



Marilyn Zurmuehlen Working Papers in Art Education

Volume 2011

Article 4
DOI: 10.17077/2326-7070.1409

Art Education In a Network Ontology: Seeing Non-Humans

Aaron Knochel
The Ohio State University

Follow this and additional works at: <https://ir.uiowa.edu/mzwp>



Part of the [Art Education Commons](#)

Copyright © 2011 Aaron Knochel

Recommended Citation

Knochel, Aaron (2011) "Art Education In a Network Ontology: Seeing Non-Humans," *Marilyn Zurmuehlen Working Papers in Art Education: Vol. 2011* , Article 4.
<https://doi.org/10.17077/2326-7070.1409>

Hosted by [Iowa Research Online](#)

This Article is brought to you for free and open access by Iowa Research Online. It has been accepted for inclusion in Marilyn Zurmuehlen Working Papers in Art Education by an authorized administrator of Iowa Research Online. For more information, please contact lib-ir@uiowa.edu.

Marilyn Zurmuehlen Working Papers in Art Education 2011
<http://ir.uiowa.edu/mzwp/>

Art Education In a Network Ontology: Seeing Non-Humans

Aaron Knochel

The Ohio State University

© 2011 Aaron Knochel

ABSTRACT

A proliferation of objects populate classroom spaces, the newest include a long list of innovative technologies, but their presence is characterized by their instrumentality. This paper presents a shift in this thinking to one where objects are seen as heterogeneous contributors to learning and teaching. Student practices within networked computing are changing how they form connections with peers, perceive boundaries, and negotiate diverse modalities as creators. The overwhelming visual nature of these various technologies provides opportunities for a visual culture pedagogy of art education to build critical foundations in investigations of visibility and may provide insights to participation through these multimedia platforms. In trying to understand these opportunities, this paper focuses on developing an analysis of the network ontology of art education through the methodology of actor-network theory (ANT). This analysis repositions visual technologies, particularly Adobe Photoshop, beyond their instrumentality to a reconceptualization as collaborators within human-technology interactions to more fully comprehend their affordances, gaps, and hegemonies. It is an investigation of a network ontology focusing on bringing symmetry to human and non-human actors in social formations, following the effects of translation, and working through the assemblage of social ontologies to better understand their contributions to human-technology collaborations.

Art classrooms are increasingly crowded spaces, and one of the newer objects to find a corner is the computer. At first just a standalone machine running software to let you manipulate pixels in a drawing work space or retouch a digital photograph, but now a network station that has access to all sorts of visual resources from video collections to online visual communities such as Flickr. The art classroom could be connected to live video conferencing events, software demonstrations recorded to digital video, or curating online gallery spaces. Or the network connection could be too slow for live conferencing, the local administration of your firewall may not allow streaming video, or

you may not have the administrative permission to update software that you need rendering that machine in the corner pretty useless. A computer harnesses at the same moment all of these possibilities and all of these failures, and when it seems like a computer just won't cooperate there is a good deal of frustration. However, in a time of ubiquitous computing in a technological ecology¹, the potential impact of participation in a digital visual culture (Sweeny, 2010) may be a defining characteristic for a generation of "digital natives" (Palfrey & Grasser, 2008; Prensky, 2001, 2006).

In this paper, I will explore changing perspectives of what the computer is in relation to learning that can benefit art educators and students as they grapple with innovation and visual technologies. This changing perspective is what I call the network ontology of art education, and it fundamentally displaces an emphasis on the instrumentality of visual technologies for a heterogeneous gathering of collaboration between users and digital innovation. I will begin by describing my own relationship with teaching the graphic design software Adobe Photoshop (here forward to be referenced only as Photoshop) through a framework that sees *my performance as a collaboration with software*, and an array of other non-human actors, within the social dynamics of teaching and learning. Using the social ontology of actor-network theory² (ANT), I will explore a network formation of Photoshop from a tool to a complex collaborator formed through an assemblage of agencies to understand more fully its contributions to the social dynamics of learning that are taking place in the digital art classroom.

Seeing Innovations in the Art Classroom

In my own experiences using computers in the art classroom, equal parts excitement and frustration, it was my students who most inspired me to explore innovations in digital technology and their potential in the art classroom. Creating the visual components of digital multimedia is becoming an increasingly important part to student work in all subjects, and it is this type of work that beckoned strongly to a teacher immersed in an art education pedagogy focused on visuality. This type of pedagogy pursues an art and design curriculum that downplays technology as an end in

¹ I am using technological ecologies as "environments—which include both human and technological actors— [that] are akin ... to ecological systems and deserve to be studied in all their layered, interconnected complexity"(DeVoss et al., 2009).

² There is much speculation, and resistance, on which phrase to use (Latour, 2005; Law & Hassard, 1999), but for consistency I will use the term actor-network theory and its acronym ANT throughout this paper. This selection upholds the "*intentionally oxymoronic*, a tension which lies between the centred 'actor' on the one hand and the decentred 'network' on the other" (Law, 1999, p. 5).

and of itself: technologies, such as graphic design software, were used as tools to investigate the nature of visuality. Visuality, as a central focus of visual culture, is the mediation of discourses that are inserted “between the subject and the world” (Bryson, 1988, p. 91) and focuses on the social construction of the visual (Duncum, 2001; Foster, 1988; Tavin, 2003). Inside of a visual culture art classroom that investigates visuality, inquiry “involve[s] discourses on all the visual arts, such as media studies, design education, cultural critique, and visual anthropology” (Freedman & Stuhr, 2004, p. 826). This is a focus on a pedagogy that uses the art classroom to engage students in using digital media to explore visuality through the performance of the interface and digital multimedia to make complex statements about their inquiry. Teachers and students find themselves in the midst of a changing landscape of visual production, where there is a proliferation of new technological tools, but a gap exists between these sites of innovation and sites of classroom learning.

My focus on the intersection of learning in the art classroom and sites of innovation is to focus on the complex relationship between digital technologies and theories of visual culture studies. While art education has had a longer history looking at technologies in the art classroom, only recently has the field of art education undergone a reconceptualization from disciplined-based art education to a field focusing on visual culture (Duncum, 2001, 2009; Freedman & Stuhr, 2004). Within visual culture art education there is more emphasis on semiotics (Smith-Shank, 1995; Smith-Shank, 2004), critical theory and cultural studies (Chalmers, 2002; Darts, 2004; Freedman, 1994; Garoian & Gaudelius, 2004; Tavin, 2003), popular culture (Duncum, 1987; Manifold, 2009; Tavin, 2002; Tavin & Anderson, 2004), and digital visual technologies (Eisenhauer, 2006; Keifer-Boyd, 1997; Sweeny, 2004; Sweeny, 2005; Taylor & Carpenter, 2002). The focus on visual culture within art education has paralleled and drawn from broader scholarship in visual studies that has positioned the visual as an important site of socio-cultural meaning to communication in the 21st century (Mirzoeff, 1999; Sturken & Cartwright, 2009). Parallel to both the rise of visual culture studies and its importance to the field of art education, has been a rapid introduction of a wide range of technological innovation that has simultaneously offered so much possibility and complication.

As an art teacher utilizing a visual culture approach to art education pedagogy, I equated these sites of technological innovation as new opportunities to develop skills with a new tool to learn about the effects of visual culture similar to the deft handling of drawing implements by a skilled art student. If graphic design software was a tool, much like a drawing pencil, then using software was similar to using a pencil. My job as the art teacher was in part to facilitate mastery of the tool so that students could then use it to make visual expressions of their world. However, in hindsight this comparison does not adequately frame the relationship of the network of intermediaries that enter into the process of using technology such as graphic design software. It is not a question of

complexity, as material culture scholars have demonstrated complexity in the most basic of everyday objects (Berger, 2009; Norman, 2011), and even the pencil can be seen to have a complicated history and engineering legacy (Petroski, 1989). However, the software and operating systems that were loaded on the computers that we used in the art classroom and computer lab had other characteristics that seemed to evolve from their connection to larger technological networks. Pencils never connected to their manufacturing company to check for updates. Pencils do not require licenses and do not have rules about how many people can use them. A drawing completed with one pencil does not need to be re-formatted to use another pencil, and pencils could be used on any kind of paper. New versions of the pencil were not marketed every eighteen months along with the publications and instructional manuals that continually needed to keep pace with these rapid developments. Online communities of learning and technique development were far more complex and extensive with software than with people trying to learn how to use a pencil for drawing. All of these differences related to complex market relationships, distribution models, network connectivity, and the culture of proprietary software development, but many of these differences factored into how students, the school, and myself could use these “tools.” And beyond these considerations of the instrumentality of software to the school, there were cultural shifts in the ways in which people thought about certain types of software. For example, we used Photoshop in almost all of my classes, and during my time of teaching these courses there was a more and more common reference in popular discourse to the name of the software being used as a verb, as in someone got “photoshopped.”

All of these characteristics of software, and the years of teaching it to students thinking of it as a tool, have led to a shift in my understanding of how we may think about what visual technologies, such as Photoshop, are when we use them in the art classroom with our students. As an art teacher working in computer labs for the past eight years teaching students how to use Photoshop as an artistic tool, how does my capacity to recognize graphic design software as more-than-a-tool change my understanding of student learning with technology? This investigation involves shifting conceptions of innovations in visual technologies as a manifestation of an increased human-technology interrelation.

This shifting conception requires a deeper understanding of the contributions that these technologies make to our worlds as non-human actors, especially as these technologies become more ubiquitous. To help facilitate this deeper understanding I will draw from ANT (Callon, 1986; Latour, 2005; Law & Hassard, 1999). As prominent ANT theorist and philosopher, Bruno Latour (2004) states:

As soon as we stop taking non-humans as objects, as soon as we allow them to enter the collective in the form of new entities with uncertain boundaries, entities

that hesitate, quake, and induce perplexity, it is not hard to see that we can grant them the designation of actors. (p. 76)

For ANT sociologists, understanding the contributions of non-human actors invigorates sociological investigation to gather its full list of contributing actors in their associations with one another which are framed as network formations. In this way, ANT provides an important fluidity to understanding social practices that include non-human contributions and begin to transform understandings of how visibility can be re-constructed through not only the visual and discourse, but also through the innovations in visual technologies that can be accounted for in collecting the various actors in association in the art/computer classroom.

The innovations of visual technologies in a digital visual culture occupy an importance beyond their usefulness as a tool or medium for artistic practice in order to fully comprehend their affordances, gaps, and hegemonies. This shift in focus from how innovative technologies are perceived through their instrumentality to a reconceptualization as collaborators within human-technology interactions is the central preoccupation of my dissertation research. It is a shift to investigate the network ontology of things, in particular visual technologies such as graphic design software, and their social effects to better understand their contributions in collaboration with humans in producing a digital visual culture.

Shift Focus: Advancing an Ontological Perspective

The focus on a network ontology is part of a much broader pedagogical discussion about new media technologies. This discussion has been discursively framed within a new literacy or otherwise (Buckingham, 2003; Gee, 2003; Jenkins et al., 2006; Kubey, 1997; Luke, 2000), and has generally focused on two frameworks: the first framework focuses on the user's performance on new media technologies and the second framework focuses on the performance of new media technologies on the user. One perspective has been to view both performances within an ethic of democracy or as a part of a "global civil society" (Delacruz, 2009) where media consumers and producers negotiate media strategically as a commitment to citizenship (Howard, 2006; Papacharissi, 2002; Zukin, 2006). Other perspectives on these performances use critical theory to focus on the ways that media and its technologies perform on users to reinscribe through ideology inequitable structures in society through media consumption (Kellner & Share, 2005; Macedo & Steinberg, 2007). This perspective ranges from work that focuses on an effort to raise consciousness through neo-Marxist methods of deconstructing the reading of media texts with a critical semiotics (Jacobs, 2005) to "a more collaborative approach to critical inquiry...to empower" (Lather, p. 272, 1986) media users as media makers (Goodman, 2003). However, either perspective is incongruent with the task of understanding non-humans in collaboration. Instead, my

focus is slightly outside of these frameworks of a participatory culture (Jenkins, 2006) of digital visual culture and user's performance on new media, and instead looks more closely at the network ontology of visual technologies to better understand our collaboration with visual technology. In other words, the framework for this research takes into consideration how new media *performs with us and not on us or us on it*. This focus invites a symmetry between human and non-human actors within social formations, and utilizes a theoretical analysis of the social ontologies drawn from ANT.

The initial step to this symmetry is recognizing the complexity of innovative technologies as being more than a tool. As media theorist Douglas Rushkoff (2010) states:

For while digital technologies are in many ways a natural outgrowth of what went before, they are also markedly different. Computers and networks are more than mere tools: They are like living things, themselves. Unlike a rake, a pen, or even a jackhammer, a digital technology is programmed. This means it comes with instructions not just for its use, but also for itself. And as such technologies begin to characterize the future of the way we live and work, the people programming them take on an increasingly important role in shaping our world and how it works. After that, it's the digital technologies themselves that will be shaping our world, both with and without our explicit cooperation. (p. 8)

Essentially, innovation in technology has changed the way of being in the world, and calls for an equally complex ontological notion of the material world. As shorthand for this difference I use the term "network ontology" to describe being in the spaces of innovation, both online and offline, of ubiquitous technological ecology.

Other branches of the social sciences have utilized the concept of networks for social formations to describe families, organizations, economic markets, and globalization (Scott, 2002). For Manuel Castells (1996), the privileging of network organization in late capitalism has collapsed spatial barriers as information flows through the networks of the Internet at the speed of light. The network society "constitute[s] the new social morphology" (Castells, 1996, p. 469) that shapes, through access to and strategic play in the information flows, the ability to generate new knowledge, amass political power, mobilize constituencies in collective action, and render an endless (re)construction of the self (Castells, 1999, pp. 60-63). The concept of the network society has drawn much attention in the social sciences and led to a generative discourse of connections and flows that map the rise of a "network sociality" (Wittel, 2008).

As generative as the concept of the network society has been for sociology, this study suggests a slight shift to investigate a network ontology. The coupling of the terms "network" and "ontology" requires a further repositioning of the term network, because

ontology shifts understandings of a network as a formation of sociality through its constitution in the world, as it exists not as it is socially constructed. As Annemarie Mol (1999) states, ontology is “standard philosophical parlance [that] defines what belongs to the real, the conditions of possibility we live with” (p. 74-75). This premeditation on “the real” leads ontological investigation into the world of things, or objects, and it is the world of objects that seemingly is at odds with a social construction in so far that the object can be socially constructed, but social construction is not an object. Therefore, the pairing of network, as a sociological metaphor, and ontology, as the metaphysics of being and existence, is intentionally referencing the productive tension between the terms.

Network ontology is not determined by technology, but instead suggests an existence in rhizomatic³ virtual worlds that are realized through technological and non-technological networks. It is an exploration of the ways that being in the world have changed with innovative technologies through their successes and failures, and looks closely at our collaboration with them. A network ontology is also an investigation of non-technological being that is remediated through the catalytic interactions of network technologies and their human users. This revisioning of non-technological being within a network ontology is an extension of the posthumanist project of expanding notions of subjectivity within postmodernity by utilizing the machine and animal hybrids of the cyborg imaginary (Haraway, 1991; 1997; Hayles, 1999). This tactic of cyborg feminists such as Donna Haraway and N. Katherine Hayles is appropriated within understandings of a network ontology to facilitate how the insights of theory building surrounding network technologies may allow a re-thinking of non-technological being as networks or as existing within a network ontology.

Nodes in a Network Ontology: Symmetry, Translation, & Assembling

ANT sets out a revision of the various fields of social sciences, education being one of them (Fenwick & Edwards, 2010), by calling for a return to a “sociology of associations” (Latour, 2005, p. 9), where individual actors are followed in their performance of the social formations of which they are a part. The ANT objective is to understand how these actors come together, and manage to hold together even if temporarily, to form associations that produce agency and other effects. As a part of this

³ I am using the term “rhizomatic” to draw parallels between the structural organization of technological networks and the biological root system of a rhizome, but also to draw connection to the rhizomatic as theorized by Gilles Deleuze and Felix Guattari (1980/1987) in *A Thousand Plateaus*. As they state, “A rhizome ceaselessly establishes connections between semiotic chains, organizations of power, and circumstances relative to the arts, sciences, and social sciences” (p.7).

objective, perhaps the most important is the new status of the non-human: first suggested by Bloor (1976) and then elaborated by Latour (1987), ANT applies a *symmetry* to both humans and non-humans in their agentic possibility within the effects of associations. This symmetry is a focus on what John Law (1999) calls a “semiotics of materiality” in that ANT “takes the semiotic insight, that of the relationality of entities, the notion that they are produced in relations, and applies this ruthlessly to all materials—and not simply to those that are linguistic” (p. 4). Objects are not to replace human actors within a collective, but contributions by non-humans become just as important in understanding a sociology of associations.

These associations of non-humans and humans can form temporarily or attain a certain durability through space and time through the ways that actors “persuade, coerce, seduce, resist and compromise each other as they come together” (Fenwick & Edwards, 2010, p. 4). Associations that attain some sort of durability are referenced as a “black box” (Latour, 1987, p. 4) where their inner relations and heterogeneity of associations become masked; ANT scholarship focuses on following actors closely to look inside the “black boxes” of social practice, resisting explanations attributed to relationships of causality, and searching to understand the correlations that erupt from these associations. When compared to a traditional notion of substance in metaphysics as a singular entity that is then modified through human intervention, for example through philosophers such as Spinoza and Leibniz (Brown & Capdevila, 1999), the notion of the black box replaces traditional substance with a concept that explodes, like a 3D diagram, the world of objects into intricate complexities of association (Harmen, 2009). A good example of a black box would be Photoshop and some of its auto correct image adjustment features: a digital image is input into the software and the output is an *enhanced version* whereby users need not determine brightness or contrast but instead let the black boxed algorithms of Photoshop assess the image and make the changes. Similarly, we can apply this black box concept to all matter and non-matter of the social world: consider the heterogeneity of associations that compose notions of identity, the art classroom, or an art history textbook. This range of materiality reminds us that there is a symmetry between the human and non-human and that we must take into account the many figurations of our actors: whether they be objects, bodies, or texts (Law & Hetherington, 2003).

An important component to understanding the actors in ANT and their associations is to differentiate between intermediaries and mediators. In the above example of Photoshop, we may never encounter the software beyond its instrumentality until it freezes the computer or until we find out that we can add third party plug-ins that change its functionality. This transition from intermediary to mediator happens constantly when using complex software: an effect that does not turn out, a tool that appears to have a mind of its own, or a corrupt file that will not open. These instances happen all the time working within spaces of digital innovation and the framework of a

human-technology collaboration sees differently notions that the computer “did it” or that somehow you are in total control when using a computer. These moments that illuminate the negotiation and struggle of the collaborative process are important in understanding what actors to look for in an ANT methodology. Intermediaries are “what transports meaning or force without transformation: defining its inputs is enough to define its outputs,” and by contrast mediators “transform, translate, distort, and modify the meaning or the elements they are supposed to carry” (Latour, 2005, p.39). The intermediary or mediator character of the actor does not indicate a level of complexity; as the Photoshop example indicates because Photoshop, when it gives anticipated outputs, can be seen as a technologically complex intermediary. This attribution of agency is transitory in understanding a sociology of associations in that non-humans and humans can go between states of being mediators or intermediaries: what is paramount is what you are assembling through translations to the extent that some ANT researchers consider the theory itself as a “sociology of translation” (Brown & Capdevila, 1999).

Another important understanding of ANT is the issue of translation. For ANT, translation takes on the somewhat special meaning of “a relation that does not transport causality but induces two mediators into coexisting” (Latour, 2005, p.108). The translations of mediators leave traceable associations through actions and these are the make-up of the network that is accounted for in a sociology of associations. Therefore translations are the interactions of actors as they form into network configurations and can be characterized by the same sense of temporality that was used in reference to associations. The key element to translation is that the very basis of translation is not only the actors in connection, but in relationships of transformation: a translation results in actors acting upon one another through forces, negotiations, resistance and exclusions that forge micro-relationships. Translation is “the process...which generates ordering effects such as devices, agents, institutions, or organizations” (Law, 366, 1992). A good example of this would be a closer look at the spaces of the art classroom to see the gatherings that proliferate. Seeing the art classroom as a network of associations re-assesses the boundaries of that learning space and calls upon following the mediators to locate in translation the many permeable boundaries. An exhibit in the hallway that includes a controversial student art piece may form through translation a network of the school hallways, administrative offices, and art department offices. A digital graphic created on a computer in the art classroom and posted to a social media site that upsets parents of other students forms in translation disciplinary civil agencies, student spaces outside of school, and possibly the legal system. A video taken on a cell phone of an incident of bullying outside of the school that can lead back into the school as an intervention through educational programming that leads to a performance inside the art classroom expressing student perspectives. The effects of translation are the

constitution of network ontologies and provide a very different framework to view permeable spaces of schools and classrooms.

When actors are involved in translation they are mobilized in the network to perform knowledge in certain ways that is fostered by the relationships that have been forged through their interactions with other actors. This is what makes translations non-deterministic: the formations for actors within social practices presents an infinite variety of possible outcomes for not only the particular actor-network that the actor is in translation with but also for the inter-actor-network complexities that define the social landscape according to ANT. This spiraling complexity of actors within translation within actor-networks has been critiqued for its infinite complexity and endless connectivity (Miettinen, 1999). Although this complexity does appear overwhelming, this perspective can undervalue the complexity of supposedly simple systems while conflating notions of complexity and complicated (Norman, 2011). The world is filled with technologies and designed objects that are complex, but understanding them through deep structures that can uncomplicate but maintain complexity is an important part of the work of ANT. In addition, a critique by means of complexity implies that there is a way to avoid it through other methodological means, but to suggest that a methodology such as ANT is faulted due to its impossible complexity overlooks the very choices involved in any research endeavor that always already are a series of reductions. Instead, this complexity will be seen as the impossible framework within which all research is conducted, and ANT presents to researchers a choice of where to “cut the network” (Strathern, 1996).

What this complexity does showcase is that actors in translation maintain a certain symmetry that does not suggest a hierarchy in status or power reducible to themselves, but rather power is garnered through increased alliances through network connectivity. Following actors in translation “shows that all are fragile and all are powerful, held in balance within their interactions” (Fenwick & Edwards, p. 10, 2010). Therefore the notion of the assemblage is of vital importance to any ANT project. Understanding assemblage becomes the main operation of ANT for its effects in social practices, the translations that it requires to remain in relation, and its durability. Assemblage draws significantly from all of the movements of ANT that I have outlined thus far: actors in their symmetry are important contributors to the assemblage, mediators are powerful assembling catalysts that work actors through translation into networks of associations, and the chief operation of assembling foregoes filling social practices with “social stuff” (Latour, 2005) unless they are within the space time duration of the assemblage.

The notion of assemblage is also a powerful concept in applying the network ontology framework to visual culture pedagogy in art education. As stated previously, a central concern for this type of pedagogy is an investigation of visuality, and in a network ontology, visuality becomes more than exploring the social construction of the

visual through the network of a space and time visibility. This conception of visibility itself as a network formation of space-time (Mirzoeff, 2006) may lead to investigations in visual culture that ask, echoing WJT Mitchell (2002), what is the visual construction of the social? What durable translations persist in visual culture through the assemblage of multimedia and the heterogeneous visibilities that visual technologies augment through digital showing and seeing? The network ontology framework provides a new area of visibility that may provide a deeper understanding of the complex technological ecology of digital innovation.

CONCLUSION

In this paper, I have laid out three central components to ANT: 1) the symmetry of non-humans to humans, 2) the centrality of translations through association and the work of tracing network formations, and 3) the work of assemblage to maintain the complexity of visibility. These three components lay out the foundation for an ontological reckoning of the material complexity that exists inside of schools and the growing number of actors in every art classroom. Art education within a network ontology may find broader resources for determining learning practices and technological collaborators. Indeed, how art educators utilizing a visual culture approach in their curriculum may augment a network of representation, alluded to in the intertextuality of visual culture, with a material assemblage of heterogeneous objects. This network ontology offers recognition to the different participants and teachers in the learning space of a digital innovation, and may strategically inform our pedagogical practices in recognition of our many collaborations with non-humans.

References

- Berger, A. A. (2009). *What objects mean: An introduction to material culture*. Walnut Creek, CA: Left Coast Press, Inc.
- Bloor, D. (1976). *Knowledge and social imagery*. London: Routledge & Kegan Paul.
- Brown, S. D. & Capdevila, R. (1999). *Perpetuum mobile: Substance, force, and the sociology of translation*. In J. Law & J. Hassard (Eds.), *Actor network theory and after* (pp. 26-50). Malden, MA: Blackwell Publishing.
- Bryson, N. (1988) The gaze in the expanded field. In H. Foster (Ed.), *Vision and visibility* (pp. 87-114). Seattle, WA: Bay Press.
- Buckingham, D. (2003). *Media education: Literacy, learning and contemporary culture*. Malden, MA: Polity Press.
- Callon, M. (1986). Some elements of a sociology of translation domestication of the scallops and the fishermen of St. Brieux Bay. In J. Law (Ed.), *Power action and belief: A sociology of knowledge* (pp. 197-220). London: Routledge & Kegan Paul.

- Castells, M. (1996). *The rise of the network society*. Cambridge, MA: Blackwell Publishers.
- Castells, M. (1999). Flows, networks, and identities: A critical theory of the informational society. In M. Castells et al., *Critical education in the new information age* (pp. 37-64). Lanham, MD: Rowman & Littlefield Publishers.
- Chalmers, G. (2002). "Celebrating pluralism" six years later: Visual transculture/s, education, and critical multiculturalism. *Studies in Art Education* 43(4), 293-306.
- Darts, D. (2004). Visual culture jam: Art, pedagogy, and creative resistance. *Studies in Art Education*, 45(4), 313-327.
- Delacruz, E. M. (2009). Art education aims in the age of new media: Moving toward global civil society. *Art Education: The Journal of the National Art Education Association*. 62(5), 13-18.
- Deleuze, G. & Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia*. (B. Massumi, Trans.). Minneapolis, MN: University of Minnesota Press. (Original work published in 1980).
- DeVoss, D. N., McKee, H. A., & Selfe, R. (2009). Collectives, Common Worlds, and the Idea of Sustainability: An Introduction. In DeVoss, D. N., McKee, H. A., & Selfe, R. (Eds), *Technological ecologies and sustainability* (pp. 1-15). Logan, UT: Computers and Composition Digital Press/Utah State University Press. Retrieved April 25, 2010 from <http://ccdigitalpress.org/ebooks-and-projects/tes>
- Duncum, P. (1987). What, even Dallas? Popular culture within the art curriculum. *Studies in Art Education*, 29(1), 6-16.
- Duncum, P. (2001). Visual culture: Developments, definitions, and directions for art education. *Studies in Art Education*, 42(2), 101-112.
- Duncum, P. (2009). Visual culture in art education, circa 2009. *Visual Arts Research*, 35(1), 64-75.
- Eisenhauer, J. F. (2006). Next slide please: The magical, scientific, and corporate discourses of visual projection technologies. *Studies in Art Education*, 47(3), 198-214.
- Fenwick, T. & Edwards, R. (2010). *Actor-network theory in education*. New York: Routledge.
- Foster, H. (1988) Preface. In H. Foster (Ed.) *Vision and visibility* (pp. ix-xiv). Seattle, WA: Bay Press.

- Freedman, K. (1994). Interpreting gender and visual culture in art classrooms. *Studies in Art Education*, 35(3), 157-170.
- Freedman, K. & Stuhr, P. (2004). Curriculum changes for the 21st century: Visual culture in art education. In E. Eisner & M. Day (Eds.) *Handbook of Research and Policy in Art Education* (pp. 815-828). Reston, VA: NAEA.
- Garoian, C. R. & Gaudelius, Y. M. (2004). The spectacle of visual culture. *Studies in Art Education*, 45(4), 298-312.
- Gee, J. P. (2003). *What do videogames have to teach us about learning and literacy*. New York: Palgrave.
- Goodman, S. (2003). *Teaching youth media: A critical guide to literacy, video production, and social change*. New York: Teacher's College Press.
- Haraway, D. (1991). *Simians, cyborgs and women: The reinvention of nature*. New York: Routledge.
- Haraway, D. (1997). *Modest_Witness@Second_Millennium.Female_Man(c)_Meets_Oncomouse(tm): Feminism and Technoscience*. New York: Routledge.
- Harmen, G. (2009). *Prince of networks: Bruno Latour and metaphysics*. Melbourne: Re.press.
- Hayles, N. K. (1999). *How we became posthuman: Virtual bodies in cybernetics, literature, and informatics*. Chicago: The University of Chicago Press.
- Howard, P. N. (2006). *New media campaigns and the managed citizen*. New York: Cambridge University Press.
- Jacobs, W. R. (2005). *Speaking the lower frequencies: Students and media literacy*. Albany, NY: State University of New York Press.
- Jenkins, H. (2006). *Convergence culture: Where old and new media collide*. New York: New York University Press.
- Jenkins, H., Clinton, K., Purushotma, R., Robison, A. J., & Weigel, M. (2006). *Confronting the challenges of participatory culture: Media education for the 21st century*. Chicago: The MacArthur Foundation. Retrieved April 20, 2010 from http://digitalllearning.macfound.org/atf/cf/%7B7E45C7E0-A3E0-4B89-AC9C-E807E1B0AE4E%7D/JENKINS_WHITE_PAPER.PDF
- Keifer-Boyd, K. (1997). Interactive hyperdocuments: Implications for art criticism in a postmodern era. In J. Hutchens & M. Suggs (Eds.), *Art education: Content and*

- practice in a postmodern era* (pp 122-131). Reston, VA: National Art Education Association.
- Kellner, D., & Share, J. (2005). Toward Critical Media Literacy: Core concepts, debates, organizations, and policy. *Discourse: Studies in the Cultural Politics of Education*, 26(3), 369-386.
- Kubey, R. (Ed.), (1997). *Media literacy in the information age*. New Brunswick, NJ: Transaction Publishers.
- Lather, P. (1986). Research as praxis. *Harvard Educational Review*, 56(3), pp257-277.
- Latour, B. (1987). *Science in action*. Cambridge, MA: Harvard University Press.
- Latour, B. (2004). *Politics of nature*. Cambridge, MA: Harvard University Press.
- Latour, B. (2005). *Reassembling the social: An introduction to Actor-Network-Theory*. New York: Oxford University Press.
- Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systemic Practice and Action Research*, 5(4), 379-393.
- Law, J. (1999). After ANT: Complexity, naming and topology. In J. Law & J. Hassard (Eds.), *Actor network theory and after* (pp. 1-14). Malden, MA: Blackwell Publishing.
- Law, J. & Hassard, J. (Eds.), (1999). *Actor network theory and after*. Malden, MA: Blackwell Publishing.
- Law, J. & Hetherington, K. (2003). Materialities, spacialities, globalities. In M. Dear & S. Flusty (Eds.), *The spaces of postmodernism: Readings in human geography* (pp. 390-401). Oxford: Blackwell Publishing.
- Luke, C. (2000). New literacies in teacher education. *Journal of Adolescent & Adult Literacy*, 43(5), 424-35.
- Macedo, D. & Steinberg, S. R. (Eds.), (2007). *Media literacy*. New York: Peter Lang Publishing.
- Manifold, M. C. (2009). What art educators can learn from the fan-based artmaking of adolescents and young adults. *Studies in Art Education*, 50(3), 257-271.
- Miettinen, R. (1999). The riddle of things: Activity theory and actor-network theory as approaches to studying innovation. *Mind, Culture and Activity*, 6(3), 170-195.
- Mirzoeff, N. (1999). *An introduction to visual culture*. New York: Routledge.
- Mirzoeff, N. (2006). On visuality. *Journal of Visual Culture*, 5(1), 53-79.

- Mitchell, W. J. T. (2002). Showing seeing: a critique of visual culture. *Journal of Visual Culture*, 1(2), 165-181.
- Mol, A. (1999). Ontological politics. In J. Law & J. Hassard (Eds.), *Actor network theory and after* (pp. 74-89). Malden, MA: Blackwell Publishing.
- Norman, D. A. (2011). *Living with complexity*. Cambridge, MA: The MIT Press.
- Palfrey, J. & Gasser, U. (2008). *Born digital: Understanding the first generation of digital natives*. New York: Basic Books.
- Papacharissi, Z. (2002). The virtual sphere: The internet as a public sphere. *New Media & Society*, 4 (1), 9-27.
- Petroski, H. (1989). *The pencil: A history of design and circumstance*. New York: Alfred A. Knopf, Inc.
- Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon*, 9(5), 1-2.
- Prensky, M. (2006). *Don't bother me, Mom—I'm learning!* St. Paul, MN: Paragon House.
- Rushkoff, D. (2010). *Program or be programmed: Ten commands for a digital age*. New York: OR Books.
- Scott, J. (Ed.), (2002). *Social networks: Critical concepts in sociology*. New York: Routledge.
- Smith-Shank, D. (1995). Semiotic pedagogy and art education. *Studies in Art Education*, 36(4), 233-241.
- Smith-Shank, D. (2004). *Semiotics and visual culture: Sights, signs and visual culture*. Reston, VA: National Art Education Association.
- Strathern, M. (1996) Cutting the network. *Journal of the Royal Anthropological Institute*, 2(3), 517-535.
- Sweeny, R. (2004). Lines of sight in the 'network society': Simulation, art education, and digital visual culture. *Studies in Art Education*, 46(1), 74-87.
- Sweeny, R. (2005). Three funerals and a wedding: Simulation, art education, and an aesthetics of cloning. *Visual Arts Research* 31(61) Fall. Champaign, IL. University of Illinois Press.
- Sweeny, R. (2010). I [heart] technology, always and forever. In R. Sweeny (Ed.). *Inter/actions/inter/sections: Art education in a digital visual culture*, (pp. ix-xvii). Reston, VA: NAEA.

- Tavin, K. (2002). Engaging advertisements: Looking for meaning in and through art education. *Visual Arts Research*, 28(2), 38-47.
- Tavin, K. (2003). Wrestling with angels, searching for ghosts: Towards a critical pedagogy of visual culture. *Studies in Art Education*, 44(3), 197-213.
- Tavin, K. & Anderson, D. (2003). Teaching (popular) visual culture: Deconstructing Disney in the elementary art classroom. *Art Education*, 60 (5), 21-23/ 32-35.
- Taylor, P. & Carpenter, S. (2002). Inventively linking: Teaching and learning with computer hypertext. *Art Education*, 55(4), 6-12.
- Wittel, A. (2008). Toward a network sociality. In A. Hepp, F. Krotz, S. Moores, & C. Winter (Eds.), *Connectivity, networks, and flows: Conceptualizing contemporary communications* (pp. 157-182). Cresskill, NJ: Hampton Press Inc.
- Zukin, C. (2006). *A new engagement?: Political participation, civic life, and the changing American citizen*. New York: Oxford University Press.