thought to handle 'open' material without rounding it off prematurely."[113] In essence this is like rounding off an open system prematurely.

But Ehrenzweig misinterprets many gestalt teachings, citing them as visual elements that are stable.[114] Rather, compositions that embrace gestalt formalism must also acknowledge formlessness as a way to provide an alternative to the streamlined architectonic structures we often see in the early twentieth century avant-garde compositions of the Russian Constructivists or in Dutch De Stijl. Such notions fall in line with my own work wherein form and formlessness coexist in the representation of clouds, particles and electricity, which are not so easily 'rounded off'. Many of my electronic works share the same concern as conceptual artist Robert Barry's early explorations of invisible forces, which feature prominently in Burnham's texts. On March 3, 1969, Barry released krypton into the atmosphere as a means to make evident the materials that compose the atmosphere. In the following days he repeated this action with xenon in the mountains, argon on the beach and helium in the desert.[115] Barry's *Inert Gas Series* works are of particular interest to me because they signal a shift in our attention, not to immaterial things but material things made manifest through detection and through the harnessing of manufacturing processes. In an excerpt from an interview, Robert Barry described his process,

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[113] Anton Ehrenzweig, The Hidden Order of Art. p. 39
[114] Ibid, p. 87
[115] Robert Barry, *Inert Gas Series/Helium, Neon, Argon, Krypton, Xenon. From a Measured Volume to Indefinite Expansion*. 1969.

> I used inert gas—neon, helium, xenon, krypton—because they were, first of all, called the *änoble gasesô* [noble gases]. I always thought they were sort of romantic. They were completely unknown about 100 years ago, we didn't know they existed, and yet we breathe them in and exhale them, we live around them and move in these inert gases. They have very beautiful names, like *änewô, ähiddenô* [new hidden] —their names in Greek are quite nice. So, I just kind of liked that as a material. And we take it from the atmosphere—we can't manufacture them—they're in the atmosphere, so they must be removed from the atmosphere.[116]

What Barry speaks to is perhaps the overarching lesson of twentieth century art and science, suggesting that things, which for the most part exist outside our everyday consciousness, ultimately shape a large part of our being in the world. Barry's work marks another shift, from the formal to the formless or that which is beyond our control as the gas canisters expel the gas into the atmosphere. Because it disperses and ends up occupying a different space, it can never be the same again. Perhaps this is a metaphor for the creative process itself, in which each decision and direction changes future trajectories.

Burnham's Systems Esthetics and Anton Ehrenzweig's investigations into the psychology of creativity offered a new way to consider how human perception and cognition operate. With the advent of new software and information technologies in the 1970s, the use of coded data rather than linguistic vocabulary made it possible to challenge established epistemological assumptions, such as the accumulation of meteorological or geological occurrences, which created new ways to describe reality other than through the naming of events.

[116] Weh Holger, "Robert Barry, The Invitation as a Medium," (Interview with Robert Barry) Kunstforum, January, February 1994. http://archives.carre.pagesperso-orange.fr/Barry Robert.html accessed 9 July 2013

A year after Ehrenzweig's text The Hidden Order of Art was published in English, Burnham published his theory on Systems Esthetics. It was subsequently republished in the September 1974 issue of Artforum. In the introduction to the republished text from The Great Western Salt Works, Burnham decried the death of formal innovation, positioning the new avant-garde as anything that negated formalistic concerns. Indeed, what Burnham attempted was to move away from the systemic binary of judging art as either beautiful or ugly. The new avant-garde, so far as Burnham was concerned, was comprised of conceptual art, ecological art, anti-form, arte povera and body art. He regarded all of these as being instrumental in the introduction of a paradigm shift.[117] It is perhaps an overly reactionary stance, since Burnham's position effectively renders most of the art of the period, pop art for instance, as 'inauthentic' and yet one can appreciate his frustration with the art world in general and those individuals posing as artists without understanding that art requires a combination of dedication, technical virtuosity and experimentation for innovation to occur. In turn this would set the stage for his antithetical stance to the gestalt.

Divergent Paths: Kepes and Burnham

In the early years, disagreements persisted within CAVS as the department began to take shape. During an interview, the former artist-fellow, Burnham recalled,

> At the Center I suspect I was still very impatient with protocol and Kepes' meetings of the Fellows. Having gone through Moholy-Nagy's and Kepes' Bauhaus pedagogy and Albers' at Yale (1958-61) I was in full revolt against Kepes' "New Bauhaus" philosophy, which was a fulfillment of Moholy's photography and his Vision in Motion. It was an extension of HG Wells and Alexander Korda's 1936 classic science fiction utopia *Things to Come*, which even in 1968 seemed terribly *Art Moderne*. After a few meetings, I realized the Center existed to fulfill Kepes' expressed

[117] Jack Burnham, Preface to Great Western Salt Works: Essays on the Meaning of Post-Formalist Art. p. 11

> ideas, which to me represented a Bauhaus romanticization of technology. Kepes' darkroom and his worshipful eulogizing of scientific photographs on molecular bonding and exploding galaxies as the imagery of the century was vapidly visionary.[118]

Burnham's disdain for the controlling nature of the instructors within the institution was a criticism of what he considered their attempt to determine the parameters of artistic expression. Yet not all fellows at CAVS felt this way. Certainly Burnham was responding to what he saw as a Bauhaus agenda being perpetuated in the face of incredible change, as a technological culture based on software, data and coding was beginning to superseded an industrial one. More importantly, Burnham came of age at a time when Europe's political and intellectual influence was waning. Technological advancements were driving the economies of postwar America, Japan and even Canada; and New York had supplanted Paris as the centre of the art world. But Burnham misses important aspects of early Bauhaus inquiry, which were not exclusively concerned with issues of formalism or design mechanization. Rather, Bauhaus instructors and students were also very much interested in the psychology of perception—a line of inquiry that would be allied with technology, namely artificial intelligence and behaviourism. For Burnham this represents a missed opportunity to engage more effectively in the disciplines of cybernetics and artificial intelligence not to mention genetics. It is also evident that the early integration of social psychological and environmental inquiry at the Bauhaus later came to impact home-grown American and Canadian ideas concerned with the improvement of urban space, as evidenced in the work of Phyllis Lambert, Kevin Lynch and Marcel Breuer, and even Kepes' own ideas regarding art in civic scale.

Both, the *Boston Harbour Project* (1968-70) and the *Charles River Project* (1971-

[118] Interview Jack Burnham, CAVS Archives, MIT, Cambridge, Massachusetts, 13 February 2004.

1974) most align with Assemblage theory insofar as they integrate art and social networks as well as have a sensitivity to the environment.[119] If we understand DeLanda's notion of assemblages within assemblages, as systems within systems, then the *Charles River Project* offers a means to consider the relationship between these concepts because both integrate environmental analysis with wider durational aspects of social use. The various fellows involved with CAVS, the history of the river, and numerous environmental and social concerns were central to the project, but there were also playful aspects that gave it a life outside of the normative aspects of urban planning. As Kepes remarked in "Art and Ecological Consciousness" there is a transaction between forms and entities.

> Every physical form, every living form, every pattern of feeling or thought has its own unique identity, its boundaries, its extension and its wider context; it contains or is contained by another pattern; it follows or is followed by another pattern. The unique identity, discrete shape, and nature of a space-occupying substance are shaped by the boundary that separates it from and connects it to the space outside. An organic form lives and grows only through its intricate transactions with its environment. An optical event becomes a visually perceived figure only when seen against its ground. The quality, feeling, and meaning of a sound is cast in the matrix of the physical processes that generated it; it is not independent of its surrounding silence or the other sounds that frame it. In the same way the physical, biological, or moral individuality of man is the function of his active relationship with the physical and social environment.[120]

Assemblage theory however breaks with this holistic view, offering another means of considering our reality. In Kepes' estimation the individuality of the moral self is a function of interactions between the physical world, whereas DeLanda's Assemblage theory follows a more Deleuzian path, wherein present ethical and social constructs

[119] I have often wondered if there is a connection to some of the projects by the former Bauhaus director and architect, Hannes Meyer. Did Meyer influence Kepes? Surely his work must have been evident to Kepes and while no evidence exists to support such a claim, both Meyer's social housing project in Dessau and Kepes' Charles River revitalization project are fundamentally civically minded.

[120] György Kepes, "Art and Ecological Consciousness," Arts of the Environment. New York: George Braziller, 1972. p. 3

emerge out of past events, and thus form future trajectories. In Assemblage theory perceived events are discrete and complex, and may be described in great detail as part of larger systems, without the urge to simplify. For example, DeLanda's notion of coding can be applied to art discourse, referencing such vehicles as university presses, journals, art publications and gallery exhibitions. Each furtherance of coding territorializes the discipline through dissemination, interpretation, production and reaction by practitioners (artists, craftspeople, designers) and art market professionals (curators, dealers, art buyers). Indeed, even Kepes' Vision and Value series featured chapters written by artists on their own work, and focused on the interactions between contemporary art, science and technology.[121] In each instance, although helping to define the discipline of art, they stemmed from a particular time and place, one in which the technology, the dedication of the authors, the institutions, and the demand for the publication dictated to what extent knowledge was archived, distributed and supported. Each new line of inquiry generated interests and new approaches to artistic practice, but also displaced other forms of creative practice—just as the deterritorializing of craft was supplanted by the promotion of industrial design, for example. At the same time both constructs, Kepes' form-finding and pattern-seeing pursuits and Assemblage theory's drive to be inclusive, traverse disciplinary territories once thought to be exclusive.

For all of Burnham's optimism, he also acknowledged that art and technoscience collaborations failed to meet expectations. In his text "Art and Technology: The Panacea

[121] It should also be noted that criticisms of museums and galleries also existed, arguing they were not only places that helped to foster formal works that incorporated gestalt tendencies, but also places that promoted a view of art that no longer had a place in peoples lives. As Allan Kaprow wrote in Art News in the September 1964 issue, "The public museums developed principally as a substitute for the patronage of the Palace and the Church. Physically, the museum is a direct parallel in mood, appearance, and function to the cloistered, unattainably grand surrounding art once had. In Europe, it was the unused monastery and former chateau that were taken over for the purpose, while in America the style was imitated. Therefore we have the 'aristocratic' manners of curators, the hushed atmosphere, the reverence with which one is supposed to glide from work to work." Alexander Alberro, ed., Institutional Critique. Cambridge: MIT Press, 2009. p. 53

That Failed" (1980), he discusses the rifts between industry, institutions and funding bodies. As a scathing indictment of CAVS he remarked that,

> Actually, except for those areas of scientific research that produced stunning photographs, such as holography, electron microscopy, and aspects of optical physics, Kepes had a strange aversion to direct involvement with sophisticated technology, particularly anything to do with the computer sciences. Due to the fact that the Center had been publicized, by virtue of its relation to M.I.T., as a technological nirvana for the artist, I found the situation mystifying. Slowly it began to dawn on me that the Center's underlying purpose was not primarily to do visual research or to make art, but to produce lavishly illustrated catalogues and anthologies that would impress foundations.[122]

However, there were other organizations apart from EAT and CAVS that Burnham mentions in "Art and Technology," which attempted to use technology in creative and interesting ways. The diverse curricula at Black Mountain College, the San Francisco Art Institute, the Ontario College of Art, under Roy Ascott, and later the Brain and Perception Laboratory at the University of Bristol, in Europe, were all gaining notoriety, and this burgeoning interest in transdisciplinarity was in part due to the influence of technological trends in the information sciences.

Another factor that curtailed collaborations between science and art was that of the institutional critique practiced by conceptual artists of the period, such as Adrian Piper, Martha Rosler, Hans Haacke, Joseph Kosuth. These artists, among others, in tandem with the deconstructionist interventions of philosophy, would further deterritorialize these technological utopian tendencies. This is particularly evident in Hans Haacke's *Condensation Cube* (1963-65), which points to many of these unacknowledged forces that support and sustain the field of artistic practice. In this work,

[122] Jack Burnham, "Art and Technology: The Panacea that Failed," The Myths of Information. Kathleen Woodward. ed., Lincoln, Nebraska: Coda Press, 1980. p. 209. While Burnham was critical of the lavish publications Kepes was producing, he too produced a series of books while a fellow at CAVS–and under the same publisher as Kepes. Among them were his 1968 volumes Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of This Century and Great Western Salt Works.

Haacke placed a plexiglass cube within the gallery as a detection device, compelling the viewer to consider the act of observation in a 'controlled' environment. The work references everything from the physics of dew points and particle behaviour to the history of climate control systems and preservation. As Burnham remarks

> Formalist art embodies the idea of deterministic relations between a composition's visible elements. But since the early 1960s Hans Haacke has depended upon the invisible components of systems. In a systems context, invisibility, or invisible parts, share equal importance with things seen. Thus air, water, steam, and ice have become major elements in his work.[123]

Although I admire the attention Burnham paid to the 'invisible' attributes of materials and phenomena, I disagree with his assertion that formal art is determined. Even Burnham understood how semiotic relations of language were in constant flux and this would be no different in terms of visual language. What is evident in his statement is an acute sense that invisible components were to frame the notion of dematerialization, as it was set forth in the era of American conceptual art. This is an essential facet of late hyper-capitalism in which we find ourselves amidst economic interests that influence everything on the planet at the speed of light, through Internet technology and fibre optics, without regulation and policy keeping pace. No one could have predicted the speed of monetary transactions and the portability of communication networks. The influence of these actants—electronic devices, surveillance technologies, and modes of transportation—foreground a relationship to a multiverse of invisible potent energies, which challenge our notion that the physical world holds sway.[124]

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[123] Jack Burnham, Great Western Salt Works: Essays on the Meaning of Post-Formalist Art. p. 22

[124] Dematerialization and Systems Esthetics both point to hidden forces, either of the machinations of the human mind or the physical systems that could just as easily exist without human intervention.

In contrast, Assemblage theory distinguishes itself from postmodern and conceptualist institutional critique in its description of interactions between various constructs and phenomena beyond a singular concern for institutional contextualization. These new imagined spaces of artistic practice, informed by the questions Assemblage theory poses, consist of inter-relational dimensions between social, cultural, economic, and political positions, which are time-sensitive and somewhat predictive through probable outcomes. There is a kinship in the way weather prediction was made manifest at the same time Complexity theory and software technologies became more widely used and is one of the reasons why these subjects are reflected in my work. I have already discussed the importance of prediction in the history of weather forecasting, which may also be seen as an indicator of a new paradigm shift from uncertainty to probability.

It may be, as Burnham suggests, that the strength of conceptual art is expressed through all its tropes: logic, systems and grids, structures of reporting data, questions surrounding meaning and the attention to bureaucracy. Yet, in many ways, this was the opposite of what EAT was trying to accomplish as their experimental methods were also employed by affiliated artists and engineers whose team projects included everything from kinetic sculpture to full-scale programmed installations. The primary concern for EAT, as an organization, was to foster new partnerships between art and technology and push the boundaries of creativity and innovation. In addition, its successes cannot only be measured in terms of mega projects such as *9 Evenings* (1966) and Expo ’70. EAT’s collaborations also bridged the initiatives of individuals with the interests of civic organizations, industry and governmental partners. Conversely, such collaborations also provided a means to energize the work of scientists and science departments, introducing

new ways of thinking as a means to disrupt often rote and formulaic methodologies.

Organizational Differences: CAVS and EAT

CAVS and EAT developed mandates and manifestos that included design theory and technology, and encouraged collaboration with other disciplines and industries. While Burnham criticised CAVS for its attempts to bring about a new era of modernist idealism, its initiatives endeavoured to explore and utilize new materials and information in meaningful and productive ways. Although EAT did not grow directly from the New Bauhaus it developed, in part, through the vision of artist Robert Rauschenberg, a former student of Bauhausler Joseph Albers, and the strict teachings of Albers and his adherence to formal rules, compelled Rauschenberg to embrace the combinatory styles and methods of assemblage.

EAT was initiated in 1966 by engineers Billy Klüver and Fred Waldhauer with artists Rauschenberg and Robert Whitman.[125] Editor and writer Julie Martin chronicled EAT's activities throughout its long history (1966-2001). Its manifesto outlined aims that expressed an urgent new awareness and sense of responsibility regarding the relationship between art and technology. Each new project was inherently fraught with financial and organizational risk. This precariousness was exacerbated by the fact that, unlike CAVS, which was embedded within an institution, EAT had no stable financial support.[126] It also did not have an organizational apparatus in place to solicit support in the same way as

[125] Kristine Stiles and Peter Selz, Theories and Documents of Contemporary Art: A Sourcebook of Artists' Writings. Berkley: University of California Press, 2012. p. 453

[126] The involvement of EAT at the Osaka World's Fair was a unique collaborative experiment, that involved over 75 engineers, artists, and industries in Japan and the United States and resulted in extraordinarily innovative projects that took place at the Pepsi-Cola Pavilion.

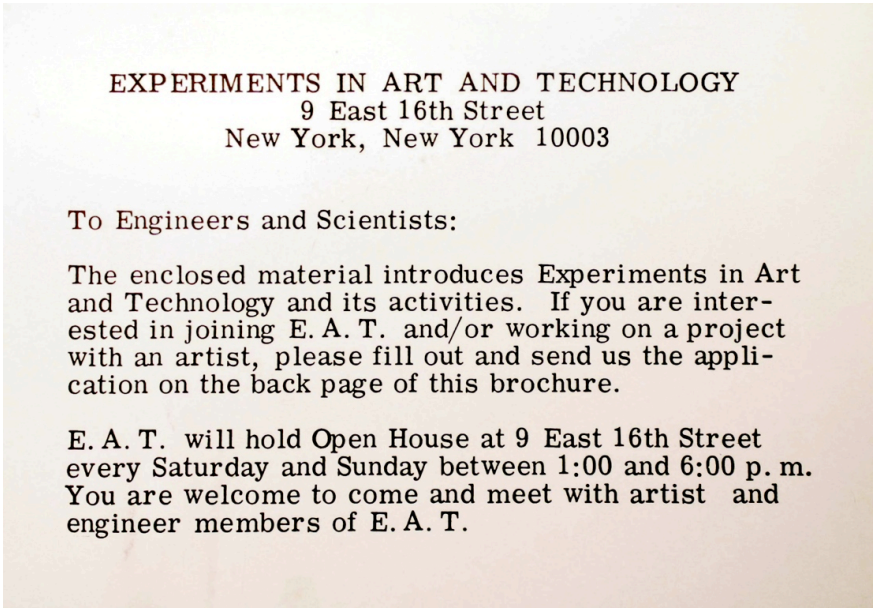
CAVS. Although EAT actively sought out individuals with diverse expertise, it subsequently dissolved due to a lack of funding, bad press and a lack of will and interest.[127] *9 Evenings,* for example, received criticism as being an ill-conceived event that was complicated by failing technologies, although according to Burnham it was the first large-scale attempt "by engineers, artists, and dancers to pool their talents in the recognition that art and technology were no longer considered alien forces subverting each other."[128] One might speculate that it was a combination of factors, or perhaps merely fatigue and frustration by its members at the prospect of having to work for little financial benefit that finally led to EAT's demise. If this is true, it may also point to a problem within the art world in which independent artistic research must find financial partners for any chance of being sustainable.[129] Indeed, if EAT had actively sought out others with expertise in marketing, fundraising and public relations for example, the fate of the organization may have been quite different. Insofar as EAT and the university were concerned, the fields of technology and scientific study gave way to philosophy, theory, criticism and cultural studies within the humanities. Nonetheless, EAT embarked on some important initiatives from mass mailings to fostering international connections

[127] See Sylvie Lacerte, *9 Evenings and Experiments in Art and Technology.* EAT Archives, Daniel Langlois Foundation, Montreal, Quebec, http://www.fondation-langlois.org/html/e/page.php?NumPage=1717 accessed 10 July 2013

[128] Jack Burnham, Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of This Century. New York: George Braziller, 1968. p. 359. It should also be noted that the exhibition *Software-Information Technology: Its New Meaning for Art,* curated by Burnham in 1970, suffered from the same problems that plagued EAT's *9 Evenings*.

[129] When speaking about the combined practice of art and technology, art historian Edward A. Shanken suggests that there are a number of reasons why artistic practice failed to embrace different forms of technological scholarly research. He argues that art and technology have not achieved general recognition by critics and historians as a bona fide art historical style and that this lack of acknowledgment is suggestive of the discipline's privileging of style as the primary criterion for potential inclusion in the canon. In addition, art and technology have been caught in the double bind of appearing to be too technological to be appreciated under conventional canons of aesthetics, and too artistic to be appreciated according to the criteria of science or engineering. This problem extends beyond the failure of art and technology to appeal to inherited codes of visual signification. Moreover, there are other institutional hurdles, particularly with respect to maintenance and restoration. Given the rapid cycles of programmed obsolescence, it is difficult for museums to manage the custodianship of artworks that rely on hardware and software platforms that will inevitably become outdated and irreplaceable. Edward A. Shanken, "Art in the Information Age: Cybernetics, Software, Telematics and the Conceptual Contributions of Art and Technology to Art History and Aesthetic Theory." PhD Dissertation. Department of Art History Duke University, 2001. Print.

including collaborations with government and industry.[130] Hardware technologies used in computing, communications and data processing in the 1970s led to a new generation of software programs.[131] Realizing the potential of software, EAT also promoted a series of projects in which artists participated, with the aid of an engineer or scientist, to explore these new developments. If there was a commonality between EAT and CAVS it was in the shared belief that artists should have access to new technologies, support and tools for measurement and research.



EXPERIMENTS IN ART AND TECHNOLOGY
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Promotional Card. From the EAT Archives, Circa 1966
Getty Library and Archives. Los Angeles, California

Burnham's Systems Esthetics, developed during his fellowship at CAVS, offers an articulation something akin to Assemblage theory. "The priorities of the present age," he remarked, "revolve around the problem of organization. A systems viewpoint is focused on the creation of stable, on-going relationships between organic and non-

[130] In terms of using organizational structures to nurture collaborations and improve design application through experimentation, their efforts suggest parallels to the *Deutsche Werkbund* of the 1920s.
[131] These programs included Pascal (1970) C (1972) Modula and Scheme (1975) Plus (1976) CBasic and FLACC (1977) and Rexx (1979).

organic systems, be these neighbourhoods, industrial complexes, farms, transportation systems, information centers, or any of the other matrixes of human activity. All living situations must be treated in the context of a system's hierarchy of values."[132] Here, Burnham employs a list structure approach similar to a software program, which acknowledges the relationships between organic and inorganic entities. In this sense, Burnham posits an entirely new way of thinking about artistic production. The main difference between this idea of interrelations between hierarchical systems, in terms of Burnham's Systems Esthetics and Assemblage theory, is that assemblages include destabilizing forces that are also necessary to define territorializing elements. Both of these tendencies aid in the support or diminishment of single entities, organizations and systems. The resultant lines of flight that form future trajectories—what Deleuze would term "becoming"—are the generative processes of change or movement within an assemblage. If we were to devise an analogy in software it would resemble something akin to a program running alongside a virus with an algorithm written into the program to either adapt to this new introduction or be consumed, and hence deterritorialized, by it.

Both Burnham and Kepes territorialized artistic imperatives by expanding discourse and promoting the field through a series of important texts as an attempt to formalize the discipline. Despite ideological differences they embraced an idealism regarding the function, promise, and potential of creative arts practitioners. As outlined in the 1967 White Papers, CAVS was designed specifically to help bridge the arts with different creative and imaginative endeavours; and the School's curriculum and publications became tools to highlight the political, social and economic realities of urban

[132] Jack Burnham, Great Western Salt Works. p. 16

life that seemed to have a moral modus operandi in contrast to EAT's more technically minded newsletter publicity, which professed to involve "Projects Outside Art." Kepes later described CAVS as,

> a research center, or more correctly a 'search' center, for new creative objectives, new formats in art. The aims of the Center are threefold. First, to investigate the possibilities of creative work on a civic scale that could give new artistic dimensions to our urban environment, and thus revitalize civic awareness to environmental values. Second, to develop participatory artforms; spectacles, events and pageantry that might bring a new sense of community to isolated individual lives. Third, to learn to utilize new techniques of communications media to develop our sensibilities as well as our consciousness of our present ecological and social situation.[133]

Yet an unforeseen complication of this diverse and transdisciplinary approach to practice conflated the problem of naming what artists do and how they go about their research.

As EAT and CAVS developed concurrently, it was Burnham that formulated an aesthetic theory that described a new phenomenon of systems integration and art, brought about by an American penchant for the adoption of information technology. But where CAVS fellows were in conflict with MIT, with regards to some of its policies concerning militarism, EAT was busy partnering with corporations, engineers and scientists to realize their projects. EAT's willingness to collaborate expanded both the scope and scale of the organization's activities far beyond the closed system of invitation that dictated the initiatives undertaken at CAVS. Moreover, this openness created an atmosphere in which projects were prioritized over the theoretical discussion of their work. Conversely, within the academic environment of MIT, the lasting legacy of CAVS resides largely in the writings and publications of its instructors and fellows.

In summary, every structure or pattern hosts a system. The pedagogical structures,

[133] John Grayson, Sound Sculpture. Vancouver: Aesthetic Research Centre of Canada, 1975. p. 94

before (Slöjd), during (gestalt) and after the Bauhaus (Systems Esthetics) evince a systematic way of thinking that promoted, governed and controlled art instruction. Such methods operated as a territorial dispositif with boundaries that were constantly reterritorialized and deterritorialized. Kepes' ideas grew out of these traditions, promoting a brand of modernist thinking that linked broader environmental concerns with his own interests in pattern-seeing and scientific imaging. Certainly institutional manifestations of utopian modernist ideals—for industry and the state to provide everything for everyone—were fraught with contradictions. For example, during their time at MIT, both Kepes and Burnham acknowledged the belief in progress that created accelerationism, exacerbated by capitalism, and resulted in environmental degradation.

The pedagogical structures carried over from the New Bauhaus, which utilized the principles of design, and later Burnham's Systems Esthetics, however, are set apart from Assemblage theory because they focus on visual pursuits that are limited to patterns and coding systems of human knowledge formation. In DeLanda's Assemblage theory, the inclusion of ideas such as morphogenesis (the birth of form), emergence (tendencies and capacities), and virtual trajectories let us know that we live in an open, problematic world, and extend our capacity to understand how social, political, cultural and technological forces, among others, act and interact beyond systems.

Chapter Three
The Characteristics of Assemblage Theory and its Application to Creative Practice

As an articulation of sociocultural, economic and political interactions, DeLanda's Assemblage theory was forged in the disciplines of Complexity theory and materialist philosophy, but nuanced in Bergsonian multiplicity.[134] As a theory, originally postulated by Deleuze, it signalled an important shift in methodology and theorization by acknowledging the complex associations between social, political, economic and even biological phenomena. In applying DeLanda's Assemblage theory to studio practice, it is necessary to consider how the term 'assemblage' was first used by philosopher Gilles Deleuze. Accordingly, Deleuze asks,

> What is an assemblage? It is a multiplicity which is made up of heterogeneous terms and which establishes liaisons, relations between them, across ages, sexes and reigns—different natures. Thus the assemblage's only unity is that of a co-functioning: it is a symbiosis, a 'sympathy'. It is never filiations, which are important, but alliances, alloys; these are not successions, lines of descent, but contagions, epidemics, the wind.[135]

Embodied in this text is the variability of assemblage just as weather is 'up in the air' and unpredictable insofar as it is complex—comprised of the co-functioning of low and high pressure zones, the earth's rotation, solar winds, intensity of electromagnetic forces and convection currents. The strength of Assemblage theory resides in its responsiveness to this variability, yet it displays a weakness in the way it oscillates from generalization to

[134] I am using the term multiplicity, as it was first described by the philosopher Henri Bergson, who recognized multiplicity as consisting of qualitative aspects (duration and time) and quantitative aspects (space). Another way to describe this is to consider the differentiation that Bergson offers when he refers to these multiplicities as "continuous" or "discrete." This allows for a more detailed analysis of change, adaptation and differentiation. This is important with regard to poïesis in which there is a phenomenon of experience where consciousness blends memory and intuition with process, material and perception. See Leonard Lawlor and Valentine Moulard, "Henri Bergson," The Stanford Encyclopedia of Philosophy. Edward N. Zalta, ed., Fall 2012 Edition http:plato.standford.edu/archives/fall2012/entries/Bergson/ accessed 1 July 2013

[135] Manuel DeLanda, "Deleuze: History and Science. Deleuzian Social Ontology and Assemblage Theory," Deleuze and the Social. Martin Fuglsang and Bent Meier Sørensen, eds., Edinburgh: Edinburgh University Press, 2006. p. 10

something specific even as it professes to negate macro and micro distinctions. The unpredictability in its complexity catches us off guard and at the same time offers surprising results that are linked to the ways materials and biological life adapt and change. Similarly, in studio practice, the vacillation between ideas, integrated with poïesis, and intuition is essential to lead one into unknown creative territory. DeLanda summarizes the main features of Assemblage theory accordingly,

> First of all, unlike wholes in which parts are linked by relations of interiority (that is, relations which constitute the very identity of the parts) assemblages are made up of parts which are self-subsistent and articulated by relations of exteriority, so that a part may be detached and made a component of another assemblage. Assemblages are characterized along two dimensions: along the first dimension are specified the variable roles, which component parts may play, from a purely material role to a purely expressive one, as well as mixtures of the two. A second dimension characterizes processes in which these components are involved: processes, which stabilize or destabilize the identity of the assemblage (territorialization and deterritorialization)…. A third dimension will be added: an extra axis defining processes in which specialized expressive media intervene, processes which consolidate and rigidify the identity of the assemblage or, on the contrary, allow the assemblage a certain latitude for more flexible operation while benefiting from genetic or linguistic resources (processes of coding and decoding).[136]

In considering DeLanda's first proposition, we may use Deleuze's analogy of the wasp and the orchid, where each entity is dependent upon the other as a symbiotic emerging unit, which has its own identity differentiated by genetic and ontological separation.[137] The aesthetic composition of the orchid—its recognizable shape and colour—creates the conditions of an attractor forming a bond between the flower and the wasp; the wasp receives nourishment, while the flower is pollinated.[138] In this case an aesthetic

[136] Manuel DeLanda, A New Philosophy of Society: Assemblage Theory And Social Complexity. pp. 18-19
[137] Unlike wholes in which "being part of this whole" is a defining characteristic of the parts, that is, wholes in which the parts cannot subsist independently of the relations they have with each other (relations of interiority) we need to conceive of emergent wholes in which the parts retain a relative autonomy, so that they can be detached from one whole and plugged into another one entering into new interactions. Ibid, p. 18
[138] Ibid, p. 11

component is regarded as information for the wasp. This is a 'relation of exteriority'—the wasp senses the orchid and responds accordingly outside of itself to become connected. Conversely, a relation of interiority is an assemblage inherent within the whole; a cell in the body of either plant or animal is an example, having its own genetic 'program' to follow in relation to other processes that constitute and stabilize the organism. The colourful trait of the flower is something that inherently exists unto the orchid as its identity. The colour wavelengths it reflects become part of its expression, which the wasp interprets from the perspective of coevolution or co-functioning. Any change to an organism's ontological existence, such as the introduction of epigenetic factors, pollution for example, or an invasive species or virus, may create conditions of deterritorialization, which destabilize the bond between these entities. This is DeLanda's second proposition, which explains how the identity of any assemblage, "at any level of scale is always the product of a process (territorialization and, in some cases, coding) and it is always precarious, since other processes (deterritorialization and decoding) can destabilize it."[139]

In my own practice, these territorialized stabilizing factors play out in myriad ways, particularly within the social and cultural habitus and within the institutionally coded frameworks of the art world. The frame surrounding the work, the gallery and the discourse that circumscribes the work, the tropes and themes of the work, even the dissertation, are all means of territorialization. Destabilizing elements include: critical reviews, antagonisms and agonistic competition, which disturb, interrupt or complicate the reading of the work or its process. The intention of the *Conditions Variable* exhibition is to complicate these stabilizing forces through the interjection of an assemblage of art tropes, which operates in a very different way than the temporal systematic (semantic and

[139] Ibid, p. 28

syntactic use of terms) in this paper. The varying components of the exhibition (visual, sonic and sensory work) destabilize one another because they are materially and expressively divergent. Yet, the physical spacing between the works, their similar stylistic elements, and the ubiquitous and varying use of weather as central theme, become stabilizing features of the installation.

We encounter weather spatially by being immersed in it and by experiencing the distributive capacity of currents and flows produced by the Earth's myriad physical forces. I have used weather as an overarching theme of the exhibition as it embodies relations of interiority and exteriority. Weather 'acts' on living and non-living organisms and yet interacts as a kind of Actor Network theory of climate events. Through its particle expression as clouds, fog, rain and mist, it has an exterior function—it collects, forming rivers, lakes and oceans, evaporating again through the dispersing mechanisms of the hydrological cycle. It also has an interior function, being consumed and processed by organisms. Water, as an element, takes on many forms, and expresses itself in multiple ways, creating ever-changing conditions for life-assisting and morphological possibilities. Distributing temperatures around the globe is an example of this life-assisting function. In most cases, within a more human-centred world, exterior or interior relationships consist of complex flows of information and changes in social, political and economic realities. In our interpretation of weather, both micro and macro distinctions are always already formed in relation to human scale, in the perception and recounting of an event. For instance the smudges of paint that reference cloud imagery coexist with the paint particles and tiny water droplets, in my works on paper, as a way of suggesting different scales simultaneously. Marks are also used to project, in the mind of the viewer,

movement as if to foreshadow a potential direction or flow. A line may also be drawn through materials, such as wax, to reference a river cutting through topography or the use of blue hues, in many of my drawings, may mimic the frequency of light refracting in a nitrogen-rich atmosphere. A bold pencil line may represent a border where a faint or 'lost and found line' might have emerging and dissipating properties that signify ephemerality. In many cases, the work oscillates in scale reflecting DeLanda's unease with micro and macro distinctions. The old binary of chaos and order does not exist in a theory or practice that explores the boundaries between the micro and macro material worlds where interacting parts are at play. Equally, it suggests that physical reality is offset by complexity because such distinctions are arbitrary. Thus weather is a fine candidate to probe complexities that produce multiple outcomes at varying scales. Some of the most complex systems on the planet are weather systems, which require advanced detection equipment for forecasting. Such equipment is central to long-range modeling, where climate science meets climate change. In this case materials, and their physical component chemicals, are in constant flux due to variations in heat, pressure, density and intensity.[140]

For artists, the integration of such ideas concerning prediction and complexity are critical to the interplay between situation and semblance, reality and resemblance, where intuition, poïesis and the senses play a key role in the articulation of an idea or body of work. In this sense, poïesis is co-functional as it attempts to reconcile the congruent and

[140] For a meteorologist to calculate an event, such as a storm, variable differential equations need to indicate: zonal velocity (the east/west direction tangent to a sphere), meridional velocity (the north/south direction tangent to the sphere), temperature, geopotential (the relative force of the earth's gravitational field), coriolis force (the motion of objects in different frames of reference), gas constants (the energy result of volume and pressure), heat; precipitable water (the depth of water in a column of air), and potential temperature (as influenced by factors such as altitude or the hydrological cycle).

incongruent elements between thought, matter and time through the working process. This is part of what makes the act of creative expression so fascinating and diverse.[141] At the same time, artists invent or adopt a style or trope, which is a pattern replicated and mimicked by successive generations of practitioners over time. Institutionalized replicators were exemplified by the Bauhaus and Conceptual art paradigms, each had there own system, schema or self-preserving tendencies enshrined in their mandates and bureaucracies. This was examined in Chapters 1 and 2**.** For DeLanda, the longer a dominant system lasts in an assemblage, the more it can influence other assemblages at varying scales. For instance, he refers to "linguistic replicators" as information that is transferred from one generation to the next. In psychology, the Stroop test exemplifies the power language has over other forms of perception. In this test the names of colours are printed in colours different from the words they spell; the word green may appear in red, the word red may appear in black. Participants are asked to quickly identify the colour they see. More often than not, identification of the written word supersedes its colour expression illustrating the powerful influence of language over other forms of perception.[142]

[141] The other way coding acts is to use words to direct and control the Earth's energy reserves where materials exist for our use. If we consider the variables of climate alteration, we understand the importance of DeLanda's proposition. Assemblage theory breaks with linear thinking by providing a template for questioning the realities of structure, phenomena, material expression, deterritoralized and territorialized spaces and ideologies. If we can exert this kind of dominion over resources without acknowledging their complexities then we fail to live symbiotically within the biosphere.

[142] J. R. Stroop, "Studies of interference in serial verbal reactions," Journal of Experimental Psychology. vol. 18, 1935. pp. 643–662.

The Appearance of Assemblage Theory as a Reaction to the Linguistic Turn

> When subject-Zeus next throws his object-thunderbolt, he expresses something other than that deed: he expresses his anger. The flash is now a proposition: a manifestation of his mood. The resemblance to lightning has passed from whole to part, from the god to his emotion. Expression is now more narcissistic than ontogenetic: all it can do is spin off further resemblances (in accordance with a rhetorical structure, in this case through a synecdoche).[143]

In this quotation social theorist Brian Massumi points to the spin-off of mythic expression that posits anthropocentric understandings of phenomena to represent the whole, which replicates in resemblance. In much the same way, postmodern theories have been unsuccessful in their attempts to elucidate many of the problems that plague societies due, in part, to an excessive self-critical and self-referential anthropocentric stance. There is also an inherent flaw in the critique of Western metaphysics (truth, god, beauty et al), a contradiction that is obvious when we think of language as something referring or standing in for something physical hence metaphysical. In short the arbiters of postmodern discourse have neglected to come to terms with a realist ontology that extends beyond human agency or incorporate complexity into their critique. In the wake of the linguistic turn, which is often associated with postmodern discourse, creative practices have been left without direction, apart from a critical, rhetorical one. The profession of the artist is cast on a sea of outmoded models of formal training, which are frequently dislocated in the linguistic-centred readings concerning creativity, authorship, simulation and institutional critique. DeLanda addresses some of these concerns by giving an example of the linguistic focus in academia when he remarks,

> Idealism, the ontological stance according to which the world is a product of our minds, went from being a deeply conservative position to become

[143] Brian Massumi, "Introduction: Like a Thought," A Shock to Thought: Expression After Deleuze and Guatarri. New York: Routledge, 2002. p. 25

> the norm in many academic departments and critical journals: cultural anthropologists came to believe that defending the rights of indigenous people implied adopting linguistic idealism and the epistemological relativism that goes with it; microsociologists correctly denounced the concept of a harmonious society espoused by their functionalist predecessors, but only to embrace an idealist phenomenology; and many academic departments, particularly those that attach the label "studies" to their name, completely forgot about material life and concentrated instead on textual hermeneutics.[144]

The paradigmatic pedagogical changes that were described in Chapters 1 and 2 exemplify the shifts in art instruction that have become suspect within creative disciplines, since many other forms of inquiry—sociology, psychology and many scientific pursuits—have incorporated other facets of human experience to become much more interdisciplinary. This is why it was so important to ferret out the connections between art and design production leading up to our current situation within art pedagogy. At the same time, artists and cultural collectives continue to resist categorization as cultural functionaries, opting instead to act as sociopolitical agents, such as Francis Alÿs, or technoscientific producers, such as Olafur Eliasson. Their resistance to the normative aspects of art presentation and production is partly due to their critical stance against entities, which attempt to interpret, catalogue and situate art within a framework of periods, cultural contexts and social movements. I assert that many artists struggle with these questions regarding their practice, that is to say that they know that their work is developed on a foundation of historical precedent, handcraft tradition and poïetic engagements, but rarely are they able find a home in discourse foregrounding creative endeavours.

Today, cultural practitioners are responding to systems of cultural categorization—environmental art, social and activist practice—in different ways. As an

[144] Manuel DeLanda, "Deleuze: History and Science. Deleuzian Social Ontology and Assemblage Theory," Deleuze and the Social. p. 29

example**,** Francis Alÿs' video work *Tornado* incorporates a decade of footage from 2000 to 2010**,** which depicts the artist repetitively running into a series of dust devils in the Mexican countryside. Reaching the epicentre of the whirlwind, Alÿs is blinded and breathless as he encounters the dangers of unfamiliar territory by exploring the boundaries between life and death—the familiar and new. In this video, part of its meaning is drawn from Alÿs' œuvre, particularly his examination of borders. Yet the work also suggests that the artist wants there to be no resolution, what remains is a possibility to move beyond our current chaotic and risky predicament. The material components of the whirlwind and its expression of uprooting topography, and anything on the surface, is a wake-up call to consider the complexities of actions or reactions to established anthropocentric impulses in which we see echoes of industrialization and enlightenment projects countered in twenty-first-century environmental practices. Comparatively, DeLanda's Assemblage theory is a resource to preserve a mix of aesthetic and structural ideas, which are an inherent part of production in the current revival of modernist thought, an antidote to the dominance of such stalwart ideologies such as the linguistic emphasis within artistic practice.[145] As discussed in Chapter 2, there

[145] It is instructive to compare and contrast more recent trends in philosophy, namely deconstruction or post-structuralism, with Assemblage theory to ferret out differences and similarities. In the last forty years this shift in scholarship from structuralism has been more broadly understood as the linguistic turn. To have a good understanding of what the linguistic turn is and what it means see "When Was the Linguistic Turn? A Genealogy." Referencing Gabrielle Spiegel's 2008 Art History Association presidential address, professor Judith Surkis submits that the linguistic turn came from "multiple domains at once: philosophical investigations of language, anthropological explorations of culture, psychoanalytic interrogations of subject formation, and radical questionings of the possibilities and limits of knowledge formation." Spiegel argues, it "took on great significance for the generation of European and American historians who came of age in the 1960s and 1970s; that generation, in turn, went on to pose new questions about the objects and subjects of historical knowledge." The resulting linguistic, cultural, and poststructuralist "turns" provoked what Spiegel describes as a "massive change in our understanding of the nature of historical reality." (p.703) I want to issue a cautionary note. By positing the notion of a turn I am not suggesting that something needs to completely replace the progress made to dismantle hegemonic structures or ideologies. Rather, Assemblage theory does not favour replacements; it regards coding as an essential element to describe reality. It may be that the focus on semiotic and linguistic coding had the effect of deterritorializing creative objectives that were looking at knowledge formation from a different point of view. I would argue that the replacement of one form of knowledge and even a form of perception over another may have occurred because of an emphasis on writing to legitimate visual, sonic and theatrical based practice as it was dislodged by scientific and market focused disciplines. It may also have an influence

was a willingness to include transdisciplinary practices in modernist projects, which in many ways began in America with Kepes and the artists at MIT. Together they established a paradigm that is still with artists as they struggle with embedded structures that direct and prefigure future events. At the same time we must not forget the inheritance of postmodern critique with regard to these hegemonic structures or we run the risk of formulating a theory that attempts to totalize and become a form of essentialism, as theorist Elizabeth Grosz argues in her text "The Problem of Theory,"

> All disciplines make theoretical assumptions, use theoretical criteria, and make theoretical conjectures, however practical their goals and orientation. Theory can thus be understood as both that which is philosophical, generic and explanatory, that which aspires beyond the empirical and the obvious, beyond doxa and assumption; but also as that which has disavowed its philosophical ancestry and sought to root itself in every discipline as its underside.[146]

Any act of communication that attempts to persuade or lay claim is an act of territorialization. We have to ask ourselves, does any theory have real-world applications, and, if so, how are we able to implement such critiques and ideas? Assemblage theory is different from postmodern theories that have delineated a discourse within the arts for the last forty-plus years. A distance from nature persists in the wake of political and philosophical shifts centred on human pursuits and capitalist tendencies that attempt to control every last tract of 'manageable' land, water and air space. The modernist urge for holism and expansion, and the postmodern assertion that problems require endless critique both fail in the face of Assemblage theory because by contrast the latter endeavours to articulate systems, networks, effects and affects as it proceeds to dislocate

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on the current iteration of the artist as researcher or in the past as the artist that embraces technoscientific pursuits as was discussed in Chapter 2. Judith Surkis, "When Was the Linguistic Turn? A Genealogy," The American Historical Review. Chicago: University of Chicago Press, 2012. vol. 117, no. 3, pp. 700-722

[146] Elizabeth Grosz, "The Problem of Theory," theory@buffalo. [Buffalo] 5 1999. p. 2

the processes of political decision-making, often fraught with contradictions. It may be that many postmodern theories malfunction because they do not acknowledge or harness the resources of the other humanities and sciences, but rather tend to utilize linguistic forms to pose questions relative to established hegemonies. Assemblage theory poses an alternative by using multifarious information to tackle a given set of problems. Here I am positing a system, not in terms of identifying something specific, but as a way to include difference within an ontic principle "there is no difference that does not make a difference." As art, science and technology investigate the minute to the immense mysteries of our universe, differentiation becomes increasingly evident. If we consider the environmental changes we are now experiencing, the need to inculcate cause and effect relationships becomes urgently critical. To illustrate this we can look to climate models, which utilize multiple ways of mapping our current status on the planet by way of record-keeping, computer simulations, radar monitoring, temperature, pressure and wind readings amongst others. In this way, data is corroborated to reflect a more detailed picture of the warming trends we experience. Assemblage theory is promising because, unlike past theories that attempt to advance a structure or a system, it embraces multiplicity, complexity and by extension diversity. In this sense it operates like deconstruction in teasing out the warring forces within artistic creations to invite agonistic and antagonistic readings, without encouraging an all-encompassing, definitive stance or offering grand proclamations. What it does offer is a way to describe current predicaments. Although deconstruction was and is incredibly important for establishing a critique of hegemonic positions, I want to briefly describe how deconstruction, the

philosophical movement most associated with the linguistic turn, 'acts' differently than Assemblage theory in its critical approach.

- First, deconstruction is a polemic mainly associated with linguistic-based practice, since to describe Western metaphysics one has to emphasize what is written, often using philosophical arguments and contradictions to prevent an essentialist position. Assemblage theory on the other hand, does not focus on text, but considers "coding" as only one way to describe reality. The roots of Assemblage theory are forged in Bergsonian multiplicity and scientific complexity and may be thought of as analytic pragmatism, without ties to truth or success in favour of speculation, probability and possibility. Deconstruction has a lexicon of terms derived from psychoanalysis, linguistics and postmodernism to describe its positions. Assemblage theory is still in its infancy and developing concurrently with many other theories espousing some of the same things namely: Actor Network theory, New Materialism, and Speculative Realism.

- Second, deconstruction critiques all forms of Western metaphysics, ideologies and grand narratives, including its own position with regards to the reading of a work as undecidable, partly because of contradiction and a belief that all texts are traces and thus fictions in which meaning is suspended in a state of *aporia*. Assemblage theory shares in the idea that totalities, essences, necessity and immanence should be properly elucidated through critique, but does not share in the primacy of its own critique. In Assemblage theory there is some agreement that our perception of things is questionable, in part, because of complexity. In other words, we cannot know everything because of the complexity of interaction, but we can know some things through our senses, the study of phenomena, through technological apparatuses and empirical experimentation. These experiments can consist of information that might be mathematically, sonically, visually, gesturally and/or textually coded as parallel modes of understanding. The belief in the necessity of contingency (that events cannot be predicted) also plays a role in doubt. Assemblage theory purports that past movements and ideas play out in lines of flight that have unknown trajectories and produce affects and effects, which are possible, and often unpredictable.

- Third, deconstruction is correlationist. As claimed by the philosopher Quentin Meillassoux, correlationism is "the idea according to which we only ever have access to the correlation between thinking and being, and never to either term considered apart from the other."[147] Correlationism is critiqued as a way of privileging humans over other entities. For Assemblage theory to work, it must develop a robust conception of reality to overcome the postmodern dictum that reality, language, consciousness, et al are social constructs, a mere effect of a specific culture or discursive system. Meillassoux also remarks that,

[147] Quentin Meillassoux, After Finitude: An Essay on the Necessity of Contingency. Ray Brassier, trans., New York: Continuum, 2008. p. 5

> "Correlationism consists of disqualifying the claim that it is possible to consider the realms of subjectivity and objectivity independently of one another."[148] What makes DeLanda's version of Assemblage theory so compelling, for artists, is that it asserts that so many processes, forces, entities and materials exist separately from human conception. Meillassoux makes two strong arguments for what he regards as a critique of a correlationist stance: A) the "arche-fossil" traces of ancestral life that came about prior to human life. If it is true that being can never be independent of thought and thought can never be independent of being then we would not be able to believe that something existed before human habitation. B) The "unwitnessed" is something beyond our cognitive grasp. As an artist who utilizes sensors, I realize that as we push the boundaries of the senses using detection equipment, we notice our own limitations as sensing beings. All knowledge is conditioned by our finite and even speculative apprehension of sensible qualities. This is also the case when we acknowledge that other organisms sense reality in different ways. For example a bat utilizes sonar, well beyond human perception, to sense its environment.

DeLanda's use of Assemblage mediates between two varieties of postmodernist thought: the playful and critical aesthetic of art, design and architecture, and the formal and technical math of set theory and topology inherited from the Deleuzian tradition. The one indulges, even celebrates, the contingent quality of contemporary life; the other hopes for an understanding of the structural principles of order and the chaotic nature of disorder within unpredictable events and processes. These strands are evocatively condensed in the ideas of Assemblage theory and are what gives it its power in contemporary cultural research. The emphasis of contemporary art discourse, at least since the linguistic turn, has focused on social history and psychoanalysis while engaging little in the philosophical or even psychological changes that have occurred over the last decade. As a means of redress, I propose an analytical approach, which illustrates how the artist has a responsibility to intuit issues concerning the direction of social and political power.

[148] Ibid, p. 5

As a creative practitioner, I am interested in a variety of ideas from many fields, favouring a transdisciplinary approach to my work. The promise of Assemblage, in its application to discrete fields, is that it breaks down disciplinary territorializing boundaries and allows components from disparate fields to coexist, and even falsify one another. Such differentiations have fostered a more comprehensive understanding of weather events, enabling an articulation of its effects. In contrast with postmodern practice, Assemblage theory does not attempt to discursively codify any one discipline as separate or discrete from another. Rather, it holds great promise for revitalizing the significance of other forms of communication in the arts, because it foregrounds material and expression as a way to mitigate linguistic dominance and provide new ways of thinking about practice, meaning and creative output. Artists, by default combine various processes, techniques, materials, and influences, to formulate a visual language through their work. Bearing this in mind it is important to understand these interactions as poïetic expression.

The Importance of Poïesis and Creativity to Assemblage Theory

Increasingly within Western culture, visual art, like any non-verbal or non-literary expression, is legitimated through textual deconstruction and semiotic critique, and therefore is invariably tied to external text-based disciplines such as philosophy and psychoanalysis. The criteria on which quality is judged are constantly shifting in relation to other fields, often ill-equipped to articulate non-textual, non-literal languages expressed through working process and material. This, in my view, seems to be the current predicament for artists, one that poses a serious threat to innovation because it deterritorializes a field born from poïesis and material experimentation. Knowing is as

much tied to working methods as it is naming through symbolic or semiotic means. Art practice demands an integrated sensory response. That is to say that often the quality of the work comes out of the way it is conceptualized in its making. The common ground on which Assemblage theory and the creative process can stand may be found in poïesis. This thinking through doing and doing through thinking is removed from the equation when non-practitioners attempt to frame artistic praxis within a history, tradition, cultural or social specificity. In this sense, poïesis is quite different from praxis, which has a kinship with wilful intentionality.[149] Both poïesis and praxis are generative, but the fundamental difference is that poïesis is a transforming encounter between the artist and their work in the unfolding conditions of art-making. It is by all accounts, an act of revealing through an unintentional act of unveiling. I contend that poïesis has a stronger bond with Assemblage theory because it pays attention to the complexities inherent in the diversity of materials and creative process. In the face of complexity one must give up control and then regain a semblance of control by attempting to seek out its intricacies. Much of the artistic imaginary is made up of the dream, intuition, the proposal and the mistake. In the process of making, one slip of the pencil can mean that new vistas, possibilities and predictions open up just as weather events can create new conditions for something to happen. Short-term and long-term effects are interconnected. The missed opportunity for many politicians and economists is that they only see the short-range functional aspect of praxis as progress rather than the larger deleterious aspects of cause and effect, particularly when we consider the changing weather patterns that are

[149] See Giorgio Agamben, The Man Without Content. Poiesis and Praxis. Georgia Albert, trans., Stanford, California: Stanford University Press, 1994. pp. 68-93

diverging from the historical record due to human agency.[150]

An example of how differences in time can be expressed as intertwined is elucidated when we imagine the relationship between praxis and poïesis. An instance of how praxis functions may be found in recent anthropological evidence, which suggests that complex tool-making activities have a relationship to the evolution of language as the same parts of the brain are activated by the process of making. A study conducted by Dietrich Stout, Nicholas Toth, Kathy Schick and Thierry Chaminade; demonstrated increased demands for effective visuomotor coordination of observed patterns in neurones. Results suggested that there was an overlap with language circuits, revealing that tool-making and language share a basis in more general human capacities for complex, goal-directed action.[151] The study documents one of the few moments when poïesis and praxis share the same time and space, and are analogous to aspects of poïesis where the subjects loose themselves in the unintentional aspects of making, while obtaining an intentional result—the stone tool. Similarly, in Affordance theory, the focus is on the interactive relationship between behaving agents and the systems in their environments.[152] In many ways there are similarities here to Actor Network theory in which objects become agents through their use. For example, if I rise from a chair and cross the room to open a door, I am simultaneously thinking about the affordance of pulling down on a lever to exit the room, which invokes memory processes (every lever I have ever seen and engaged is 'stored' in memory and at least, in part, recollected

[150] Martin Heidegger's term 'enframing' is applicable here as a criticism of anthropocentric pursuits where the world is used only for human consumption, reducing ontological existence to a calculative order. Hence, a mountain is not a mountain but a supply of coal and clouds are not clouds but a way to deliver irrigation through cloud seeding.
[151] See Dietrich Stout, Nicholas Toth, Kathy Schick and Thierry Chaminade, Neural correlates of Early Stone Age toolmaking: technology, language and cognition in human evolution. Philosophical Transaction the Royal Society. 2008.
[152] James G. Greeno, "Gibson's Affordances," Psychological Review. vol. 101, no. 2, 1994. pp. 336-342

through rote rehearsal and conditioning). The prediction is that the lever will turn, and its physical affordance will enable me to exit the room; both thought processes help to form the action.[153] Perception, in this case, is formed by action, and behaviour is altered through the engagement with objects.[154]

Poïesis, intuition and happenstance are all aspects that shape creation and perception. Such a creative strategy diverges when using a system that is more prescriptive, such as writing or numeracy. Conversely, free-form drawing employs inventive mark-making techniques to express everything from mood to detailed schematics. It is a responsive means to actively engage with the moment. In my works, the negation of specific themes and anthropological marks is intended to help enhance the viewer's imagination, empower their own potential creativity and allow for multiple readings. The works concern weather, yet simultaneously, they address many other things from the deep blues and blacks that conjure the night time firmament to the parallel existence of tiny cells. In each case my studio experiments involved multiple processes. Some required attentiveness; others were performed almost hypnotically illustrating how unintentional processes can yield unpredictable results. The *Climate Record* series, for example, were 'drawn' on a turntable. In these images, the process of utilizing a rotating device prevented me from seeing the image develop. The velocity of the turntable distorted my view of the application of paint, and I was only able to perceive the developing image as a line, rather than a dot pattern, until the turntable came to a stop. Such forces of creation, ones that involve movement and time, are emblematic of the way

[153] See Barbara Stafford, "Iconic Turn to Neuronal Aesthetics: Towards a Cognitive Image History," Lecture Series by Hubert Burda Stiftung. Felix Burda Memorial Lectures, 2012. https://www.youtube.com/watch?v=uwADtbuGmr4 accessed 14 July 2013

[154] See Juan Maria Songel, A Conversation with Frei Otto. New York: Princeton Architectural Press, 2010. pp. 88-94

we can only perceive a small fraction of what actually exists. This is also evident in the way we perceive difference at varying times.

A more concrete example in my work is one in which the conceptual dimensions of the image grow over time. The expanse in the *Dispersion* and *Climate Record* series of works exemplifies a space of growth that surrounds the image in a kind of *res nullius* of void in which the image floats. In the *Dispersion* series, the circular patterns suggest visual analogies to tornados, hurricanes or galaxies. Each following circular paths and becoming recognizable shapes within the swirls and eddies of variable atmospheric conditions. This leap from the grid, in my earlier circuit works, as a trope of conceptualism, to one of the broken circle and particulate compositions used throughout my practice, creates a syntax that allows for the osmosis of thought from one 'track' to another. The circle is not one continuous line but rather a series of orbiting patterns. It falls within a history of antecedent works such as John Whitney's film *Permutations* (1966) or Rodney Graham's *Coruscating Cinnamon Granules* (1996), or the work on cymatics (the study of modal phenomenon) by Hans Jenny in which sounds are made visible through the vibration of fine powders and sand on a thin metal ground.[155]

Assemblage Theory and the Work in *Conditions Variable*

Insofar as the studio work is integrated into Assemblage Theory I have opted for the use of assembled components. These components and particles that comprise my current practice are evident in the electronic sensory works, the sound works and the works on paper. This is not a unifying theme but rather a reflection of complexity. All of the works were produced simultaneously while working in the studio. Assemblage theory helped to

[155] Hans Jenny's text on cymatics influenced the work of Alvin Lucier and György Kepes.

focus my attention on non-anthropocentric themes such as weather, just as the sonic and visual research I was conducting in the studio informed my reading of the theory. My intention is that the work be in dialogue with the content of this paper without being controlled by its propositions. Although all the work I produce follows an environmental trajectory it is sometimes more literal and sometimes more abstract. I regard thematic work as just one of the many possible vectors—hence the term variable in the title of the exhibition. The term 'variable' refers to its future contingency of meaning as well as its diversity as expressed through different materials and compositions. The layering in the drawings and the overlapping of elements suggest a process of flux where the work is in dialogue with the sound and electronic sensory work.

Section 1: Atmospheric Works on Paper

As artists we have a role to play. In our creative practice we investigate and traverse territorial disciplines, adding complexities to arguments by way of extra-sensory critique, which includes gestural, olfactory, sonic or haptic descriptions not readily available to the writer or theorist through practice. As a creative producer the manner in which I am able to sense something is as important as what is being produced, which is part of an exchange between the producer and the material. The works on paper fulfill different requirements in the exhibition than the electronics or sound works, not just because they are different in terms of material, but because they can illustrate things that another medium cannot. A diagram will express information differently than a written description for example. The characteristics of each composition are unique in their own right; in many of the works the forms appear cellular while in others more chaotic. In *Carbon Composition*, ideas are articulated through the spacing of time and distance. Each

"biomorphic" cloud shape was created at a different moment or was part of another composition before being positioned; they are never completely random elements, but are also aesthetic choices.

Carbon Composition, 2013, acrylic on paper and carbon Paper, 18" x 24"

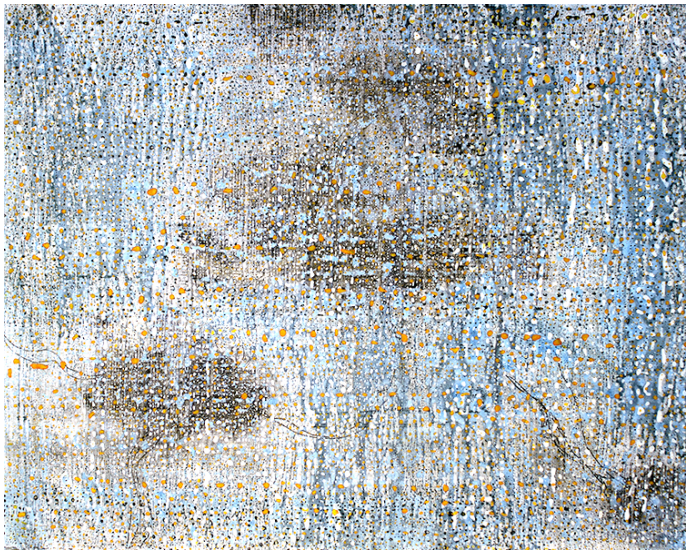
Simultaneously, systems within systems are evident within each biomorphic shape, taken out of another instance and placed in a new set of relations. Assemblage theory also provides the analogy of territorialisation, which implies a pre-existing condition of time (as movement and space) in order to deterritorialize another space. The forms are 'set' on a trajectory. As one form moves over another in the composition, they either integrate or become subsumed. In many of the drawings the combinations of paint particles are mixed, just as meteorological processes engender new conditions for the formation of clouds. Most of the works on paper reference clouds, yet the differences are nuanced. In the human-centered symbolic imagination atmospheric clouds represent ascension and the miraculous apparition. Conversely, the prototyping board, used in

many of the works, refers to the recent phenomenon of cloud computing and electronic modeling.[156] The cloud also has come into the modern imagination as something generated by the Anthropocene such as dust clouds, radiation clouds and chemical trails. Through our own creation comes a formlessness in the sense of a particulate pollution cloud that is continually shifting, suspended in the forces around it, combining in unpredictable ways with the atmospheric imagination. Such transitions and changes in morphology are described by the drawings more accurately than the sound work because we can see one shape melting into another. The territorializing of one of the last vestiges of 'primal' space is the desire to shape weather as it has been conceived in the geo-engineering of clouds, which alters twenty-first-century imaginative possibilities. These possibilities are referenced in the drawings that utilize electronic elements. In *Clouded Prototype I* the prototyping board is suffused with the paper over which it is placed as an indexical transfer rather than a trace. Metaphorically these atmospheric 'circuits' signal the unpredictability of atmospheric electricity: cloud-to-cloud lighting, static electricity, atmospheric ionization and sprites. These forms coupled with the 'empty' prototyping board suggest systematized configurations in standby mode waiting to be plugged in. In the works on paper every line drawn, due to the inherent conductive properties of graphite, becomes a conduit for an electrical charge since graphite itself has conductive capacities.[157] These drawing speak to the precarious situation we now find ourselves in

[156] Hubert Damisch, A Theory of/Cloud/ Toward a History of Painting. Stanford: Stanford University Press, 2002. pp. 198-199

[157] What is interesting to me is the material of graphite, which is on the verge of revolutionizing the microchip industry when processed as graphene. Carbon micro-particles can spontaneously rearrange at high temperatures to form onion-like structures in which the concentric shells are fullerene or giant fullerenes. This phenomenon reveals the dynamics of carbon "melting." When this happens, the nanoparticles of graphene form a structure only one molecule thick with the capacity to be 100 more times conductive than copper. In this work, the analogy to stormy weather and conductivity is a bridge between two worlds: between music/sound and drawing or between electrical engineering and meteorology.

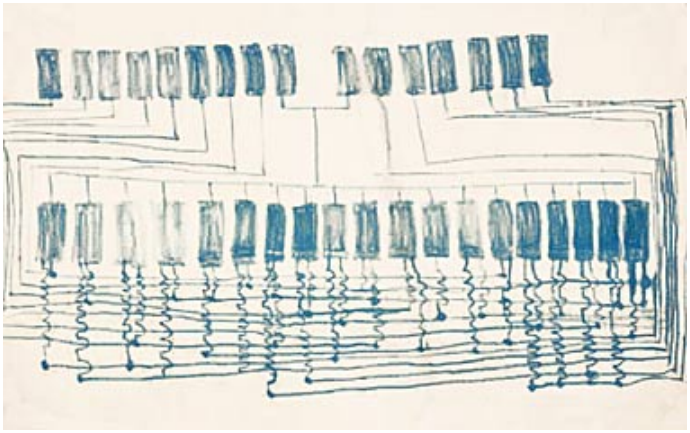
regarding human production, lifestyle and luxury, as it expands into every corner of the globe.



Clouded Prototype 1, 2012, graphite breadboard tracing, oil stick, acrylic and watercolour on paper, 19" x 24"

In creating the prototyping board rubbings I was 'drawing' connections between these works and Atsuko Tanaka's mid-1950s circuit drawings, in which the diagram expresses a functional system of circuits, and acts as a catalyst for an idea that may be realized in another form. In Tanaka's *The Electric Dress*, from 1956, the circuit drawing becomes a catalyst for a wearable device prefiguring electrical and biological sensory integration. In this sense, I am conceding that artworks exist along the lines of a meme as something that can forecast and prefigure aspects of cultural production. Tanaka's circuit diagrams resemble a blueprint for something to be physically achieved, or is representative of a bridge between two realities, the unrealized and realized work.[158]

[158] This new age of electronics production is also exemplified in John McHale's transistor collages exhibited in 1954, which visually codified the process of communication using the new invention of the transistor, which would revolutionize radio and computer technology.



Atsuko Tanaka, *untitled (Study for Electric Dress)*, 1956 colour pencil on paper, Deutsche Bank Collection

Electronics have a kind of miniature life of resistance and capacitance through which electricity passes, is held for later use, or is rerouted or stopped. Signals, pulses, increases and decreases in currents and flows are not so different from the electrochemical processes of memory connecting thoughts and impressions experienced differently, electrochemically. This is not dissimilar to Anton Ehrenzweig's diagram that explained the variances and complexities in the creative thought process exemplified in Chapter 2. It may also be the case that an impression is not an immediate manifestation of an action but a culmination of experienced events through an interconnected mass of networks and interacting components.

Section 2: The Atmospheric Recordings

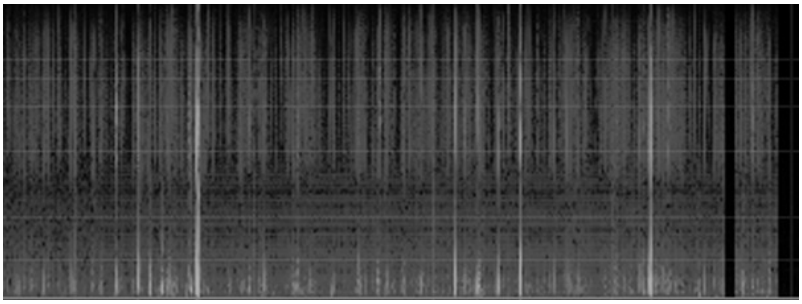
From 2011 to 2013, I made several very low frequency (VLF) recordings in southern Ontario and in the southwest desert of the United States. These locations were chosen for their clear reception of the magnetosphere. In more populated areas, electrical towers disrupt low frequency reception. It may be that sometime, in the near future, we will no longer have the ability to record the magnetosphere from the ground, as our world

becomes a noisier place at all spectrum levels. Unlike collage work or *musique concrete,* where fragmented materials are juxtaposed with one another, the paper works and expressions of sound embody a more pointillist and particulate identity. The VLF recordings have more in common with granular synthetic sounds than rhythmic compositions. In these instances intensity and density of interacting micropolyphony negate all attempts to differentiate distinct parts.

VLF pertains to radio frequencies in the range of 3 kHz to 30 kHz with wavelengths from 10 to 100 kilometres. Given the narrowness of bandwidth at this frequency spectrum, sounds of the environment, which operate at different frequencies, are filtered out and atmospheric sounds are emphasized. The sounds heard in the exhibition are caused by massive lightning storm discharges and subsequent after effects. VLF recording also picks up solar wind buffeting the Earth's magnetic field. Visible expressions of these events are displayed as the Australis and Aurora Borealis. The VLF receiver is also sensitive to what DeLanda refers to as phase transitions—positive electrical energies that focus into lightning.[159] My recordings are a document of these electromagnetic phenomena, which I have left unaltered. As an index, the VLF recordings are emblematic of a site (the limitations of reception, a 1000 km radius) with a defined duration (an edited fragment). In these recordings there are two territorializing aspects**.** The first is the range of the VLF receiver, which defines a boundary space. The second is the rebroadcasting in the exhibition space. This is symbolic of how reproductions have territorializing effects. The audio is included in the exhibition to

[159] There is no known date when VLF observations were first heard, although some speculate that it was not until the late 1800s. With the installation of continental and transatlantic lines, the first telegraph operators reported hearing peculiar sounds that they described as clicks and crackling noises. We now know this atmospheric phenomena was picked up by using their long telegraph lines, which functioned as antenna. Stanford VLF Group. Introduction to VLF. http://vlf.stanford.edu/research/introduction-vlf. accessed 3 March 2013

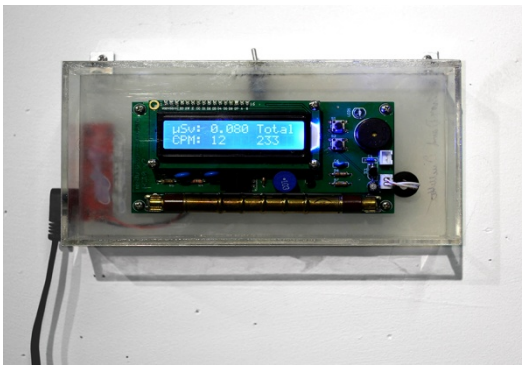
evidence its own unique signature within the larger coded discourse of weather and atmospheric activity. The sound becomes an actor among the *mise en scène* of expressive qualities in the exhibition like lighting, materials, and space.



VLF Recording #3, July 23, 2013, Spectrum Analysis (Segment), Fish Point, Pelee Island, Ontario

The VLF recordings help to deterritorialize the other works that are framed within a more familiar context such as the exhibition space. The detection of 'hidden' sounds, materials, elements, lighting conditions through sensing equipment, is part of a tradition of seeking out reality just as the traditions of painting have sought to describe visual phenomena. This idea of receiving signals also mirrors the audience's reception of the work, which may take on myriad interpretations based on the installation. These 'invisible' detections of electromagnetism become a way to think of energies and forces that did not enter the human imagination until the end of the nineteenth century. As we expand our knowledge of phenomena and create the repeatable experiments and apparatuses to detect occurrence, the once invisible forces of wavelengths (for instance) become an active and palpable part of our imagination. Phenomena enter our consciousness, not only through sensations, but through translated means (a photograph, a diagram, a math equation, or through the live capture of a detector) with the full force of their power as new knowledge. Sometimes this results in a paradigm shift or, at the very least, a new way of understanding the forces that surround us.

In the studio, I have all kinds of sensors: temperature sensors, motion sensors, VLF and voltage detectors, and photovoltaics. Each sensor is able to read an action, moment or object in a particular way, just as the paint pigments register moisture, colour and chemical interactions onto a sheet of paper. In science, the search for invisible forces is exemplified by the discovery of an increasing number of elementary particles. In biology we are just beginning to understand how organisms detect all kinds of frequencies, smells and colours of the electromagnetic spectrum where our human perception fails to register such differences. The VLF recordings offer a means to detect the phenomena that surrounds us, and perhaps influences our actions just a surveillance influences our behaviour. It is my contention that with the increase in sensory technology the ability to detect the ill effects of pollution and irresponsible power structures will be revealed.



Simultaneous Variable Sensing Device #1 (Geiger Counter), 2013, electronics, LCD, Geiger-Müller tube, 4"x 6" x 2"

Section 3: Sensory Work and Institutional Atmospherics

The *Simultaneous Variable Sensing* series of works consists of four sensing devices, which are set up to gather information about the exhibition environment. The four works consists of 1) a light sensor, used to measure light intensity (in mounting exhibitions such sensors are used to determine appropriate light levels so that works are not damaged); 2) a metal detector to recognize the metals in the electronics themselves; 3) a Geiger counter that is able to pick up particle radiation; and 4) VLF receiver that will identify the power line frequency of the building's electrical system. The creation of this work exemplifies an awareness of the hidden and potent forces that occupy space and coexist in a world that we regard as concrete and structured rather than problematized and variable.

In *Simultaneous Variable Sensing #1,* the Geiger counter detects ionizing radiation—alpha, beta particles and gamma rays. The Geiger-Müller cylinder has a wire running end-to-end through the inside. The cylinder is filled with neon. When a charged particle with high energy flies through the copper and glass tube, it knocks electrons out of the atoms of the gas. These electrons, being negatively charged, are attracted to the thin positive wire anode. The 'damaged' atoms, which are positively charged inert gas ions, are attracted to the negatively charged cathode (the outer shell of the tube). The

electrons cause what is known as a "Townsend avalanche," and are attracted to the internal, positively charged wire. Close to the anode in the avalanche region the electrons gain sufficient energy to ionize additional gas molecules and create a large number of electron avalanches, which spread along the anode and effectively throughout the avalanche region. This 'gas multiplication' effect gives the tube its key characteristic of being able to produce a significant output pulse from a single ionizing event. Finally the charge is detected as a pulse of electric current, indicating that a charged particle has passed through the tube. This charge is detected by an electrical pulse and registers on the display, LED and piezo speaker.[160] In this sensory work a modern device detects an ancient event, as technology increases in sensitivity to phenomena as a real-time indexical account of the site in which it is placed.

Simultaneous Variable Sensing Device #1, #2, #3 and #4 symbolically reference hidden forces, be they political, economical or institutional, realized as assembled electronics. The assembling of global electronics are indicators of what I term a 'technontology'—a lived experience of assembling, using, disposing of and/or reusing electronics. This term offers up a way to describe global technophilia, surveillance subterfuge and the attendant invisible forces of unseen labour and environmental degradation.

As natural resources diminish, the environmental surveillance of the energy sector by individuals with the means to share information is on the increase. The failure of political systems, as they collude with financial and economic incentives, is critiqued in

[160] Each ionization event creates a large chain reaction that gives the same-sized pulse regardless of the radiation's original speed or energy. The registration of the particles is an indexical real-time event. The level of radiation is expressed as an amount of radiation in a unit called sieverts and given the symbol (μSv). CPM represents the average counts per minute by the sensor itself.

this work on one level. As Assemblage theory embraces complexity, it follows that it may have a potential to grapple with some of the policy-making problems that are already plaguing our current "costs of doing business." Through modelling complex scenarios based on variable and diverse data, Assemblage theory may act as a means to bypass out-dated political processes, which are unable to consider long-term catastrophic effects such as those witnessed at Chernobyl, the site of BP's oil spill, and more recently, the Fukushima incident.[161] In these sensory works I purposely expose some of the circuitry to reference the open-source nature of electronic kits and hacking in opposition to the secrecy of corporate and state-sanctioned science. This subtle gesture references the empowerment of the creative individual and acknowledges it as a component of reskilling.

Apart from its use in the gallery, each apparatus is linked to specific tasks. For instance, the Geiger counter in the exhibition was initially designed for domestic purposes, to track the radiation that spread from the Fukushima Nuclear Power Plant. As of this writing, radiation is now traceable on the West coast of Canada with high levels leaching into the Pacific Ocean off the coast of Japan. This contamination represents the spread of disastrous consequences, dispersed in the winds of global weather systems and ocean currents as a result of a desire for increasing amounts of energy.

Today we have real-time systems of reporting in the form of weather forecasts through Doppler radar and satellite imaging technologies, surveillance cameras, and social media reporting amongst others that together give a more complex account of an event. One may only speculate on the future of simultaneous sensing apparatuses. Burnham's notion of real-time systems resonates with the increased use of technology

[161] It should be noted that the artist and sociologist John McHale wrote The Future of the Future, in 1968, which presented a vision of the earth being organized through a criteria of ecological efficiency and productivity. See Charlie Gere, Art, Time and Technology. New York: Berg, 2006. p. 121

and consequently our ability to more accurately predict events. According to scholar Charlie Gere,

> Burnham imagined the role of the artist as also giving the public 'real-time information, information with no hardware value, but with software significance for effecting awareness of events in the present.' He suggested that this would lead to a situation in which 'the most important artist best succeeds by liquidating his position as artist vis à vis society.' Burnham was unusually prescient, but even he could not have foreseen the rate at which real-time and network computing was developed and has become part of everyday life.[162]

Assemblage theory offers criteria that the artist may employ through the use of territorialization, deterritorialization and notions of interiority and exteriority to gain insights into how cultural practice is connected to and effects other systems. In some sense the criteria operate like Burnham's notion of boundary concepts. "Conceptual focus rather than material limits define the system," Burnham argued,

> Thus any situation, either in or outside the context of art, may be designed and judged as a system. Inasmuch as a system may contain people, ideas, messages, atmospheric conditions, power sources, and so on, a system is, to quote the systems biologist, Ludwig von Bertalanffy a "complex of components in interaction, comprised of material, energy, and information in various degrees of organization." In evaluating systems the artist is a perspectivist considering goals, boundaries, structure, input, output, and related activity inside and outside the system. Where the object almost always has a fixed shape and boundaries, the consistency of a system may be altered in time and space, its behavior determined both by external conditions and its mechanisms of control.[163]

By definition these kinds of processes fit with the sociological and philosophical musings of Assemblage theory, particularly considering DeLanda's axis of territorialization and deterritorialization we can draw parallels to boundary-making. It is possible that all defining terms that differentiate and classify are really identifying the

[162] Ibid, p. 137
[163] Jack Burnham, Great Western Salt Works: Essays on the Meaning of Post-Formalist Art. p. 17

boundaries of systems of various disciplines in an attempt to divide and professionalize each field. This is done in a manner similar to the way the attractor and adaptation systems forge relations between entities as elucidated by the wasp and orchid. Perceived and tested benefits of association become grounds for maintaining territorial sympathies.

Assemblage Theory, Weather and Complexity Theory

Complex behaviour arises from the inter-relation, interaction, and inter-connectivity of elements within and between systems and their environments. The root of the word *plexus* means to be 'entwined', from which complexus—'braided together'—derives. Expounded upon in Chapter 2, in relation to the work of Kepes and Weiner, Complexity theory was an outgrowth of cybernetics, artificial intelligence, and Systems theory since the 1940s.[164] More recently, Assemblage theory also takes into account the intertwining of elements of social organization, which is most evident in relation to DeLanda's ideas on social complexity. As he remarks,

> To give a complete explanation of a social process, taking place at a given scale, we need to elucidate not only micro-macro mechanisms, those behind the emergence of the whole, but also the macro-micro mechanisms through which a whole provides its component parts with *constraints and resources,* placing limitations on what they can do while enabling novel performances.[165]

In this social iteration of complexity we can think of interactions between social agents as elaborate behavioural conditions acting upon one another. From the outset, Complexity theory was devised to analyze constituent parts and study interactions and reactions with

[164] Norbert Wiener (1894–1964) was an American mathematician who established cybernetics as a precursor to Complexity theory. "Wiener began research on stochastic, or random processes such as Brownian motion, including work on statistical mechanics and Ergodic theory (which is concerned with the onset of chaos in a system). Other areas that he advanced were integral equations, of a kind now known as Wiener integrals, quantum theory and potential theory." David Millar, Ian Millar, John Millar and Margaret Millar, eds., The Cambridge Dictionary of Scientists. Cambridge: Cambridge University Press, 2002. p. 376

[165] Manuel DeLanda, A New Philosophy of Society: Assemblage Theory and Social Complexity, pp. 34-35

other component parts, in the hopes that it would tell us something about the ways in which entities functioned and adapted, even if in a state of entropy. In these entropic states, entities never resolve themselves, but are in a state of flux that also never seems to completely dissolve into turbulence. They are liminal.

Complexity is central to my work because it affords connections between things such as biodiversity, meteorology and physical matter. Such a realization is key to understanding how perception works, in us and in other organisms, so that we may apprehend, in a much more refined way, the interactions between life and matter. Artists are pivotal figures in this equation. It is often the case, while in the process of creation, that new information from other fields is gleaned, recombined and recounted to shape one's work. In my works on paper, for example, a number of decision-making processes are at play, because the images oscillate from wave patterns to crop circles, tree rings or solar systems—all of which simultaneously reference their imagined affective and material differentiation as much as their semiotic interpretation. When considering the work, one may imagine a hailstone in relation to ice or a tree ring in relation to wood. Such imaginative leaps fold into one another inflecting the texture and shape of the experience within a larger sphere of experience.

As a producer, I reference particular periods of production and themes, as the œuvre itself morphs based on the influences in my life, although the compositions themselves may also allude to events, phenomenon and things often unseen. The interchange of weather patterns, electromagnetism and the particulate environments of atmospheric forms are confounded and rife with loose ends. Each of these complex phenomena is increasingly situated against the backdrop of industrializing processes of

electrical grids, energy production and the organizational complexes of militarism, economics, transportation and communications. The drawings revolve around many of these themes that delineate and comment on scientific histories through the study of cloud nomenclature. These environmental concerns do not address any particular issue; rather the theme of the exhibition is a force of its own. It only requires a sufficient amount of energy by the artist and people interested in the connections to give rise to debate.

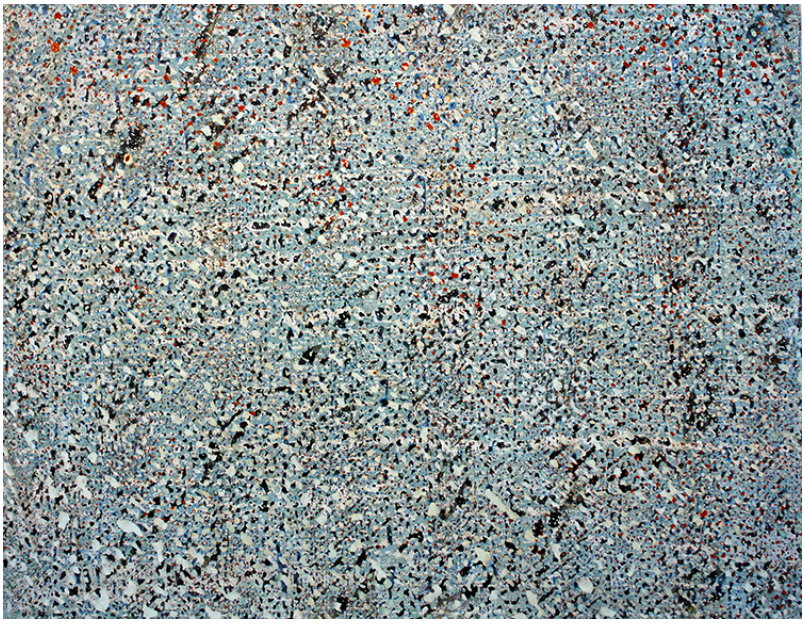
The sociocultural complexity of art education and practice, discussed in Chapters 1 and 2, are indicative of how artists and institutions have responded to the changing tides of technology and scientific knowledge, not to mention the organizational flux of the nation state and its economic policies. Between industry and the nation state, the control of academic pursuits, to service the wider sphere of industry, labour and militarism, served to divide science and the humanities even further from disciplines that have similar concerns (neuroesthetics and art for instance). As they occupy more of the human imagination, the scientific postulates efface our conceptions of reality while simultaneously offering new avenues for artistic investigation. For example, the principles of design, articulated at the Bauhaus, became a systematic method for integrating artistic practice into social life through functionalism and an interest in Gestalt psychology; similarly, computational systems and datasets were used in tandem with technology and rule-making as described in Chapter 2 to bridge new forms of data-driven description and artistic practice. These latter methods cemented the relationship between conceptual art and the organizational complex, its language and the prescriptive labour of

capitalism—at least as it was envisioned in America.[166] Burnham's Systems Esthetics developed in tandem with a critique of the larger systems of organization such as auction houses, galleries and dealers and the art market values based largely on stylistic trends.

The adoption of a style by artists has often been used to exploit the possibilities of a line of inquiry, but the market takes on a different dimension creating a canon/movement within creative practices, which at times seems arbitrary. Style therefore becomes a means to unify work and identify a practice as well as to foreground a territorializing boundary through resemblance in the work. The problem with how artistic systems, styles, or even tropes have been formulated is that they tend to enshrine (as do ideologies) a way of thinking about and representing reality. The market also plays into the ability of the artist to access materials (standard paper material sizes and particular brands of ink) and the adoption of some cultural meme regarding process traditions of ink painting for instance. These are also historical and territorializing elements**,** derived from an economic system of affordability, supply and demand, marketing, competition and manufacturing processes. Artistic styles reinforce lines of inquiry through the repetition of defined formal rules, which have less relevance today when we account for different organizational dynamics within science, environmental practice and their attendant political dimensions. Meteorology, for example, encompasses a large number of variables and scientific pursuits such as computer forecasting, radar tracking and record-keeping, which simultaneously activate political and economic lines

[166] It is also evident that the very notion of determining the aesthetic "worth" of a work of art came from a questioning of value within the art market itself. This followed a sub-set of decision-making factors that are based on individual beliefs extending to institutional, sociocultural and political support systems that also shape the way works play-out. This is also part of the conceptual art critique, which is nevertheless embedded and subject to art market economics no matter how much it attempts to distance itself. Examples may include how artistic practice is promoted through university presses and legitimized through credentialing and how the production of a work is disseminated to a wider student population and promoted to a wider audience.

of inquiry. By focusing on this as subject matter, I am proposing an alternate answer to the question of what art can be as an intellectual pursuit. The paintbrush and pencil can act alongside detection equipment to produce, to report or to complicate their readings. An example, in my work, resides in the *Clear Weather Ahead* series, for which I used a technique of layering paint in one direction, disrupting the image by adding a layer of paint in the other direction. The evidence of directional pattern and specific colour use disrupts, if not completely obfuscates, the underlying surface through successive applications of paint. In political spheres, this strategy of interference is often referred to as 'optics'—an act of camouflaging topical issues to promote differing agendas that attempt to destabilize new possibilities through deflection.



Clear Weather Ahead 1, 2011, acrylic and oil stick on paper, 19" x 24"

Although the surface is comprised of multiple layers of paint, the image is more reminiscent of an all-over composition than that of complex interactions, until the viewer examines the way in which the paint adheres to and resists the surface. What appears at

first to be noise is ironically comprised of a successive use of the grid, which is more readily seen from a distance. The proximity of the viewer to the work takes on an important role in terms of recognition, memory and duration. In many of the works on paper the depth of the picture plane is unclear—moving in and out of focus—an expression of liminal, temporal or ethereal conditions. Such occurrences in the creation of the work are suggestive of DeLanda's phase transition, the moment when critical differences between intensive processes such as temperature, speed, and pressure, occur and completely transform themselves into another state. The title of the work, *Clear Weather Ahead*, references the, often unheeded, warning of major climatic changes, such as we are currently encountering. For example, levels of atmospheric carbon dioxide have recently surpassed any previously recorded.

Attractors

DeLanda's articulation of deterritorialization and territorialization proposes that in complex arrangements, small catalysts can cause large changes. One alteration in an area of a system may adversely impact another area of the system. Formally, interference becomes an attractor because its ambiguity prompts our evolutionary propensity to search for, define and clarify an image as something recognizable and associative—to stretch the imagination and conduct experiments. As DeLanda asserts,

> The key is to think of phase space as a space of possibilities; attractors represent dynamic spaces where special places in this space trap systems and hence reduce the number of possible behaviours. It is this reduction that we as observers see as the emergence of order. If a system wanders all over phase space, it would look to us as random, but if its behaviour is pinned down to a few states, then it will look ordered…. Also, attractors trap systems in a completely deterministic way (they are destinies for the system) yet because they always come in bunches, there are always

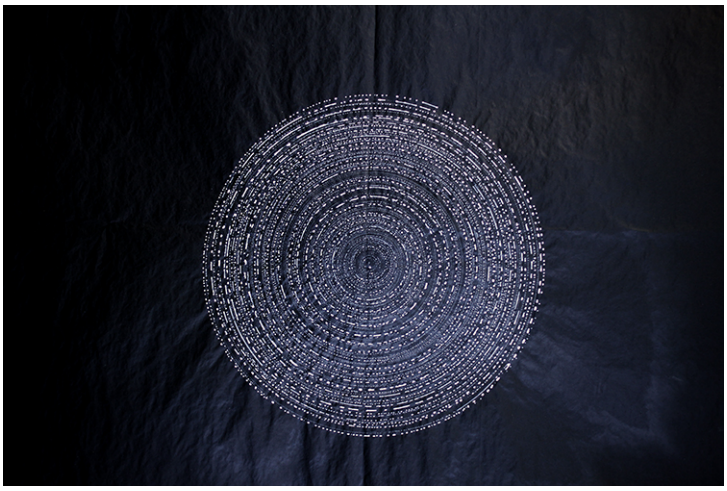
alternative destinies.[167]

The physicality of my work bears this out. The droplets of paint play a primary role as something that drops onto the paper and is resisted by the prepared surface. However, the paper reacts to the paint and water materials being applied by undulating and changing the trajectory of the paint droplets. Hence, the paper ground becomes a vehicle by which to demonstrate attraction and resistance and by extension material territorialization and deterritorialization. In terms of a more political reading it may be analogous to the introduction of a new idea that meets resistance forming alternatives, unforeseen propositions, where forces that we are unaware of shape the effects. Attractors, however, may be sympathetic or empathetic. In genetics, attractors exist in nucleotide bonds or in chemistry through forces that bring molecules together.[168] In electricity, magnetism may exist as an attractive force; meniscus (or water surface tension) also functions as an attractor. Everything from gravity that attracts mass to the functioning of pheromones in biology—are forces in a larger sea of life-forming or emergent possibilities. This is of particular interest with regard to my *Dispersion* series, when considering the paint droplets that bind, pool, and create small, territorialized spaces as the waxy surface of the carbon paper resists or absorbs each layer. Such forces act to 'draw in' my forms at various points in the creative process: gravity; the angle of the paper; the rate of water absorption and the distortion it creates on the surface of the paper. Each force plays its part as an element that effects the final image. Additionally, pools of pigment on the

[167] Manuel DeLanda, interviewed by Brett Stalbaum, "Manuel DeLanda: Metaphor & Phase Space," SWITCH. vol 3, no 3. 1997. Worldmake, San José State University, http://worldmake.blogspot.ca/2006/04/manuel-de-landa-metaphor-space.html. accessed 22 November 2013.

[168] On a molecular level, water is bonded and attracted in different directions as the result of three main forces of chemistry. In dipole-dipole forces, the attraction is between the positive end of one polar molecule and the negative end of another polar molecule. In hydrogen bonding, the bond is a type of attractive (dipole-dipole) interaction between an electronegative atom and a hydrogen atom bonded to another electronegative atom. Finally, the London dispersion force is a temporary attractive force that results when the electrons in two adjacent atoms occupy positions that make the atoms form a temporary attraction to each other.

surface form in various places because of the force of the paint or ink sprayed in a mist that descends onto the paper.



Climate Record 1, (carbon paper series) 2013, acrylic on carbon paper 18" x 24"

In my recent carbon paper works, carbon itself became a means to subtly suggest a connection to the carbon cycle and weather cycles by way of the Earth's rotation**,** but there is also the allusion to a drop of rain in a puddle or the expansion of a source of energy, each iteration remaking itself in a unique context within the studio. In my investigations of the carbon paper ground, I realized, almost by accident, that the wax-coated paper had the same qualities of resisting the water-based paint that my prepared oiled surfaces had—an operation that could only be discovered through poïetic engagement. In the making of these works there was no way to predict what the carbon paper would do except by testing it in the workspace. There is also some irony inherent in these material choices since carbon paper was originally made not to make copies but to provide a means for the visually impaired to write with the aid of a machine.[169] But rather

[169] Author Kevin Laurence remarks that in the early nineteenth century "the 'Stylographic Writer' was intended to help the blind write through the use of a metal stylus instead of a quill. A piece of paper soaked in printer's ink and dried, was then placed between two sheets of writing paper in order to transfer a copy onto the bottom sheet. Horizontal metal wires on the writing-board acted as feeler-guides for the stylus and presumably helped the blind to write." Kevin

than copying something onto another sheet of paper, I've used the carbon paper as the surface on which to create a series of ink drawings and acrylic paintings. The fact that these works exist on a surface originally designed for replicating textual information is an important aspect of the work as it resists the specificity that text seemingly wills into conception. In this way it signals a new exchange between different types of cultural production where visual and material properties are emphasized. My works on paper, although not overt statements against a particular environmental problem, point to an increased awareness I sense within what is now termed the Anthropocene. This awareness relates more to the current predicament of having to come to terms with climate change, overpopulation and habitat depletion. My works on paper circumscribe events, which our senses are unable to differentiate. The slow-moving events of climate change that are at once complex and invisible to our temporal imagination, find a home in the recording and reporting of the archive imagined in the *Climate Record* series, which has its analogue in the tree rings and ice core samples that record short-term events made more visible through the analysis of long-term data.

Duration and Assemblage

For philosopher Henri Bergson, incremental time as an immobile, complete line with discrete points is conversely mobile and incomplete. We now know from cognitive science that seeing is not a direct register of our conceptions, but rather a fast mental construction that squares sensations with memory and desire. For the individual, the perception of time may 'speed up' or 'slow down' depending on one's situation or state of mind; whereas, scientifically speaking, time remains a consistent incremental measure.

Laurence, "The Exciting History of Carbon Paper!" www.kevinlaurence.net/essays accessed 25 May 2013. Also see Michael H. Adler, The Writing Machine: History of the Typewriter. London: Allen and Unwin, 1973.

Engaged in the act of creation, the artist is not necessarily 'in' any specific moment; but rather between poïetic states. Rather, creation is the result of happenstance, intuition, memory, surprise, subtraction and summation even when inculcated in a very limited formal system. We see this systematization in Sol LeWitt's instructional wall drawings where the artist becomes the authority to direct an activity, and where the interpretation of the instruction plays out in myriad ways.

In contrast to this directorial approach I opted for a more direct, slow-moving investment of time, resulting in the painted and drawn works. The works on paper in the *Conditions Variable* exhibition allowed for the thought process to be prolonged. It would be difficult, perhaps impossible, to account for all the sensory factors which allow the work to emerge, let alone the factors that play out in one's life that influence practice—yet they nonetheless reside in the culmination of a work of art, which points to a certain amount of causation. Here, intentionality and causality must coexist, just as the forces that gave birth to Assemblage theory were generated from notions of multiplicity.[170] Bergson posits that multiplicity, which includes duration, is something that is continuous and discrete, and in this way it is both qualitative and quantitative. In philosopher Michael R. Kelly's text Bergson and Phenomenology he argues:

> For Bergson, duration is a qualitative multiplicity—as opposed to a quantitative multiplicity. In Time and Free Will, we find several examples of a quantitative multiplicity; the example of a flock of sheep is perhaps

[170] If we examine mathematician Bernard Riemann's postulates regarding magnitude we immediately recognize the influence on Bergson. For instance, any measurement might be applied to various phenomena—it has multiple applications in different instances. We can imagine the degree to which something is salty or sweet, loud or soft, hot or cold, all are described by Riemann as "magnitudes." In DeLanda's theories we can identify this same concept in what he refers to as "intensities." Riemann goes beyond these "magnitudes" by defining two types, those that change continuously and those, which change in discrete surges. An example in music can be found in the playing of a guitar. When the stings are plucked or strummed in combination there are discrete notes or more flowing sounds. And here we can see parallels in Bergson's discussions regarding duration as being discrete or continuous. It is also the case that Reimann's notion of measuring curved space found its way into the philosophy of Deleuze by way of topology, breaking with the Cartesian view of three dimensional coordinate space.

> the easiest to grasp. When we look at a flock of sheep, what we notice is that they all look alike. Thus a quantitative multiplicity is always homogeneous. But also, we notice that we can enumerate the sheep, despite their homogeneity. We are able to enumerate them because each sheep is spatially separated from or juxtaposed to the others; in other words, each occupies a discernable spatial location. Therefore, quantitative multiplicities are homogeneous and spatial. Moreover, because a quantitative multiplicity is homogeneous, we can represent it with a symbol, for instance, a sum: '25'. In contrast, qualitative multiplicities are heterogeneous and temporal; this is a difficult idea since we would normally think that, if there is heterogeneity, there is juxtaposition. But, in a qualitative multiplicity, heterogeneity does not imply juxtaposition (or it implies juxtaposition only retrospectively).[171]

This description is particularly useful when considering the concepts of 'virtual' and 'actual'. Qualitative differences are virtual and durational, while quantitative differences are actual. Quantitative numbering concerns separation as it relates to space. Qualitative multiplicity, at least for Bergson, relates more to duration as something that has not yet occurred or has already happened and continues to change and morph. Similarly, differentiation may be seen within a series of individual drawings, which, although they may be numbered sequentially or otherwise quantified, continue to be differentiated in terms of their individual mood or the contextual climate in which they were created. Moreover, the differences in approach and theme, which were considered in their creation, were also factored in the aesthetic result. We may think of serial work as being quantitative, accumulating or diminishing in some sequence of counting and similarity, and qualitative work as consisting of duration created through the effects of process within more individualized works that may be discerned from one another.

To simplify Bergson's concept of duration, we can use an often-cited example of a series of notes played in succession. When one remembers the melody and then has it

[171] Michael R. Kelly, Bergson and Phenomenology. New York: Palgrave Macmillan, 2010. p. 36

immediately played back with a discordant note it becomes noticeably different. If one remembers a melody from long ago the recollection of that melody is not spatialized by succession in the same manner as something more immediate. In our experience defined by Bergson, different moments are not separate, but penetrate each other. This permeability represents part of an overarching theme of memory, recall, aesthetics and quality that plays out differently in musical composition than within the realm of sounds in general.[172] Everyday sounds are indications of material interactions. Sound duration, in this instance, is less mediated through human intentionality as sounds that have no prescribed rhythm and no determined interval except through the material interactions themselves. The intentionality of composition and arrangement are not present in the same way a composer might attempt to separate different instruments to perform specific instructions. The difference between 'everyday sounds' and 'musical sounds' is more evident because the epicentre of the vibration in a 'musical sound' is often concealed, like the strings in a piano where the spring steel is stretched to exhibit different properties than the elemental properties of metal. Take lightning for instance, where the instantaneous heating during a return electrical stroke causes the air to explosively expand, producing an immense shockwave heard as thunder. Its unpredictability creates a chaotic mood—a surprise attack on the senses. The analogy in my material practice resides in the work that concentrates on more simple interactions between two mediums, namely the compositions where ink is applied to carbon paper in a more minimalist tradition; in this way materials are expressed over the aesthetic composition.

[172] Henri Bergson, "The Multiplicity of Conscious States: The Idea of Duration," Time and Free Will: An Essay on the Immediate Data of Consciousness. F.L. Pogson, trans., London: George Allan and Unwin, 1910. pp. 75-139

Assembling a History of Weather and Atmospheres

The influence of atmospheric phenomena on art can be seen in a plethora of historical precedents. Examples from art history include the early deluge drawings of Leonardo de Vinci and weather spectacles of the European sublime from the Romantic period. Past visual depictions of weather have been used to generate different effects. For instance, some weather tropes in the history of painting used atmospheric perspective to create depth or drama. These effects are often seen in the paintings of William Turner and the drawings of Victor Hugo. Yet other formal methods in which haze or clouds have been used to obfuscate parts of the scene are used in the works of Impressionists such as Claude Monet. In all cases, these depictions are illustrative of the periods they inhabit. Together, they share the drama of atmospheric conditions in flux. According to philosopher Hubert Damisch,

> The painters of the past were able to express the quality of the sky, but did not seize upon its truth, for they did not perceive the calculated connection between the blueness of the atmosphere and the whiteness of the clouds, the regulated setting in which clouds were distributed in three different regions, three scenic systems, each of which corresponded to a specific formal datum: a central region, the only one to which earlier painters (in particular the Flemish) had paid attention; an upper region that Turner made his favorite domain, opening 'to the world another apocalypse of Heaven'; and finally a lower region, that of rain clouds and mists without form or consistency, where modern painters excelled.[173]

Artists of the nineteenth century often painted out of doors, to capture the differing 'moods' of nature, keeping a set of sketches and studies of the same viewpoint in differing weather and light conditions so that they could better describe, in paint, their observations of the landscape.

By the 1880s atmospheric phenomena took on new dimensions as artists became

[173] Hubert Damisch, A Theory of /Cloud/: Toward a History of Painting. pp. 186-187

fascinated by electromagnetism. First identified by scientist Heinrich Hertz, based on experiments by physicist James Clerk Maxwell, classical electromagnetism became the grand discovery of the nineteenth century. By 1912, futurist Filippo Tommaso Marinetti declared that we had entered into an era of the 'Wireless Imagination'. This became the moniker of the limitless possibilities offered by the new technologies associated with electromagnetism.[174] Around the same time Marcel Duchamp's interests in scientific observation, meteorology and wireless telegraphy foreshadowed a paradigm shift from written to electrical telegraphic communications. We now live in an age in which connectivity is unparalleled, ubiquitous and pervasive. In Lucy Lippard's 1971 essay on dematerialization she stated that,

> Among the issues raised by Duchamp and still valid and continuing today are: his *Dust Breeding*, 1920; his *Hidden Noise* ready-made, 1919; his string installation of the 1942 Surrealist show; his preoccupation in the *Large Glass* with shadows, with perception and the cinematic, with invisible, conceptual structures that connect by association or 'electricity'.[175]

During the early twentieth century, a host of new technologies were developed to help bridge previously undocumented forces. Edouard Branly, for instance, developed the first wave detector; Nikola Tesla invented the first oscillation transformer; and Guglielmo Marconi developed long wave transmission. And soon artists capitalized on these developments in their work.

Duchamp realized telegraphy's importance as the twentieth century ushered in

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[174] Linda Dalrymple Henderson, Duchamp in Context: Science and Technology in the Large Glass and Related Works. Princeton: Princeton University Press, 1998. p. 99 I am surprised that the Bauhaus and New Bauhaus were less interested in the sonic possibilities of radio transmission and electromagnetism, particularly since many early theories and experiments were German developments. Indeed, physicist Heinrich Hertz made possible the development of radio, television and radar by proving as early as the late 1880s that electricity could be transmitted in electromagnetic waves. This is also surprising when one considers that artists such as František Kupka and Marcel Duchamp were already looking at these new technological developments and utilizing them long before the inception of the Bauhaus in Weimar in 1919.

[175] Lucy Lippard, "Changing: Essays in Art Criticism," The Dematerialization of Art. New York: E.P. Dutton and Company, 1971. p. 269

new imaginative possibilities. His scientific curiosities are adeptly illustrated in the *Large Glass* from 1915-23 (formally titled *The Bride Stripped Bare by Her Bachelors, Even*). Many attempts have been made to decipher Duchamp's *Large Glass*, including Burnham's religious and coded sexual reading of the work from 1972.[176] Art historian Linda Dalrymple Henderson offers a more scientific reading of the work, based on her research of Duchamp's *The Green Box* notes and interviews, which provide particular insights into his interests.[177] "Developments in wireless telegraphy during the early years of the century assured continued fascination with the world of electromagnetic waves," she argues. "Anyone attuned to contemporary culture in the early twentieth century realized that a fundamental aspect of reality had been redefined as a realm of vibrating waves of varying frequencies."[178]

Duchamp's early interests coincided with the transmission of voice. In the *Large Glass*, everyday occurrences blend with the unusual invisible and surprising discoveries that helped occupy the social imagination, just as environmentalism seems to populate the imagination of contemporary living. In the creation of his work, Duchamp often utilized images and materials in formal and intellectual ways, selecting materials in order to mimic the processes of electrical engineering, such as the looping of wire on a grindstone image, which has its double in the winding of an electromagnet. Each visual and material element is combined to act as a catalyst for thought. The resulting work is much more than an analogy or visual metaphor; it allows the viewer to step outside of

[176] Published in three issues of Arts Magazine from March through May 1972. *Large Glass* (1915-22) served as an architectural model for the installation of Burnham's exhibition *Software* at the Jewish Museum in New York in 1970.
[177] In 1934 Duchamp published "The Green Box," a collection of 94 documents elaborating on *The Large Glass*. The notes were left loose so that the reader would discover them in an undirected way. This box contained the scientific and technological ideas that informed his creative process; for example, the fourth dimension, atomic theory, X-rays, radioactivity, electromagnetism, the laws of chance, classical mechanics, thermodynamics and physical chemistry.
[178] Linda Dalrymple Henderson, Duchamp in Context: Science and Technology in the Large Glass and Related Works. p. 100

scientific discourse, to examine it within a range of other possibilities. Here I am speaking about the social, cultural, economic and political order that often enshrines, enables, and facilitates technological progress. In this sense, Duchamp's *Large Glass* operates much like Assemblage theory, eliciting wider, more complex, readings.

It is this full engagement with systems, ideas and intuitive sense that makes the work more interesting, as a response, and perhaps as a reflection of the way we view reality. For instance, the fracturing in *Large Glass* creates conceptual outcomes—not merely a physical likeness to something other, lightning for example. The work also stresses material expression. The physical break in the glass impedes the viewer from seeing through it; the viewer's sight is instead entirely directed by the break itself. The physical break is a prime example of the artist meeting the material halfway, as a poïetic act using the properties of the glass to great effect. Remarking on the glass portion of Duchamp's work, philosopher and artist Donald Shambroom notes that,

> Cracks travel, but never in a straight line. They are always slightly deflected, but a crack that starts at one edge of a sheet of glass will hardly ever stop until it reaches another edge. Cracks in glass have virtually no physical dimension. They are breaks in the molecular structure made visible. For several years Duchamp was a glass painter, and three of his four works in this medium are shattered. He would say that these transparent paintings were not broken but merely "wrinkled," and even enhanced, or "brought back into the world," by the new linear designs that accidental falls or jolts had imposed upon them.[179]

Duchamp also used glass as a way to seal in pigments to prevent oxidization thereby preserving the image. He understood the chemical reactions that take place in the aging of the work. On a sociological level the glass ceases to function. The split between the realm of the bride, as domestic figure, and that of bachelors gathered and controlled in a

[179] Donald Sambroom, *Marcel Duchamp and Glass*. www.Toutfait.com The Marcel Duchamp Online Studies Journal. ASRL/PERPETUAL 1999. accessed 7 June 2013. Author Lawrence Steefel writes "As Duchamp remarked to me in 1965 the cracks brought the glass back into the world. When asked where it had been before this he threw up his hands and laughed." See Lawrence Steefel, The Position of *La Mariée Mise à Nu Par Ses Célibataires Même*. Ann Arbor: Xerox University Microfilms, 1975. p. 22

mechanical apparatus, are roles that seem less relevant today. The scientific nature of the work, however, is a different story. Duchamp was interested in all manifestations of scientific inquiry including: the use of electricity on helium, argon, neon, krypton, xenon, and radon.[180] Henderson elucidates some of the social and technological assemblages that Duchamp was engaged in during his life, shifting from the often referenced Kantian relationships that Duchamp had with regard to the question of what qualifies as art to those of equal importance regarding the work's relationship to science.[181] Citing the indexical relationships in Duchamp's work, Henderson observes "An index, like a footprint or a weather vane, functions as evidence of another phenomenon, such as the presence of another person or a gust of wind. Duchamp's wave detectors in the *Large Glass* can now be seen as indexes of electromagnetic waves."[182] Thus, the work expresses the relationship between visible and invisible worlds.

In my own work, such relationships play out in the tactile engagement with materiality, since one must be physically present to produce an indexical mark. In the prototype board works, there is the transfer of the board into the paper through frottage, but the electrical connections are missing, suggesting some potentiality. Ironically, the prototype board is something that is obsolete. Most circuits now are designed on computers to test connections and avoid destroying microchips and other expensive components. Virtual diagrams of circuitry become the basis of realized material connectivity.

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[180] We see this line of inquiry again in Robert Barry's exploration of invisible forces as actants.
[181] This Kantian problem is about judgment—the binary of whether something is art or not. Furthermore, the very idea of a found object goes against the hypothesis of Assemblage theory because the idea conveyed by a 'found' object is a micro reductionism that attempts to set an object apart from its earlier life. There is no such thing as a found object since any object resides in a network of relations. Use and context may contribute to future objects that have trajectories stemming from their initial creation.
[182] Linda Dalrymple Henderson, Duchamp in Context: Science and Technology in the Large Glass and Related Works. p. 116

Duchamp's interest in meteorology, as electromagnetic mechanisms came into vogue for detecting weather events and lightning strikes, is also a measure of his recognition of phenomena happening outside the body and mind. Concurrently, it suggests that the mind and sensory equipment are perpetually linked to the event or material they attempt to identify. Today, information gathering processes and detection electronics are an expression of the complex interactions between events and material expression. On the one hand, electronic marvels of detection promote the state apparatus of surveillance and control; while on the other hand they expand our conception of reality beyond our biological senses. In the case of the latter, the technological instrument is an *appareil enregistrant*, a sensing organ that is both artificial and biological and extends perception. As new inventions, such as thermostats and other automated systems technologies were more widely used within institutions that supported cultural practice, artists began to question and reflect on the truth-value of art, its autonomy and its neutrality. As Burnham remarked,

> In the emergent "superscientific culture" long-range decision-making and its implementation become more difficult and more necessary. Judgment demands precise socio-technical models. Earlier, the industrial state evolved by filling consumer needs on a piecemeal basis. The kind of product design that once produced "better living" precipitates vast crises in human ecology in the 1960s. …In the past our technologically-conceived artifacts structured living patterns. We are now in transition from an *object-oriented* to a *systems-oriented* culture. Here change emanates, not from *things*, but from the *way things are done*.[183]

In this quotation by Burnham there is a sense of urgency where older models fail in the face of the expedient global system of production and consumption. Incidentally, the calls by Burnham for long range forecasting computing systems were already in the works on

[183] Jack Burnham, Great Western Salt Works. pp. 15-16

the MIT campus where Burnham was a fellow. Edward Lorenz**,** who was on faculty as a research meteorologist from 1955-1988, was the first to attempt to predict complex weather events beyond a few days using his Royal McBee computing machine. His insight concerning weather modeling was that small changes have large consequences over time and over distance—otherwise known as "the butterfly effect." This effect makes accurate weather prediction impossible after only six or seven days and emphasizes the immense power of complexity as it relates to long-term effects.[184] Before the advent of radar and computer systems weather prediction was conceived through the observation of clouds, and by the measuring of temperature and air pressure.

Of Codes and Clouds

Early cloud paintings and drawings were important as inquiries into aggregate climactic forms, but they focused on depicting clouds from the human scale and fell short of describing the complex interactions that we are now able to study with refined meteorological instruments. In his 1802 volume *Annuaire Météorologique*, naturalist Jean Baptiste Lamarck proposed five types of clouds related to general causes of weather: hazy clouds, *en forme de voile*; massed clouds, *attroupés*; dappled clouds, *pommels*; broom-like clouds *en balayeurs*; and grouped clouds, *groupés*. The key idea set forth by Luke Howard, after Lamarck, in his Essay on the Modification of Clouds, first published in 1803, is that it is possible to identify, from within the variability of changing skies, a number of categories. The more distinctive cloud categories for Howard consisted of: heaped clouds, *cumulus*; layered clouds, *stratus*; curled clouds, *cirrus*; and rain clouds, *nimbus*. Each developed as a process of coding and understanding weather patterns. Since

[184] See James Gleick, "The Butterfly Effect," Chaos: Making a New Science. New York: Penguin. 1987. pp. 9-31

the nineteenth century, clouds have continued to suggest a multitude of intermediary categories. In Howard's essay, the birth of meteorological study combined poetry and engravings by artists with rather romantic descriptions of clouds and weather. In this first attempt at a comprehensive written and visual understanding of weather, the integration of disciplines was not only acknowledged but was necessitated by a fuller 'appreciation' of such phenomena.[185] As codes, all recorded representations of weather have shaped our current state of affairs, and are affected by the trajectories entangled with weather throughout history, including the more recent indications of accelerated climate change and anomalous cloud formations. By extension these classifications and textual codings take shape through the titling of my work. Using this method of titling, I am able to organize each work in a series and connect it to the historical nomenclature of meteorological study. Weather has often been used in Assemblage theory to describe some of its key concepts: intensity, lines of flight, and phase transitions, for example. In this sense it is important for Assemblage theory to build an expressive language between disciplines to account for the changes we are seeing in detection technologies that describe everything from social phenomena to Systems theory. This means that an expressive cultural role is as important as a scientific, political or social role in the observance of the changing events. Artist Fujiko Nakaya's *Fog* or *Low Hanging Stratus Cloud* embodies such synergy between disciplines.

Exhibited at the Pepsi Pavilion at the 1970 Osaka World's Fair, Nakaya created a cloud of vapour surrounding a geodesic dome as an expression of atmospheric phenomena. The structure at Expo consisted of a Buckminster Fuller-style PVC dome

[185] Luke Howard, Essay on the Modifications of Clouds. London: John Churchill and Sons, 1803.

covered with piping and pressure nozzles.[186] Nakaya's was the first physical articulation of a cloud, significantly predating Diller + Scofidio's widely renowned 2002 *Blur Building*. And unlike the exhibition of Barry's *Inert Gas* works or Haacke's *Condensation Cube,* which could be 'activated' at different locations, Nakaya's work was made specifically for the Pepsi Pavilion. Her 'constructed' atmosphere also juxtaposed modernist ideas of geometric measure, efficiency, pattern-seeing and form-finding with the outside atmosphere and the futurism of the Expo itself.[187] Yet her work moved beyond the structural stability of modernism because its formlessness signalled notions of unpredictability.

Fujiko Nakaya, *Fog* or *Low Hanging Stratus Cloud* at Expo '70 Osaka World's Fair, Pepsi Pavilion. EAT Archives, Getty Library and Archives, Los Angeles, California.

In Pavilion, the text by Experiments in Art and Technology, Nakaya recounted the physical, material and environmental challenges that she faced during the project. Her

[187] In the decade and a half following WWII, the United States and Canada went through a period of cultural and social reformation dominated by social planning, civic reconstruction and economic growth. Simultaneously the Cold War ushered in a period of intensive capital investment in scientific pursuits—aeronautics, space exploration and weaponry. In this period cultural value was coupled to educational programs that would help shape civic reconstruction and technological innovation. Thus the coupling or the civic reconstruction and technological innovation would have a civilizing effect, neutralizing the trauma and horrors of the two world wars that destroyed both infrastructure and generational expertise—mostly in Europe and Japan. These reconstructive urges formed part of the desire to find new ways of living. In turn, these urges prompted everything from world expositions to new designs for living.

concern with process, construction and material formed the basis of her engagement, which involved extensive research and experimentation.[188] Yet one element that was omitted from the Pavilion text was the way in which clouds relate to art practice in general—as visual codes for unpredictable bodies between heaven and earth. This emerges from an analysis of painting, which speaks to the differences between permeable and solid forms as well as the logics of perspective, as opposed to the unpredictability of dream and illusion.[189] In terms of Assemblage theory, the complexities of Nakaya's project have a symbolically coded relationship with the history of the cloud as ascension, elevation, obfuscation and morphology. Cloud parameters are not easily measured; they exist as objects that are formless as they change in non-Euclidian geometry. As part of larger systems that depend on this movement—the biosphere, hydrologic cycle and the jet stream—clouds distribute water in all its states.[190]

Clouds also have the unique coded marker of representing turmoil in addition to the life-giving properties of rain. More recently, in their text Cloud Time, authors Rob Coley and Dean Lockwood contend that "The Cloud, of course, represents the coming of the institutionalized, integrated imagination, its very purpose being to make pre-emptive connections in order to contain radical events within the system and thus deny their radicalism, to 'translate probable association… into actionable security decisions' or

[188] Billy Klüver, Barbara Rose and Julie Martin eds., Pavilion: Experiments in Art and Technology. New York: E. P. Dutton and Company, 1972. pp. 207-223

[189] See Hubert Damisch's A Theory of /Cloud/ Toward a History of Painting, published in French two years after Expo '70 in Osaka.

[190] Years after Nakaya's innovative work, Otto Piene, who became the director of CAVS, changed the organization's mandate adding *Sky Art conferences* (as they would be called in the 1980s) to the list of collaborative projects. Piene expanded the call for international participation and in 1977 *Centerbeam*, became a massive project designed for Documenta 6. Conceived by artist Lowry Burgess as an outdoor work, it consisted of a 144-foot-long water prism, which incorporated holography, argon-neon lights, an ice line and laser projections on steam clouds. With projects such as *Centerbeam* the impetus was to involve artists in collaborative efforts, similar to those envisioned by Billy Klüver and members of EAT.

what we might otherwise understand as the endeavour to enclose and delimit futurity in the bureaucratized present."[191] To change and shape the techno-social sphere and to 'manage' the atmosphere is to change humankind, and every other aspect of the planet's functioning. Like the cloud itself, we are drifting as a species towards an unknown future with rather bleak prospects because of our inability to deal with real problems and real situations on a global scale. This inaction results in a haunting feeling**,** an increasing expectation that the weather will 'turn on us,' so aptly described by Francis Alÿs' *Tornado*.

Antecedent Atmospheric Soundworks

Fujiko Nakaya's project at the Osaka Expo was not the only experimental artistic work in 1970 to investigate atmospherics. The other geodesic site at Expo was at the German pavilion. For the World's Fair Germany built the only spherical concert hall. Based on concepts by the electro acoustic composer Karlheinz Stockhausen and the Electronic Studio at the Technical University in Berlin, the Germans were able to reproduce a three-dimensional sound space. In this structure, audience members were seated on a sound-permeable gridded floor. Fifty clusters of loudspeakers were arranged just below the grid and along the walls of the pavilion. In the course of the 180-day exhibition, Stockhausen, and his ensemble, gave live concerts for over a million visitors. The composition played by Stockhausen was *Spiral, for a Soloist and Shortwave Receiver*. According to media scientist and musicologist Dr. Golo Föllmer "It was possible to achieve the three-dimensional sound distribution live, using a spherical sensor built in Berlin to feed the 50 sound sources, but a ten-channel rotary mill constructed to Stockhausen's design was

[191] Rob Coley and Dean Lockwood, Cloud Time: The Inception of the Future. Washington: Zero Books, 2012. p. 85

deployed more frequently."[192] These atmospheric sound performances were meant to evoke a sense of flying or to provoke a sort of out-of-body experience within the geodesic structure.

Conversely, in his 1961 score *Atmosphères*, György Ligeti used hazy and indefinite musical textures to approximate weather conditions and atmospherics as a relation of exteriority. Ligeti's compositions have a textural expression that derives from the materiality of traditional music production, such as the string section of an orchestra. His compositions are also quite difficult to play and almost impossible to accurately conduct, although every note was meticulously scored. One wonders if the accuracy of the intention or the pliability of the interpretation is what Ligeti was after. The fact that orchestras, over the world, interpret his compositions differently is a testament to the adaptive nature of sonic expression, which cannot easily be pinned down by the coded aspects of notation (graphic or otherwise). What Ligeti discovered was that he could build and diminish sounds that could territorialize, deterritorialize, or reterritorialize one another through sensation, rather than the pattern of rhythm. Ligeti's overlapping sounds offer new possibilities for atmospheric compositions to describe weather or geological processes. This way of working subverts established rules that musical architecture has traditionally relied upon such as bridges, melodies, phrases or harmonies. For Ligeti, the density and ephemeral nature of his sonic clouds create an aural experience of natural and unnatural entities that populate the creative imagination. His slow transitions of sound, overlapping one another, can also be compared to radio signals phasing in and out, a phenomenon that came to fascinate sound artists in the latter half of the twentieth century.

[192] Golo Föllmer "Karlheinz Stockhausen Spherical Concert Hall" Media Art Net. http://www.medienkunstnetz.de/works/stockhausen-im-kugelauditorium. accessed 20 November 2013.

As a spatial phenomena radio travels along defined lines and distances as much as it occupies space. Radio receivers detect signal transmissions from a large number of different paths in the atmosphere. These paths may be the result of reflections from buildings, mountains or other reflective surfaces including water, glass etc. that may be adjacent to a signal. Additionally, other effects such as ionospheric reflections give rise to multipath propagation, which create static signals where coherent reception phases in and out of our attempts to make sense of what we are hearing. Robert Barry's *90mc Carrier Wave (FM), not held in the collection of the Museum of Modern Art* (1968) consists of radio waves generated by a hand-engineered FM radio transmitter, which is installed in the gallery space, hidden from visitors. When tuned to a specified frequency (90mc), the amplified radio waves produce tones and sounds of varying intensity, depending on the strength of the signal. The work challenges conventional conceptions of sculpture by positioning sound as a prospective medium. It also challenges the notion of site specificity, because the radio signal can travel through objects and be received at various locations that often cross boundaries we define as sovereign, private or public. Indeed, radio's contribution to disciplines such as astronomy or interplanetary travel has become a means for artists to conceptualize the vast distances within our solar system and beyond. For instance, artist Katie Paterson's sonification experiments with Morse code radio transmissions of Beethoven's *Moonlight Sonata* to the moon and back, in *Earth Moon Earth* (2007/2008), considers the variables of atmospheric distance. In this way, Paterson suggests a poetics of radio interference and loss of signal as the notation comes back in a form unlike the 'original' score. The coded aspects here can be broached from at least two perspectives: one being sound as an historical aspect of Morse code, a notational

device of dots and dashes; and the other as a reinterpretation of Beethoven's notational score as it meets modern technology. For Paterson, the economic, political and institutional supports were in place to realize her project, but there are also historical and scientific factors at work. The coded replicators DeLanda refers to take the form of signal interruptions through atmospheric phenomena as a message translated through a medium.

In the twenty first century, information colonizes and territorializes a space of possibilities in a world of hyper-capitalism. These massive transactions of electronic data are in direct proportion to the increase in very low anthropogenic sound frequencies that abound in urban contexts to which artists have responded. In 2003, Christina Kubisch provided listeners with an opportunity to scan the electromagnetic fields of urban centres in a series of "electrical walks" that took place in a variety of European cities. In doing so, participants were able to discern the electrical interference present, and yet mostly hidden, from their everyday experience. The experience was made possible by using electromagnetic induction headphones.[193] By creating VLF works myself, I endeavour to draw attention to the fact that the spaces needed to get a 'clear' recording of the magnetosphere are being diminished—banished by anthropogenic electromagnetic interference.[194]

Perhaps no one else has utilized VLF recordings more than sound artist Joe Banks, who in the 1980s began working with both atmospherics and electromagnetic signals, utilizing a vast array of electrical objects from large towers to small appliances. Banks has experimented with electrical storms, harmonics and radio signals radiated by

[193] Subsonic artist Joyce Hinterding also points to this as a recent phenomenon.
[194] If we take into account how VLF is used in submarine communications we begin to see how entire populations of animal species, in this case dolphins and whales, are being threatened by the frequencies being produced because they use low frequency sound for echolocation.

alternating currents from circuitry to discover the latent sonic potential of things that mostly go unnoticed.[195] He is one of the few people to acknowledge the heightened interference of 'natural' VLF waves by anthropogenic frequencies. Banks couches VLF phenomena in a history of competing forces where scientific applications and more specifically meteorological means are hijacked by military agendas. This co-optation is an attempt to territorialize shared intellectual capital. Territories, insofar as they are controlling forces and boundary-making processes, need to be more succinctly addressed by Assemblage theory. DeLanda in his texts often tends to focus on the historical and social dynamics that limit its potential to modify political decision-making processes.

Overcoming Some of the Limitations of Assemblage Theory

With Assemblage theory comes limitations. It is a theory still in its infancy and is competing with many similar theories that espouse some of the same ideas, namely Actor Network theory, Object Oriented Ontology, New Materialism and Speculative Realism. Unlike deconstruction, which attempted to dismantle Western metaphysics, Assemblage theory has not properly articulated any political positions. For instance, when DeLanda speaks about genetics there is never a discussion of its ethical dimensions. I argue that this is in part due to an attempt to establish Assemblage as an objectivist theory instead of realizing the problematic history of objectivity, which I believe can coexist. This embrace of objectivity can be described as a blindness to irregularity in favour of symmetry and elegance. Hence, DeLanda's attention to attractors and disdain for political upheaval as a means to promote alternative political systems is avoided in many of his texts. Another drawback to Assemblage theory is that it is entrenched in social theory and has not

[195] David Toop, Haunted Weather: Music, Science and Memory. London: Serpent's Tail, 2004. p. 48

expanded into cultural theory or scientific critique. Admittedly, Assemblage theory is abstruse because it is born of Systems theory, multiplicity and Complexity theory. Each theory is difficult to differentiate because they not only borrow many of the same terms, but also apply them in similar ways. An open system, for example, means the same thing in all theories mentioned above. This begs the question, how then are we to formulate a theory that can reenergize cultural practices when its terms are ambiguous? Which theory should we choose, or can we borrow ideas from each theory and recombine and adapt them to new ways of working and thinking? While clearly the dominance of linguistic and subjectivist philosophies is being challenged by New Materialism, I prefer the expressive realist materialism of DeLanda as it allows for an ever-expanding articulation of its terms. Instead of systems emerging from mind/world correlates, systems and assemblages are generated by entities that are continually interacting with one another. This can be more readily apparent in the specific codes that are adapted to describe interactions, material expressivity or complex relations. For example, in physics the 'language' of mathematics seems more suitable for discussing abstract theoretically postulated entities. The question is thus, is there a language (or way of using visual, sonic or gestural expression) that is appropriate to abstract philosophical concepts or subjects? Such a notion is not dissimilar to the way variable differential equations describe complex meteorological interactions between the forces of pressure, movement and heat. As technology expands and becomes more integrated, variables are more readily represented as graphic or sonic information of which aesthetic computing, diagramming and sonification are examples. Here, Assemblage theory may offer one of the best ways to bridge these new descriptive technologies.

Having briefly unpacked DeLanda's theory of Assemblage, I argue that he is embedded in a philosophy of sociology that shies away from many of the arguments made by sociologist/philosopher Bruno Latour regarding Actor Network theory. These propositions, described in Latour's 2005 text Reassembling the Social, outline the domains of technology, markets and politics, among others, acting together. This analysis could easily work with Assemblage theory without destroying its intent to elucidate these organizational constructs because it seeks the same critique of macro-micro distinctions, which are so often used to communicate social and cultural interactions. Both theories also focus on real accounts of the inner-workings of social interactions not limited to human actors, where objects, materials, discourses and ideas form relational networks link things and concepts. Where DeLanda differs is more evident in his emphasis on the aspects of territorialization and deterritorialization that accompany these networks. He insists that when discussing social relations, real connections must be involved. This includes how materials, objects and support structures need to be aligned to promote and preserve territories. As an example, the analysis of what makes up the functioning of an art gallery may be used. In this case, the connection between the objects of technology—computers for payroll and tracking exhibitions must be networked with artists, artworks, curators, registrars, docents, preparators and security guards who must all participate as functionaries within the organizational system. DeLanda, however, differs from Latour when he emphasizes the connection between institutions, markets and economic actors.[196]

[196] "No actant is just fodder for others; each enhances and resists the others in highly specific ways. Since every actant is entirely concrete, we do not find its reality in some lonely essence or chaste substrate, but always in an absolutely specific place in the world, with completely specific alliances at any given moment. Everything is imminent in the world; nothing transcends actuality. In other words, Latour is proudly guilty of what Roy Bhaskar and Manuel DeLanda both call "actualism." For Latour the world is a field of objects or actants locked in trials of strength—some growing stronger through increased associations, others becoming weaker and lonelier as they are cut off from others." See Graham Harman, Prince of Networks: Bruno Latour and Metaphysics. Melbourne: Re.press, 2009. p. 16.

The most outstanding methodological (and indeed argumentative) oversight of DeLanda's Assemblage theory is the problem of realism versus antirealism, or objectivity versus subjectivity, and the ontological status of the laws of nature, that have been raging since the Enlightenment. One of the only ways that DeLanda deals with this omission is to introduce the idea of the virtual**,** where causes that take place in the present have 'real' future consequences and influences. By doing so, he breaks with the Speculative Realists when it comes to issues concerning a 'realist' ontology. Speculative Realist Graham Harman in particular criticizes DeLanda's movement away from singular entities towards disembodied attractors and topological structures lying outside all specific beings. These virtual lines of flight short-circuit objectivity because they introduce skepticism and doubt.[197] Every action and every thought has variable and differential tangents similar to the ones posited by DeLanda in his notion of capacities. Although it may still be possible to give an account of these tendencies, DeLanda more accurately describes these causal events as catalysts. He therefore countermands the notion that singular causes produce singular effects or affects. When we see weather in terms of Complexity theory we note that it can change due to multiple factors at once. Minute changes can introduce diverse and unpredictable dynamics over longer periods of time, a point emphasized in my multi-layered paintings. There is a process of simultaneity that builds into events such as storms or tornadoes. We might speculate that these types of physical phase transitions run parallel to the political, economic and social dynamics whereby unforeseen circumstances are a result of this extreme complexity.

Latour also argues emphatically in Politics of Nature that democracy must follow the same testable rigour of scientific disciplines when it comes to ecology questions. See Bruno Latour, Politics of Nature: How to Bring the Sciences into Democracy. Catherine Porter trans., Cambridge: Harvard University Press, 2004.

[197] Graham Harman, "DeLanda's Ontology: Assemblage and Realism." pp. 367-383

Economic uncertainty, a growing precariat workforce, increased militarism and environmental degradation all make for a tempest of dubious contradictions and perilous circumstances. Paired as they are with government inaction and corporate irresponsibility, these factors at once plague and free the artist's imagination to consider new possibilities and course corrections. What Assemblage theory offers beyond its current sociological and even philosophical incarnation is a way to use information from various fields and stitch together a vast tapestry of real interacting processes. If Assemblage theory is to become a viable candidate for probing creative practice its proponents must be open to the different descriptive systems that are able to elucidate ideas in much broader terms—ones that may combine different sensory discoveries.[198]

The Creative Capacities of Assemblage Theory

Art never has been a singular descriptive system—it is produced through a wider variety of procedures and processes, which are acutely observational. Creative practice affords the unique ability to use the senses to find forms and discover combinations between materials and sensations. The artist is in the unique position of being able to link ideas from many sources and have them coalesce into what we generally refer to as a practice. In the exhibition *Conditions Variable* a range of expressive and conceptual possibilities that connect and disconnect are deployed. This is a kind of creative play that cannot be formatted so easily into a completed watertight argument. When considering Assemblage theory it is important to speak of poïesis as creative works emerge—that is the moment when the exchange between doing, remembering, reworking, making mistakes, making

[198] Sonication in chemistry refers to the ultrasound irradiation to increase the rate of a reaction in mixtures of surfactants and water. Sonification in artistic practice is a way to perceptualize sound data as visual data.

corrections, and realizing one's own position within a larger schema of real and imagined possibilities plays out. Like the chance operation, this generative nexus occurs when the work and the material 'tells' the practitioner about its properties through live manipulation.

The main thrust of this paper is not to propose a framework that helps shape the work, but rather one that assists the analysis of the work by relating it to a much wider spectrum of knowledge and historical precedent. This in no way diminishes the importance of intuition, accident or emotional responses as integral and legitimate components of the creative process. Rather, by grafting the main components of Assemblage theory onto cultural endeavours, it opens up the possibility of utilizing various fields in the reading of artistic process. We have already surveyed the basic pedagogical foundations of the Bauhaus, New Bauhaus and Systems Esthetics. Assemblage theory goes far beyond these earlier models by offering an analysis that is much more open and signifies a sweeping change from the scepticism of postmodern discourse. Rather than a critique, it offers an explanation and description. It suggests greater accountability for decisions that must ultimately be based on more rigorous processes, just as new knowledge in any field offers new alternatives and avenues to pursue.

Although DeLanda purports that Assemblage theory is open and fluid, it nonetheless remains a descriptive system that has been devised to shape and illuminate traditions and antecedent histories, which help to forge creative and artistic activities. But the promise of a new explanatory way to express the thoughts and ideas of visual art is an attractive proposition, offering a way through the endless criticism we have experienced

since the linguistic turn. It is instructive to remember that agendas are embedded in all critique as much as they are in a creative form or devised system. The difference between critical theory, for instance, and Assemblage theory is one of wonder. If everything is viewed with scepticism, what is to become of the thrill of discovery? Artists must have contact with the physical world as a prerequisite of description in all cultural forms. You can see how this contact changes the body of work over various periods of an artist's life.

In summary, the Bauhaus, New Bauhaus, CAVS, and EAT attempted to adapt to the changing economic and political realities of their time. Although these organizations dissolved or transformed, their influence is still keenly felt, not only through the work of their alumnae or fellows, but through the teaching methods and the ambitious ventures that fostered new ways of thinking. The complex challenges these institutions faced, as they confronted new social and political ideologies, forced them to restructure, or reshape their projects to adapt to changing dynamics.

Assemblage theory offers a means for artists to take charge of the discourse surrounding their work, directing it from within the field. The openness of such a theory expresses the fluid reality of systems and interactions.[199] We have glimpsed how various fields that come together can create a force of collective intentionality, even after the massive critical stance of deconstruction. Assemblage theory is not a new philosophy that espouses a totality, a theory that seeks universalism; rather it comes after postmodernism's critique, poised to integrate myriad fields. It does this not as a deconstructive formulation but one wherein logocentric, Eurocentric and anthropocentric

[199] By using the word 'open' I do not mean something akin to linguist Noam Chomsky's, description of language as a system, which "makes infinite use of finite means," (ironically Chomsky is quoting diplomat Wilhelm von Humboldt). What I am referring to is a criterion that acknowledges something beyond ourselves, our senses, and processes. These combinations are more like an emergent system of imagination fashioned in a much larger universe than the one we are accustomed to in an economically driven world. In every theory there is the promise of discovery and wonder—as DeLanda suggests there is a space of possibilities.

inheritances have been acknowledged, offering the senses more than linguistic cues. DeLanda, in the introduction to A New Philosophy of Society, cautions us about falling into the trap of totalities and essentialism. The relationship between artistic practice and Assemblage theory should not be about how practice can find a theory on which it can rest, rather it is a theory on which creative practice may be stimulated and reenergized, just as poïetic interplay between perception, circumspection, process and memory can inform Assemblage theory through anamnesis.[200] This idea concerning anamnesis is really a reverence for time scales that go beyond human existence. There is also another aspect to anamnesis, one that is haunted by a failure to bring about change. What we risk by not acknowledging Assemblage theory, as a viable model is nothing less than a future hauntology forged from our inability to consider an alternative philosophy as it now presents itself.

[200] "Anamnesis means remembrance or reminiscence, the collection and recollection of what has been lost, forgotten, or effaced. It is therefore a matter of the very old, of what has made us who we are. But anamnesis is also a work that transforms its subject, always producing something new. To recollect the old, to produce the new: that is the task of Anamnesis." See Levi Bryant, Nick Srnicek and Graham Harman, eds., The Speculative Turn: Continental Materialism and Realism. Melbourne: Re.press, 2009. n.p

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