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Research, writing, and computer technology: A reconsideration of invention and process

Donna Price Seckrater

RESEARCH, WRITING, AND COMPUTER

TECHNOLOGY: A RECONSIDERATION

OF INVENTION AND PROCESS

A Thesis

Presented to the

Faculty of

California State University,

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In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

English Composition

by

Donna Price Seckrater

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Approved by:

_____   06/06/08
Mary Boland, Chair, English   Date

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Jacqueline Rhodes

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Ron Chen

ABSTRACT

Current composition scholarship rejects the notion

that invention takes place only at the prewriting stage,

recognizing connections inherent in language, writing, and

knowledge construction; however, despite theoretical moves

beyond writing-as-product, current first-year writing

courses and their associated research texts seem to have

changed little. In this thesis, I argue for a more open and

active research process and approach toward the teaching of

researched writing. Specifically, I argue that the

hypertext-based research environment may enrich student

learning and writing by reinforcing recursivity throughout

the writing process, at the same time as it encourages

reflection on both cognitive and social processes of

knowledge construction. Further, I argue for a more

vigorous student engagement in knowledge-making activities

by encouraging active research further along in the writing

process.

According to certain contemporary hypertext and

learning theories, there is a cognitive relationship

between learning and invention, indicating that the

cognitive and social processes affecting composition are

inseparable. Thus, blending writing and computer technology

may enhance invention, through the social aspects of knowledge construction, and through offering writers the opportunity to become aware of the mental processes in which they engage as they invent, research, and construct knowledge. Through nonlinearity, a digital electronic form, and highly sensory nature, hypertext forces the reader to "play" with the ordering of thoughts and "notice" how that affects cognition and meaning. Hypertext, then, may be a facilitating technology, bringing both different and greater possibilities for critical thinking and invention in the researched writing process.

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DEDICATION

To my parents, William S. and Nada J. Price, proud WWII Marines, who selflessly lived their lives that I might have what they could not; who also encouraged me, in all that I do, to "press on toward the goal."

And to my sons, Brian and Steven, in whom, I pray, such heritage firmly resides.

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CHAPTER ONE

COMPOSITION AND RESEARCHED WRITING

Introduction

As a freshman composition student in 1970, I was required to submit research essays in stages, with an outline and first draft, and there was little or no feedback prior to the final draft. The method for producing a finished piece of academic writing was linear and privileged narrowing and focusing a topic prior to researching. One simply did one's research, produced notes and a draft, then wrote up the resulting paper. I have no recollection of freewriting, collaborative brainstorming, or other such activities that emerged from what came to be known as the "process movement." I remember no peer groups, no revision, simply editing to hone grammar and form, following the then standard emphasis on correctness through a neat and orderly formula. The idea that research might continue throughout a project, to further develop understanding or knowledge, was absent. My essays, judging from my grades, were successful. In the end, however, I did not arrive at the place I would rather be, the result of a too closely, too narrowly followed predetermined script.

That is to say, in the act of writing I discovered other
ideas I wanted to explore, to research, which might have
lead to further and richer invention. I was, instead,
required to stay on task. As I, on my Brother typewriter,
pecked out the final draft, my sense of ownership and
closure was denied.

Since my early college days, the preferred paradigm in
writing pedagogy has shifted from writing-as-product to
writing-as-process, acknowledging that writers produce
writing through the recursive processes of invention,
writing, and rewriting. Within this framework, the act of
writing guides the writer to understanding and triggers
insights while ordering thoughts. In this way, invention
may occur throughout the writing process. This insight has
been given further weight by theoretical models offered by
scholars who consider writing a social process. Recognizing
connections inherent in language, writing, and knowledge
construction, such scholars teach us, among other things,
that writing is a collaborative act that requires writers
to enter ongoing conversations and discourse communities.
Invention, then, is understood as an important aspect of
the process of entering conversations. Thus, the
recursivity of the writing process and the nature of

knowledge construction suggest the necessity for writers to revisit invention throughout their writing process.

Despite such theoretical developments, the treatment of research in first year composition courses and in research writing textbooks seems to have changed very little; in general, research assumes a position as the first stage of composing and is, by and large, absent thereafter. In other words, efficiency in the process may be stressed at the expense of more meaningful learning. A glimpse at some popular research writing textbooks suggests how little classroom approaches have changed. *The Bedford Researcher* (2003), for example, advises students to move from choosing and narrowing a topic, to developing a research question and plan, then to finding information. On completion of these stages, writers are to engage the processes of organizing, outlining, drafting, revising, and editing. Similar programs are advised by *Writing Research Papers* (2005). The textbook *The Research Paper: A Guide to Library and Internet Research* (2003) summarizes "the steps you need to follow" when writing a researched paper (6). The text encourages student writers to evaluate sources, focus clearly on their hypotheses, and be ready to revise their hypotheses and outlines in light of what their

research uncovers. With a revised hypothesis and clear thesis, students are to produce an abstract and outline. While writing the rough draft "fairly rapidly," writers are reminded to cite sources correctly, and then revise the draft for organization, support, language, and documentation (7). Additional research during the writing phase is recommended only if additional documentation is necessary to support the student's thesis. Excluding discussions related to electronic research methods and sources, the current texts generally parallel first-year composition research texts from the past. Thus, current student research methods often remain mechanical, curb recursivity and, as such, they truncate the possibilities of invention inherent in the research process.

My thesis responds to this typically abbreviated function of research in the writing process, and I argue for a new attitude and approach toward the teaching of researched writing. Drawing from scholarship in composition, hypertext, and learning theories, I examine the inventive possibilities of writing done concurrently with online research and its potential to reinforce a recursive, rather than linear, writing process in which the writer moves between research and writing activities,

augmenting and honing the text over time. Attributes of hypertext based research, such as highly intuitive search engines and hyperlinks, can quickly put forward new associations and opportunities for interdisciplinary thinking, providing a richer environment for the active reader and advancing the prospect for increased discoveries and a deeper, richer learning and inventive writing experience. Insights of post-process theories in composition and the scholarly dialogue surrounding learning and invention theories often converge with hypertext theory, supporting my argument that the inclusion of a recursive process of writing in conjunction with hypertext based research may promote a varied and more extensive learning and, in turn, a more enriched and meaningful experience through writing. I also suggest that current scholarship in hypertext and learning theory may help scholars in composition reconnect social epistemic models of writing with cognitive research and cognitive models for learning.

Composition's history supports a richer understanding of knowledge construction and writing than do the textbook methods I have discussed. As I examine recent composition theory, I hope to show how, as language users acknowledging

social theories of language, we make meaning and construct

knowledge in response to our changing situations and

interpretations, which should encourage us to welcome a new

approach to research and the possibilities of a richer, if

chaotic, method of research and writing.

Post-process Concepts

The most recent move for composition study is in the

direction of post-process theory, though the exact

definition of the term "post-process" is contested. In a

1994 *CCC* review article, John Trimbur coined the term

"post-process," referring to what had become known in

composition studies as the "social turn," that is, shifting

emphasis from the writing-as-a-process cognitive issues of

theory to larger social issues. Trimbur explains the

"social turn" as

> [. . .] a post-process, post-cognitivist theory
>
> and pedagogy that represent literacy as an
>
> ideological arena and composition as a cultural
>
> activity by which writers position and reposition
>
> themselves in relation to their own and others'
>
> subjectivities, discourses, practices, and
>
> institutions. (109)

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Trimbur set the divide between process and post-process along cognitive-social lines, setting the social outside the process paradigm, thereby increasing the divide between process and post-process camps.

Scholarly attention largely shifted from the formulaic processes by which the writer produces text toward an emphasis on the larger systems of social construction affecting the writer, such as culture, economics, politics, and institutions (Kent, *Paralogic* 7). Post-process theorists focus on the benefit of theorizing rather than theory building and understand the act of writing as "a" process rather than "the" process. Such theorists assert that "no codifiable or generalized writing process exists or could exist," in Thomas Kent's words, and that the activity of writing cannot be encapsulated within a standardized process or "Big Theory" (*Post-Process* 1).

Most post-process theorists hold three assumptions about the act of writing, according to Kent: (1) writing is public, that is, the act of writing is a form of communicative interaction that includes the writer and other language users "at specific historical moments and with specific relations with others," since these moments and relations change; (2) writing is interpretive, that is,

we must come to an understanding with other language users to "make sense of" language we write or read, that writing involves interpretation, and interpretation is not reducible to a process; (3) writing is situated, that is, writers have a specific way of seeing things, carrying specific interests, beliefs, and fears that situate them in relation to other language users and influence their use of language (*Post-Process* 1-2). Simply put, writing is a public act that requires understanding between language users. Furthermore, communication is contingent and situational. Writing, for these reasons, is a process that cannot be generalized.

Still, the label "post-process" remains unclear, a result of questions and disagreements amongst the scholars. Bruce McComiskey regards Kent's notion of post-process as "*anti*-process." A more productive notion of post-process, according to McComiskey, is post-process as an extension of the process concept rather than its rejection (49-50). If discourse production and analysis defy modelization, if language is unstable and contradictory, it follows, for Kent, that it is impossible and "beyond logic" for a writer or reader to predict the path of understanding for another. Interpretation between writer and reader is a hermeneutic

strategy that works only as a guessing game (see Kent's *Paralogic Rhetoric*). McComiskey looks beyond the issue of language instability and its interference in universal meaning production. Though Kent and McComiskey agree language is unstable and contradictory and, as such, writing cannot be codified into universal practices of a master theory, McComiskey's interest in invention and revision strategies focus on developing the writer's use of language, transforming the instability of language into discourse that is enriched and purposeful. McComiskey points to the act of writing as a means to accomplish this understanding and purpose, explaining:

> [I]nvention and revision strategies, as I understand and teach them, do not assume a stable and predictable linguistic system for generating universal meaning, their function is, instead, to harness the polyphonic character of language in communities, to develop rather than constrict a writer's sense of purpose. (39-40)

The act of writing holds the capacity to remedy the instability of language. According to McComiskey, "*writing well transforms this unstable language into discourse that can accomplish real purposes*" (50). McComiskey's vision of

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post-process offers "social-process rhetorical inquiry" as

a pedagogical approach in composition to understand the

social realm in composition discourse, offering rhetorical

heuristics that help writers navigate through economic,

cultural, political, and social contexts (20).

The very nature of post-process theory defies a neatly

packaged definition. As writing studies academics move into

the twenty-first century they continue wrestling with

theories of knowledge-making and reject the concept of a

generalized writing process, given the notions of

interpretation and the fact that specific historical

moments with specific relations are ever-changing. The

challenge of diversity, however, remains a focal point

within the field. Current trends, which carried over from

the 1990's, attend to issues of diversity related to

gender, race, and class. Additionally, disability studies

and sexual identity receive greater attention as well as

the notions of an internationalist perspective and moving

beyond the mastery of English only (*Bedford Bibliography*).

Current scholarly trends reflect an interest toward

analyzing new media and technology, evidencing diversity

extends beyond student identity and into areas of

composition's histories, theories, and curricula (*Bedford*

Bibliography). Genre studies and activity theory (Vygotsky) may also provide fertile grounds for post-process writing theories (*Bedford Bibliography*).

What Next?

Current post-process understandings of recursivity offer us the opportunity to rethink the purposes and means of research writing. Students may discover a more fruitful writing experience if given the opportunity to recurrently research and revise while writing, narrowing and refocusing the topic further down the line. With the advent of computers and the ease with which text is revised, even moved in large sections (an inconceivable function during *my* freshman composition days), the ability to implement a recursive process of concurrent online research and writing is greatly simplified.

Technology's role in writing and invention, according to certain computer science and composition scholars, directly associates to how and what the writer rhetorically invents, evidenced in arguments that computer-mediated communication contributes to fragmentation and postmodern thought, affecting human cognition (Harnad 1 par. 9); further, computers more closely imitate the associative

mental process and speed of thinking (Harnad 2 par. 4); and a "new kind of consciousness" stems from and works through fragments of information the mind plucks from electronic media, causing us to think in a new way (Guyer 334). Such points bring new and different possibilities to the student writer, and suggest composition studies might take a closer look at technology's link to cognition, as well as the conversation surrounding current learning theories related to metacognition and learning strategies.

In the remainder of this thesis, I explore these ideas more fully, grounding them in the theories that give rise to them. In chapter two I argue that metacognition and learning strategies work to enhance learning; I also show the possible limitations of traditional learning theory in light of potentialities brought about through technology. The third chapter discusses invention theory in relation to writing and computer technology; the connections between these zones allow teachers and learners to tap into both the social aspects of knowledge construction and the writer's mental processes. Chapter four explores how and why concurrent writing and online research, supported by the nature and dynamics of hypertext, that is, its nonlinearity, digital electronic form, and highly sensory

nature, may significantly augment the experience of critical thinking and invention in the writing process. The final chapter presents my conclusions and recommendations to promote a hypertext research and writing pedagogy.

CHAPTER TWO

LEARNING THEORY

Composition studies' shift to social or post-process concepts, combined with the interdisciplinary prominence of post-modern thought, generally worked to redirect attention away from cognitive theories in composition studies. Old cognitive theories did not successfully account for how one comes to the content one writes, how the larger social and discursive forces situate writers and help constitute what they believe and what they can say. The social process models, in contrast, offered accounts of knowledge-making as a communal, language-based activity and explored how larger social and discursive forces situate writers and help constitute what they believe and what they can say. While it would be unreasonable to say that cognitive work has been abandoned in composition studies, my experiences and reading in the field suggest that we have pursued that avenue with less vigor after the 1980s.

In examining hypertext as a means to recursivity in writing, however, I discovered strands of current learning theories that help illuminate the cognitive reasons why a social notion of invention as an ongoing process throughout

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writing would lead to greater learning. Such theories indicate that the cognitive and social aspects of learning can and should be mutually investigated and understood, as they are intertwined and inseparable, leading to the more holistic individual experience and explanation of learning. This line of reasoning points to the potential usefulness for composition studies to further explore the connectedness of learning theory and invention and their relationship to research, technology's link to cognition, and the composing process.

Schools of Thought

Generally speaking, there are three dominant learning theory schools: behaviorism, cognitivism, and constructivism. To complicate the matter, each theory has numerous subsets (Jean Piaget's social cognitivism, Lev Vygotsky's social constructivism) and learning theories and theorist classifications are contradictory. For example, Piaget and Vygotsky are sometimes classified as cognitivists, along with Bruner and Gagne, though Gagne's Conditions of Learning is grounded in behaviorism (Kearsley). Further, The TIP (Theory Into Practice) Database (Kearsley), frequently cited by professionals and

scholars, labels Bruner a constructivist whose framework is based on cognitivism, while psychology of learning scholar M.P. Driscoll (200) tabs Bruner a cognitivist. Then there is Bandura's Social Learning Theory of modeling, influenced by Vygotsky, which draws on cognitive *and* behavioral theory (qtd. in Kearsley, "Social Learning"). Specialization, disciplinary boundaries, and the volume of information situated within each discipline has led to multi-disciplinary disconnects. Compositionists would thus be wise to avoid the tangle of labels and categories; we can and perhaps should actively discover and borrow any theory that might help us understand the mechanisms of learning.

There are two particular threads of learning theory that I have found especially promising: constructivist learning theory, which reinforces the concept of writing to learn, and e-learning theories, a growing force within the discipline of education. Both constructivism and most forms of e-learning draw on cognitivism. Cognitivists focus on the learner's mental processes, how the brain processes and stores new information. Learners are considered proactive agents, and learning is accomplished through mental processes that transform content into usable knowledge, similar to the information processing of a computer. For

cognitivists, knowledge relates to organization, and learning is a process of relating new information to information previously learned.

Learning Theory and Composition

Constructivism

Constructivism draws on cognitive theory, adding a social element into the mix. The constructivist theory of learning is student centered, acknowledging individuals as active agents who purposefully engage in their own knowledge construction and integrate new information by associating and representing it in a way that is meaningful to them. Knowledge is not a fixed entity; rather, it is constructed by individuals through their own experiences in the course of active participation within socially, culturally, historically, and politically situated contexts, notions complementary to post-process theory. The constructivist approach suggests educators consider the knowledge and experiences students bring with them to their learning tasks.

Educators and compositionists have long been in conversation over the connection between writing and learning. In 1977 Janet Emig suggested the connection

between writing and learning, arguing that learning

involves the active, personal, and self-regulated

construction of organized conceptual associations, with

associations further refined by feedback processes. She

hypothesized that these same features also characterize

writing. In other words, the writing or symbolization of

one's understandings makes them available for self-

reflection and revision, which in turn allows further

learning.

Emig's work helped lead the field of composition

studies to pedagogical approaches like "writing-to-learn,"

and offered rationales for integrating writing across the

curriculum. In the 1980s, Flower and Hayes further helped

extend such cognitive work in composition. The 1980 Hayes

and Flower cognitive writing model, for instance, viewed

the writer's mental processes (planning, translating,

reviewing) as central, overseen by self-monitoring

comprehension, or, metacognition (Bangert-Drowns et al.,

"Effects" 30). The self-monitored planning, translating,

and reviewing of Hayes and Flower drew on the writer's

long-term memory and interacted with the writing assignment

and developing text. The Hayes/Flower notion of writing was

similar to their contemporaries' information-processing

models of learning (see Gagne).

More recent cognitive research in the lower grades has

offered further insights into the relationship between

writing and learning, the creation of text and content. A

more current cognitive analysis of writing by Hayes in 2000

is consistent with information-processing models of self-

regulated learning described by Bangert-Drowns' et al. in

1991 ("Instructional"). In that study, Bangert-Drowns

depicts students as active agents who construct personal

knowledge, strategies, and text simultaneously through the

use of cognitive and metacognitive strategies ("Effects"

30). A 2004 study by Bangert-Drowns et al. focuses on

writing-to-learn programs in middle-school, and indicates

that "learning models, more than writing models, emphasize

explicit external feedback for shaping knowledge, skills,

and strategies" ("Effects" 30). Accordingly, "Writing can

prompt and support the use of cognitive strategies"

("Effects" 32). In addition, writing supports a high level

of organizational strategies and elaboration of thought by

linking new understandings with prior knowledge and

synthesizing knowledge. Writing, as well, can be a "tool of

self-reflective monitoring of comprehension," an ability

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that positively influences learning (Bangert-Drowns et al., "Effects" 32). The study suggests writing can be expected to enhance learning; that the learning stems from "metacognitive scaffolding" and "self-regulation of learning strategies" (Bangert-Drowns et al., "Effects" 51). In other words, writing that supports metacognition and learning strategies hold the capacity for greater learning.

E-learning

The pace of knowledge has quickened, and the life of knowledge itself has decreased, its validity, or state of being cutting edge, is soon obsolete. George Siemens calls our current pace of knowledge "the Achilles heel of existing theories," (*Knowing* 33). Behaviorism, cognitivism, and constructivism all developed in a time before the availability of digital technology. Viewed through the eyes of technology, "limitations" can be seen in established learning theory (Siemens, "Connectivism"). Late in 2004, Siemens formulated and presented an alternative theory of learning, an e-learning, which incorporates technology and connection. The emerging learning theory, connectivism, is a response to learning that is stored and manipulated by technology, and it bundles multiple theories, including

connectionism, chaos theory, and complexity and self-organization theories.

Connectionism is an information processing theory that hypothesizes how computers learn to "think," and it resides within the multi-disciplinary field of cognitive science, drawing on theories of artificial intelligence, cognitive psychology, neuroscience, and psychology of the mind.[1] Connectionists base their models of how computers work on the neurophysiology of the brain and properties believed to be required for human cognition, including connectivity, activation functions, pattern learning modified by experience, and interpreting semantics (Garson). Today connectionism is characterized by powerful networks that can be fully trained to sufficiently "learn" (Medler). The model is useful to Siemens' connectivism as it relates to connections between entities, including computer networks, power grids, and social networks. Changes within any network have a "ripple effect" on the whole, and the ability to see connections between and among fields, ideas, and concepts is a core skill (Siemens, "Connectivism").

Connectivism steps away from constructivism, in so far as it considers constructivism's definition "too vague" to be useful (Siemens, "Constructivism vs Connectivism").

Connectivists view constructivism as a philosophical conversation: If knowledge is not a representation of reality but construction, how does one account for the existence of plural realities? Rather than constructing knowledge, we "link" to our existing understanding and, in that way, much of our learning is a connection-forming process, where we "augment our capacity to know more" (Siemens, "Connectivism"). This view thus borrows from other sources of understanding the meaning-making process. According to chaos theory, for instance, meaning exists, and even through the breakdown of predictability, science recognizes that everything is connected to everything. The notion of connectedness suggests that it becomes the learner's challenge not to "construct" meaning, but to identify patterns and *find* meaning within that which seems to defy order (Siemens, "Connectivism"). When a decision is made and an underlying condition used to make the decision changes, the decision itself may no longer be correct. A decision requires new evaluations to be made, and perhaps, a new direction taken. The capacity to recognize and adjust to pattern shifts is a key task (Siemens, "Connectivism").

Complexity and self-organization theories acknowledge the significance of self-organization in the learning

process, building and coordinating connections between sources of information while creating information patterns. Self-organization promotes learning in that it requires the learner to continually shift and reorder thought. The individual's ability to make connections and form useful patterns is required to learn. Learning is situated in action.

The core of connectivism rests on multiple foundations: new information is continually being acquired and foundations are ever shifting; learning (defined as knowledge) can reside outside us, that is, within an organization or database; and the ability to distinguish between important and unimportant information is vital. Continual learning is essential, thus, the capacity to know more is more important than what is already known, since a "right" answer today may be supplanted by another "right" answer tomorrow, based on shifting information that affects decisions. Connectivism's foundational basis of an ever-shifting reality of knowledge carries a premise and need for theory to remain open to change, including connectivist theory (Siemens, "Connectivism").

Connectivism promotes the benefit of the Internet learning environment through connectivity, both

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technological and social. Further, the theory's inclusion

of chaos fits neatly into post modern concepts and supports

the belief that complexity offers greater opportunity for

seeing relationships and making meaning. The notion of

continual learning affecting change in knowledge direction

parallels my thesis call to encourage recursivity and

invention. Connectivism embodies the connectedness of

learning and invention.

However, while connectivist principles are concerned

with diversity of opinion, nurturing and maintaining

connections with information sources, either human or non-

human appliances, decision-making as a learning process,

and the importance of accurate and up-to-date knowledge,

cognitive issues play no role in its theory. The number of

factors that impact learning is overwhelming, and Siemens'

brand of e-learning spends its time concerned with learning

as it relates to context, need, and learner's intent.

Connectivism, therefore, offers a view of learning related

to technological and social connectivity, rather than

considering the individual's meaningful activities of

learning.

For me, interest remains in the cognitive and

constructivist learning theories as well as connectivist

theories as they relate to hypertext and learning. In this
regard, I find the work of Ping Chen, professor of computer
science and information technology, instructive. Chen
argues the benefits of computer-based learning systems,
focusing on a learner centered constructivist approach and
the e-learning design. The learner centered approach,
learning through experience, or meaningful activities (John
Dewey), has long been applied in education and continues in
the hypertext environment. Learning potential lies in the
ability to facilitate meaningful activity in the hypertext
setting, and, for that reason, the development of computer-
based learning environments "should stress the importance
of techniques to enable learners to explore, experiment,
and construct understanding through their experiences,
rather than have learners experience rote learning of
numerous facts" (Chen par. 2). With e-learning, both
constructivist and connectivist, it is probable people are
able to enhance learning and develop new ways of thinking,
knowing, and solving problems (Chen). However, to recognize
the potential e-learning carries, one should understand
just *how* hypertext may help the reader learn.

Hypertext and Learning

How we learn from hypertext is more complicated than how we learn from traditional text. The nonlinear structure of hypertext may alter the learner's mental perceptions and ability to use the new knowledge (Shapiro and Niederhauser). According to Amy Shapiro and Niederhauser, features unique to hypertext add complexity to the standard character decoding, word recognition, and sentence comprehension of printed text, affecting the cognitive processes that underlie hypertext assisted learning (HAL). Primary in nonlinearity is a "flexibility of information access" (Shapiro and Niederhauser 23.1 par. 2). Traditional text assumes new information follows material previously encountered and understood by a reader. Hypertext, however, is retrievable in a nonspecific order specified by each user. Such nonlinearity requires the learner to maintain a higher degree of "learner control," to more closely monitor how well he or she understands what has been read and if there are information gaps to be filled (Shapiro and Niederhauser 23.1 par. 2). In other words, hypertext places greater metacognitive demands on the reader.

There are considerable differences between reading hypertext and reading traditional text, since the hypertext

environment introduces new issues into the reading mix. Readers' interests and prior knowledge influence their selection of links. Hypertext readers may focus on navigating the system rather than developing meaning at the word, sentence, or paragraph level (Trumbell, Gay, and Mazur). Additionally, hypertext carries physical attributes different from traditional text. Hypertext is presented on a computer screen. The limited size of the screen generally necessitates scrolling, and text is presented in frames, characteristics that increase the reader's memory load and affect the natural reading eye movement pattern. When reading, the eyes move forward and backward, allowing the reader to consider what was read, predict what comes next, and determine meaning (Nuttall). Breaking text into frames hinders the reading process, since what is read in one screen must be recalled and integrated through multiple screens. Other distractions of the hypertext environment include unusual color schemes, varied fonts, type sizes, graphics, sound, and drop-down boxes that cover portions of the text.

Further, well-defined structures, hierarchies, are helpful in achieving simple, factual knowledge for the beginning learner but may lead the learner to become

passive. Ill-structured systems challenge the learner to seek coherence, promoting deep learning for advanced students. Individual knowledge directly relates to the readers engagement with hypertext, and low prior knowledge readers tend to benefit most from high structured program controlled hypertext, while high prior knowledge readers work well with learner-controlled systems (Shapiro and Niederhauser 23.4.4 par. 2).

By offering environments where students may engage in specific cognitive activities that encourage learning, that is, active, metacognitive processing aimed at integrating knowledge and increasing understanding, hypertext has the ability to enhance learning (Shapiro and Niederhauser). Hypertext cannot guarantee learning; rather, it sets up an environment to promote learning through student engagement, offering a place to explore, reflect, problem-solve, develop understanding, and integrate information (Shapiro and Niederhauser 23.8).

Development of e-learning theory is in its infancy, as little research has been published on technology that relates directly to education and learning. Moreover, HAL researchers currently employ a "kaleidoscope of perspectives," with no unifying standards and methodology

(Shapiro and Niederhauser 23.8 par. 5). As I will discuss in chapter four, hypertext carries conflicting definitions and concepts. As a result of this lack of coherence in the field of e-learning, there are no well developed, universally accepted models for hypertext based learning per se (Shapiro and Niederhauser 23.2). To explain the cognitive foundations of learning in a hypertext environment, however, we can look to two reading and learning theory models (Shapiro and Niederhauser 23.2).

The Construction-Integration Model, (CIM), of text processing states students must integrate prior knowledge with new information for meaningful understanding of new material to take place. Active learning is necessary for meaningful learning, thus, hypertext users must be mentally active for learning to take place (Shapiro and Niederhauser 23.2.1). Furthermore, students in a self-generated goal situation tend to exhibit a more effective use of metacognitive strategies (Shapiro and Niederhauser).

Cognitive Flexibility Theory, (CFT), focuses on the nature of learning in complex and ill-structured domains, stressing the importance of constructed knowledge. Learners must be given freedom to explore and consider new information from their own different perspectives (Spiro).

According to CFT, learners must be active and approach new content from a number of different perspectives in order to attain deep understanding. Spiro explains:

> By cognitive flexibility, we mean the ability to spontaneously restructure one's knowledge, in many ways, in adaptive response to radically changing situational demands . . . This is a function of both the way knowledge is represented (e.g., along multiple rather single conceptual dimensions) and the processes that operate on those mental representations (e.g., processes of schema assembly rather than intact schema retrieval). (165)

The linked organization of hypertext allows the learner to approach content from different paths, introducing the learner to opportunities for knowledge integration unlikely to take place in the traditional sequential presentation of printed text. Central to CFT and other cognitive models of learning is the ability of the reader/learner to self direct and monitor their cognitive process, or, *executive control*. Research points to enhanced learning through executive control when the learners have a high level of prior knowledge, a high interest in learning, and are self-

regulated rather than cue-based in their navigational approach to links (Shapiro and Niederhauser 23.5).

The concept of learner's executive control supports composition's student centered approach to learning, and within the halls of academia, it seems wise to pursue avenues that lead to student benefit. Tumbling within the floodwaters of dominant theory and the powers that be, savvy college students labor to salvage agency and defy simple replication and indoctrination. To that end, active learning and invention, for the student, is vital. For the student writer, invention may open the door, not only to enhanced learning, but to agency and empowerment.

CHAPTER THREE

INVENTION THEORY

Invention, as a term, evokes the notion of creativity, something yet unknown or something yet unfound. It announces something new. Moreover, invention is essential to learning, and learning may lead to further invention. In this chapter, I show the complementary, perhaps even critical, relationship that exists between invention and learning theory, in an effort to encourage increased attention to the insights that cognitive process theories might offer scholars in composition studies. My take on invention draws on rhetorical tradition, Karen Burke LeFevre's view of invention as a social act, and Scott Lloyd DeWitt's understanding and model of invention.

Invention in the composition arena, in the classical rhetorical system, is the first stage of composing, where rational arguments, based on *logos*, logic, are formulated for the purpose of organizing and presenting evidence to persuade. Aristotle links invention and discovery, his *Rhetoric* devoting Books I and II to the idea of inventing arguments, that is, developing ideas to be used in a text (Bizzell and Herzberg 175). Rhetorical tradition, which is

drawn from classical antiquity, models invention as an individual act produced by an individual writer.

This view, as Karen Burke LeFevre points out in *Invention as a Social Act* (1987), presents an "incomplete picture" of the writer's process and development (1). Rather than considering rhetorical invention as a private act alone, LeFevre suggests we view it as a social act in a broad sense; that the writer, as an individual, interacts with society and culture to create their own distinctive work (1). A comprehensive understanding of rhetorical invention considers invention, in general, as "the creation of what is new in any discipline or endeavor," an act involving a process of inquiry and creativity (LeFevre 2-3). Rhetorical invention is best understood as a social act in which an individual yet "social being interacts in a distinctive way with society and culture to create something," an act accomplished predominantly through the use of language and other symbol systems (LeFevre 1-2).

LeFevre: Invention as a Social Act

Invention builds on a foundation of knowledge laid by generations that have come before. New ideas begin where others have left off. That is, knowledge is borrowed from

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others and added to, extending the knowledge to future generations who will, in turn, borrow again. Invention, then, becomes social even when its agent is one individual (LeFevre 34).

Further, in LeFevre's words, "Invention may first of all be seen as social in that the self that invents is, according to many modern theorists, not merely socially influenced but even socially constituted" (2). The self that invents, then, is socially constructed, a social process we use to create and maintain our beliefs in ordinary concepts, focusing on what happens in relationships between people rather than what some have considered innate knowledge that is hidden in the human mind. Moreover, social expectations both promote and prohibit our invention. For the student writer, forces, requirements, and attitudes of society in general and academia specifically, feed, encourage, and support certain ideas, while effecting control or exclusion over others.

What of language and its relationship to rhetorical invention? As writers, LeFevre asserts, it is important for us to understand that as we consider and name an object or idea, we are beginning to invent the subject matter for our discourse (112). This is significant because thinking

is related to language and language is critical in telling us to what we should pay attention. Language, according to LeFevre, plays a role in how we conceive new thoughts and is associated with scientific thinking and discovery, a concept she links to German philosopher Ernst Cassirer. Cassirer incorporates symbolization and the role of culture as influence on how we constitute reality, which ties language to the view of invention as a social act. Language, for Cassirer and LeFevre, is not "a passive copy of the 'real thing,'" but an active force in the way we constitute reality that relates to how we think, understand, and invent (LeFevre 95). Language is a spark for discovery. Let me say that again. Language is a spark for discovery. Language is developed and used between individuals and social spheres. It is what we inherited, learn, and share with others. In other words, language is socially developed in an ongoing process and communicates a common perception of meaning. With this ongoing process, language is ever becoming new.

How does language relate to how we think, understand, and invent? LeFevre references an assumption of current thought on language in the words of Polish born philosopher Chaim Perelman:

Contemporary philosophies [. . .] recognized the

role of language as an indispensable instrument

of philosophical communication. [. . .] The

reasons that induce us to prefer one conception

of experience, one analogy, to another, are a

function of our vision of the world. The form is

not separable from the content; language is not a

veil which one need only discard or render

transparent in order to perceive the real as

such; it is inextricably bound up with a point of

view, with the taking of a position. (qtd. in

LeFevre 106)

In Perelman's view, then, language becomes more than

rhetorical -- language becomes epistemic, a way of knowing

(LeFevre 106).

DeWitt: An Alternative Model of Invention

While composition studies scholars were primarily

focused on post-process theory, Scott Lloyd DeWitt,

professor of computer and composition studies, was doing

work often parallel to learning theory studies by Bangert-

Drowns, Shapiro and Niederhauser, and Siemens, all of which

reinforce DeWitt's processes conclusions. DeWitt's effort

resulted in a pedagogy that utilizes technology toward his instructional goals of discovery and rhetorical invention.

Representing a larger body of composition scholars, DeWitt rejects the idea that invention takes place only at the prewriting stage and is not a part of "the writing process." DeWitt offers an alternative model recognizing that, for the writer, invention occurs when a connection is made between two or more initial discoveries. One or more of these discoveries is external, what the writer encounters, and one or more is internal, what the writer recalls from within. As the writer composes, the act of writing guides the writer to understanding and triggers insights while ordering thoughts. Thus, invention occurs throughout the writing process. Dewitt uses the term *invention* to mean "a rich collection of processes, both systematic and chaotic, that leads to discoveries of what is not yet known" (4). Further, DeWitt asserts, "Writer's connections can only be as rich as the opportunities that make them possible. The more complicated the approach [. . .], the greater the opportunities for seeing relationships and making meaning" (35). For DeWitt, then, the pedagogical goal is "to teach students to seek out multiple and diverse moments of invention in order to see

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productive connections that will result in rich, elaborate, and plentiful written inventions that are real in purpose" (24).

As a writing teacher, DeWitt fuses composition and computer technology to reduce the dull, slow, Brother typewriter concept of composition while providing access to new forms of research that were previously nonexistent. His focus on invention relates to how computer technology and certain instructional goals can be connected; his aim, to encourage students' development as "active" writers, while promoting the interconnectedness of reading, writing, exploration, discovery, and research. Accordingly, the act of writing itself is directly tied to invention, and the current practice in composition and rhetoric studies reflect that notion. (The notion of hypertext based learning and instructional goals, as well as active readers and writers, are further addressed later in my text.)

DeWitt's theory of invention draws mainly from instructional/cognitive psychology and collaborative learning theory, and relates to the mental processes of what writers do. The recursive processes, specifically, are what he calls *noticing,* vital to the process of discovery, *forming and shaping,* which connects internal and external

discoveries, and *reflecting* on the disorder and invention
created from the fragmentation and chaos of the writer's
research (DeWitt 15).

DeWitt defines noticing as "allowing one's eye to
wander" (33). When the writer notices, fragmented
information begins to shift and reorder, allowing new
associations. Invention in writing takes place, says
DeWitt, when a writer connects two or more discoveries, at
least one discovery external, something encountered, and at
least one internal, something the writer recalls from
within (23). The writer then forms the connection into
something new, invented discovery, which belongs to the
writer. DeWitt sees invention as "a layering of episodes,"
calling each episode a "moment of invention." Such moments
occur when students notice something, see relationships,
and then make connections (24). The writer makes even
richer "moments of invention" when they connect two or more
"moments of invention," pulling together their fragmented
experience into a mental text. DeWitt compares this
layering to the image of water drops merging – small ones
combining and recombining, becoming larger and larger, and
finally becoming a pool. Both external and internal
invention continues as the writer hands over their mental

discovery to writing, at which time they reform into

written invention with rhetorical consideration of role,

purpose, audience, and language (23). From the mix of

internal and external invention within computer mediated

chaos, the writer discovers, intentionally as well as

unintentionally, that seemingly unrelated topics may be

woven together to achieve order though discovery, gaining

reconciliation in the process of writing.

Noticing, for the writer, is a continual process,

which leads the writer to ask questions and make

connections, to form and reshape. Reflecting allows the

writer to pause and consider, to hypothesize and question,

lending to an opportunity to discover the *best* solution for

a problem rather than the *first* solution possible.

Proficient readers and writers routinely apply the strategy

of reflection to their thinking process, while less

proficient readers and writers tend to seek closure, to

finish, producing a more simple text than the reflective

reader/writer (DeWitt 140-41).

Computer technology allows access to information

through hyperlinks that one will not stumble upon in the

traditional hard bound text approach to research. While Web

searches are intended to be associatively linked, they may

also provide giftable fragmentation, for searches also splinter topics in such a way as to present seemingly unassociated subject matter to enter the conversation. DeWitt sees hypertext links as the key to recognizing connections and associations that seem unlikely, linking one text to another on a path they may otherwise not have seen. The hyperlink opens wide the door to randomly "discovering" informational possibilities. Proficient writers are willing to tolerate chaos, ambiguity, and uncertainty to invent and solve problems of writing (DeWitt 37). Proficient writers place themselves in disordered situations where, through the act of writing, they can form and shape ideas; they *bring* order, creating knowledge newly discovered.

A decentering, "a letting go of what *was* and readjusting to what *is*," occurs each time a reader clicks on a link and leaves the site (DeWitt 142). Decentering allows the reader to refocus and reorganize, presenting a potentially rich environment for invention. For the non-reflective reader, DeWitt stresses, decentering may leave "holes in our students' cognitive fabric" (144). In other words, for students who are not aware of and actively practicing metacognition, knowledge construction and

invention are seriously compromised, leaving them, as writers, to create simple texts.

The process of research, according to DeWitt, is the best bridge between gaps in reading and writing. He calls research "generation and creation. Exploration and discovery. Invention" (40).

Important to invention, and related to noticing, is "allowing," since when the writer closes their mind, they are unable to engage in active, critical thinking; their minds block, or limit, invention. Connected to allowing is the importance of students' awareness of their own learning processes (DeWitt 176). For students to become most effective at constructing knowledge, they must be aware of and actively control the mental processes involved in the act of learning, that is, engage in metacognition. Hypertext may well be touted as a learning opportunity, but it is important to understand clearly just *how* hypertext may be situated in the learning process.

CHAPTER FOUR

HYPERTEXT: THEORY AND RESEARCH

> In so many different places, we're
> finding that the old linear, more
> mechanistic, single-perspective
> approaches don't work. You need
> interconnected knowledge and knowledge
> in context. You need to be able to
> apply multiple perspectives, multiple
> knowledge sources, multiple points of
> view, and that's what we've tried to
> do. Luckily, we have this new medium,
> which is a flexible medium.
>
> Rand Spiro
> *New Educator*

My interest in hypertext research lies in the belief

that, compared to traditional text, hypertext, through its

nature and form, creates an environment that introduces

different and, perhaps, greater possibilities for the

student writer to both learn and invent. In this chapter I

track the development of hypertext toward understanding its

basis and role in academia and examine hypertext with the

purpose of showing how hypertextual research encourages

recursivity, invention, and critical thinking in the

writing process. I suggest that hypertext allows us to

better attend to cognitive development in writing, when

working in conjunction with the social nature of language

and meaning-making, which is consistent with other veins of

composition studies as outlined in chapter one.

A Brief History

The term "hypertext" carries a rich history, though

its structure and purpose, either envisioned or achieved by

the earliest pioneers, may be at odds with the current

application and direction. Early conceptions were of a

personal use machine with which to manage information and

connect scholars, while maintaining permanent links and

trackable changes, an effort to preserve a viable system

for copyright. Hypertext retains four early points of

significance: first, the notion of enhancing "memory," due

to limited human cognitive capacity, by way of a receptacle

or system in which to store, link, and retrieve knowledge,

second, linking by association, third, the concept and

premises of nonlinearity, and fourth, access.

Hypertext, as a concept, was a response to the

rapidly increasing pool of scientific information prior to

WWI. Vannevar Bush, the designer of room-sized computers,

is generally credited with the first description of

hypertext-like ability. A rapid growth of knowledge brought

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specialization within the sciences, and information access became limited to each field's experts. Bush criticized this practice of each scientific discipline hoarding in-depth knowledge within their hierarchies, which he believed thwarted disciplinary connections and contributed to social and political strife. Bush sought a nonlinear text-based system devoted specifically to the development of interdisciplinary connections among specialized scientific fields. In 1945, Dr. Bush's theoretical "memex" system allowed the user to both store and retrieve documents, linked by association, on microfilm.[2]

In the 1960s, computer pioneer Douglas Engelbart imagined people sitting in front of cathode ray tube screens, "flying around" in an information space where they could invent and illustrate concepts that would better connect sensory, perceptual, and cognitive capabilities; to communicate and collaboratively organize information with great flexibility and at a high rate of speed (*Bootstrap.org*). Influenced by Vannevar Bush, Engelbart pioneered what is now known as collaborative hypermedia, envisioning the computer as an extension of human communication capabilities and a resource to augment a

collective "human intellect."[3] Engelbart's vision echoes in Siemens' current notion of connectivism.

The term, hypertext, was coined by hypertext pioneer Theodor H. Nelson and first used publicly at Vassar College in 1965. Nelson's vision of hypertext grew out of his interest in a nonsequential structure of thought that could be presented directly to function as a structure parallel to the mind. Nelson's original hypertext project, Project Xanadu, was never intended to be a World Wide Web. Rather, it proposed a model of literature where links do not break when versions change (Nelson refers to them as "deep links"), and documents could be compared and annotated side by side.[4]

However, in 1989 the direction of a hypertext system turned toward what became Tim Berners-Lee's World Wide Web (WWW or the Web), a hypermedia internet-based system designed for global information sharing. Having no means by which to recognize change or protect intellectual property rights, the discussion surrounding copyright continues to vex web users and theorists today.

Hypertext: What Is It?

Hypertext development, like most of computer science and engineering, has been driven by competing theories of mind, shaped by thinking in cognitive science, literary theory, utopian social thought, written and visual arts, as well as knowledge structures, artificial intelligence, database management, and information retrieval (Joyce, *Two* 21). For this reason, definitions of hypertext have changed along with its history, promoting new and sometimes contradictory definitions. Defining "hypertext" is not, then, a simple task. The term may extend beyond what it is to its qualities, flexible and interactive, or what it facilitates, a system.

Nelson explains his concept of hypertext in his 1982 book *Literary Machines*. He writes:

> [B]y "hypertext" I mean *non-sequential writing --* text that branches and allows choices to the reader, best read at an interactive screen. As popularly conceived, this is a series of text chunks connected by links which offer the reader different pathways. (2)

George P. Landow agrees and extends this definition, explaining that hypertext "denotes text composed of blocks

of text – what Roland Barthes terms *lexia* -- and the
electronic links that join them" (*Hypertext: Convergence*
4). This "information medium" links verbal and nonverbal
information (Landow, *Hypertext: Convergence* 4). Hypermedia
is an electronically rendered extension to hypertext that
supports linking visual information (graphics), sound,
animation, and video elements in addition to text elements.
In his 1992 book, *Hypertext: The Convergence of
Contemporary Critical Theory and Technology,* Landow
emphasizes his non-distinction between hypertext and
hypermedia, since hypermedia is an extension of hypertext,
and he uses the terms interchangeably throughout the text.
Michael Joyce similarly emphasizes the visual nature of the
medium, offering a bold and sweeping perception of
hypertext. The first chapter in his *Of Two Minds: Hypertext
Pedagogy and Poetics* begins with this commentary:

> Hypertext is, before anything else, a visual
> form. Hypertext embodies information and
> communications, artistic and affective
> constructs, and conceptual abstractions alike
> into symbolic structures made visible on a
> computer-controlled display. (19)

Other hypertext theorists, like Jay David Bolter, emphasize the spatial and dynamic nature of the medium. According to Bolter, "the Web *is* hypertext for us today" (author's emphasis; xi). This Web, Bolter explains, is a "textual space" that extends throughout the Internet, where words or phrases in the text can be "hot," that is, clicking on them will take the reader to a new page, which may also contain hot links that, in turn, lead the reader to further pages (27). The individual Web pages become a network of interconnected writings, a network Bolter calls hypertext.

Hypertext is classified as either *exploratory* or *constructive*. "Exploratory hypertext" is a restrictive hypertext, used to convey information (Joyce, "Siren"). The reader navigates his or her own path, thereby determining the text to be read. "Constructive hypertext," such as the site Wikipedia, allows the reader freedom to alter existing texts by adding text to the network, creating new links, or changing fonts or colors and in this way becomes a co-author of the text (Joyce, "Siren"). There are various forms and genres of electronic writing, and how electronic writing develops (or is read) depends on the goal of the user.

For the purpose of this thesis, my discussion of hypertext relates to exploratory hypertext, since it most pertains to student research as an informational tool or medium, rather than hypertext as constructive or as a literary form. I also borrow Bolter's equation of hypertext with the Web. When I refer to the Web or World Wide Web, then, I mean to signal the "textual space" of electronically networked links and writings, which include linked graphics, sound, animation, and video.

Hypertext and Critical Theory

Critical theory, particularly the poststructural orientation toward de-centering, discontinuity, and intertextuality, helps us understand how electronic writing "redefines" both the text and the act of reading itself (Bolter 162). The relationship between hypertext and critical literary theory has increasingly "converged," as theory lays out hypertext's role and influence on the reader (Landow, *Hypertext: Convergence; Hypertext 2.0*). Critical theory provides the reader lenses through which to view and interpret a text. Because digital writing technology is so "malleable," it can be understood according to a number of critical theories (Bolter 161).

Academics working in hypertext and hypermedia, however, associate electronic writing firstly with poststructuralists published during the 1960s through the 1980s, whose primary concern was with the making or unmaking of meaning in literary and other discourse and included theories on reader-response, semiotics (Barthes), and deconstruction. Poststructuralists aimed, above all else, to subvert traditional views of literature and end the perceived authority of authorship.[5-6] Barthes and Derrida, in their concern over power and authority, argue against notions of center, hierarchy, and linearity, early on referring to an ideal of textual openness, while employing terms such as link, web, and network in their discussions of traditional text, language that "contradicted the assumptions of print" (Bolter 181). Hypertext is considered by many theorists to be the manifestation of poststructural theory (Landow, *Hyper/Text/Theory*), the material embodiment of textual openness that changes the dynamics of the engagement between the reader and the text.

linking), which may work to maintain, strengthen, or weaken textual coherence (Engebretsen 5 par. 2).

Since coherency in hypertext is tied to connectivity rather than linearity, it is up to the reader to make and find connections in both hyperspace and the mind. Coherency in the reading of hypertexts, then, is a result of mental work tied to the reading process rather than the text (Engebretsen). This view of coherency is key in that the reader actively makes connections and, in so doing, *assigns* coherence to the text (Engebretsen 4 par. 3). Three-levels of coherence in hypertext correlate with the linguistic levels of hypertext: *intranodal, internodal,* and *hyperstructural* (Engebretsen 4.3 par. 1).

Intranodal coherence relates to coherence at the node level of the hypertext. It most likely follows the traditional textlinguistic view of coherence and corresponds to the expectations of a printed text (Engebretsen 4.3 par. 2).

Internodal coherence defines coherence between two text nodes read in sequence. Hypertexts are generally non-linear in structure; however, each separate reading will always be linear. The reader expects traditional textlinguistic local coherence between linked nodes that

the structure allows to be read in sequence. Links signal relevance (Engebretsen 4.3 par. 3).

Hyperstructural coherence concerns coherence in the structure that governs the full system of links and nodes. Hyperstructural coherence relates to the textlinguistic notion of global coherence (Engebretsen 4.3 par. 4).

What does this mean for researched writing? As Engebretsen notes, "cognitive coherence is of greater importance than textual coherence [in reading and researching in hypertext]" (5 par. 2), since whether the reader finds the text coherent or not depends on his or her understanding of the tasks involved in the reading process. In hypertextual contexts, the tasks become "a combined interpretive and *explorative* reading process" (author's emphasis; Engebretsen 1 par. 2).

Hypertext represents a presentational form that explicitly invites active exploration (Engebretsen), while offering the student the means to gain "quick and easy access to a far wider range of background and contextual materials than has ever been possible with conventional educational technology" (Landow, *Hypertext: Convergence* 126). Yet, simply having a wealth of information online is useless if students are unwilling and/or unable to use

information effectively. Students should know *how* to formulate questions and make connections between and among available information in order to use library resources efficiently, to use what they have in hand and on screen. To achieve the most extensive learning and most meaningful writing experience, students should work to thinking critically. The nonlinearity and nonsequentiality of hypertext models the text characteristic of scholarly writing, such as footnotes, statistics, and the like, which require the reader to leave the main text. Hypertext "teaches the student to read in this advanced manner" (Landow, *Hypertext: Convergence* 127). Landow views hypertext as a means of "reconfiguring the student" in the direction of scholarly reading skills, while pressing the student to gain critical thinking skills (*Hypertext: Convergence* 126).

Hypertext exploration, moving from link to link, forces the researcher to continually "play" with the ordering of thoughts and "notice" (DeWitt) how that affects cognition and meaning. Entering new text somewhere other than its beginning breaks the linear reading of that text, which contributes to fragmentation and chaos for the researcher. Each site of disorder presses the researcher to

seek cognitive coherence by actively monitoring their understanding and filling their information gaps, as they work to integrate prior knowledge with new information. Such fragmentation need not be chaotic; rather, it functions as "a perpetual state of reorganization" (Bolter 12). Metacognitive strategies, Dewitt's *forming*, *shaping*, and *reflecting*, help the researcher establish and maintain both meaning and direction. For the writer who remains an active researcher further in to the composing process, the opportunity for learning continues as "reorganization" takes place, all the while encouraging recursivity.

Unlike traditional text, hypertext's form presents spatially, rather than physically, which affords informational flexibility and connectability through linking. Such form promotes active reader-centered encounters with the text. Linked documents require the reader to navigate through an ever changing environment and functions as "an enabling technology rather than a directive one, offering high levels of user control. Learners can construct their own knowledge [. . .] according to the associations in their own *cognitive structures* (author's emphasis; Marchionini 356). Moreover, linking connects not only information, but ideas; links

validate association and, in that way, contribute to establishing both textual and cognitive organization. This process is further enabled by the highly intuitive search engines available on the web, which assist the user in finding connections, suggesting associations that might otherwise have gone unnoticed.

The process of making associations is further enabled by hypertext's highly sensory presentation; its capacity for sound, motion, color, images, and fonts are all in play to catch the reader's eye (and ear) differently than print. While hypertext's drop-down boxes and multimedia capacity could work to *distract*, competing for the reader's attention, image, color, sound, and motion most probably work to *attract*, affecting what the reader may "notice," and, in turn, influencing their direction and choice. Digital electronic rendering of information de-centers and rebalances the notion of text (Lanham). Words now compete for attention with images, motion, and sound.

Finally, the significance of the spatial nature of connectivity in hypertext also extends to issues of access. A digital electronic information system allows for learning and researching from a distance, that is, the researcher has availability of the virtual presence of authors and

sources without requiring the student's physical presence

at a specific geographical or spatial site. Students,

therefore, have access to sources minus the constraints of

time and location, which makes available an individualistic

opportunity to read and research, to research and write at

home or elsewhere.

Hypertext and Culture

The Social Connection

Technology is changing the way we obtain and share

information and the very nature of what we need to know in

order to effectively interact within both social and

academic culture. Hypertext associates with a larger

cultural phenomenon that holds a fascination with

hypermedia and technology in general. Technology is an

element of any culture, and the relationship between

technology and culture is reciprocal; technologies "shape

and are shaped by social and cultural forces," (Bolter

xiii).[7]

Writing is also a part of culture, and in the broad

sense, writing is a technology (Bolter). Technology, in

light of its Greek root, *techne*, is an art or craft, a

skill – the application of a method. All writing employs a

method, as well as materials; the paper and pen are a method of writing (and materials), as are the printing press and the computer (Bolter). The supplanting of one technology by the next brings about a change in both method and material, thereby effecting a revolutionary change in *what* is produced and how it is disseminated (See Stevan Harnad's discussion of the four revolutions in human cognition.)[8] This change brings to light the material aspect of all writing technologies, which ultimately carry social and political sway. "The technical and the cultural dimensions of writing are so intimately related that it is not useful to try to separate them: together they constitute writing as a technology" (Bolter 19). For composition, the computer replaced my Brother typewriter both as a printing method and as a writing method that resituates culture's social and political rhetoric. "If personal computers [. . .] are part of our contemporary technology of writing, so are the uses to which we put this hardware" (Bolter 19). I discuss the topic of social change as it relates specifically to composition studies in chapter five.

The computer's reciprocal relationship with culture seems evident in what appears to be society's shifting

interest -- from print to electronic media. Computer use

and ownership is now common and, in turn, acts as a

cultural force that informs the social nature of language

and meaning-making within society. For example, it seems

that computers have "foregrounded the relationship of word

and image" and led to "an increased emphasis on visual

communication" (Bolter xii-xiii). Joyce's description of

hypertext as "before anything else, a visual form"

parallels an increasing prominence of visual communication

in culture as a whole (*Two* 19). This growing status is

fueled by culture's interest in and increasing reliance on

information transmitted via television, cinema, cell phone

and computer screen, technologies that literally feed

imagery to the brain.

For a culture that increasingly gravitates from books

to movies, print to electronic media, "a picture is worth a

thousand words." For many, visuals have the capacity to

help think through and conceptualize problems, to

illustrate solutions. The values we place on images spill

into the social arena, and the contrast between word and

image is essential (Guyer). Words most often transmit

verbal information. Pictures solicit reaction to a story

being told; they have the potential to evoke emotion, which

affords them social and political power. Images, like language, "are never unmediated [. . .] a brain must be involved" (Guyer 325). Visuals are open to interpretation, alterable, and our reality is sensitive to time and space – to context.

Visual communication challenges the power and dominance of prose. Printed text, through its fixity, has historically been associated with power and authority; imagery was held subordinate by way of ratio and design. Hypertext, however, renegotiates that relationship between the visual and the printed text. The point is, the relationship between image and word is increasingly unstable, and "a whole set of cultural questions is connected with the changing status of the word" (Bolter 7).

A Shifting Cognition

What appears to be a cultural and technological shift from print to electronic media is accompanied by "controversy and contention" regarding, for one thing, "the nature of the mind" (Joyce, *Two* 25). That is, the move to electronic information brings, perhaps, a corresponding shift in the way people think -- a cognitive shift (21-22).

The tools we use both define and shape our thinking; technology is "rewiring" our brains (Siemens,

"Connectivism"). As early as 1993, Lanham pointed to the

implications of electronic information for technology,

scholarship, and the humanities. While Lanham called the

academy to consider how electronic information would affect

the organization of knowledge as well as the social basis

of knowledge production and dissemination, he also stated

the digitalization of the humanities enacts a fundamental

difference in the operating system that:

> . . . affects the neural pathways of the brain,
>
> and they are being irreversibly laid down; thus
>
> it affects whether students will be able to
>
> pursue any intellectual work which requires the
>
> higher processes of symbolic thought. (concl.
>
> par. 2)

Lanham's point is significant, as it speaks to technology's

force on both what and how we notice and perceive, which,

in turn, affects knowledge construction and meaning.

The cumulative effect of electronic media, ranging

from fragmented print layouts and narratives to web surfing

through seemingly unrelated content, may contribute to a

changing consciousness, which stems from and works through

fragments of information. Hypertext allows the reader to

move quickly between passages and links - like high-speed

number crunching – changing the way we read and write by taking in and responding to such fragments. The discussion is not a matter of technical determinism; rather, it speaks to adaptations of a culture drawn to the technology of video games and texting, a language of brevity. A short attention span has come to characterize our youth and, frequently, the population at large (Guyer). While many may lament this perceived short-coming, a sustained attention span in an age of multiplicity may be of less use than a cognition that leaps from here to there and back at a quick pace (Guyer). This so called "new kind of consciousness," brought on by electronic technology, offers the hypertext researcher an opportunity to explore in an environment where "perspective is everything" (Guyer 334).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

The traditional purpose of researched writing in the college composition classroom is to demonstrate academic writing and research skills, as well as the ability to ascertain the credibility of sources; these efforts are directed toward the goal of integrating scholarly facts and opinions with the writer's insights generated through critical thinking. Generally speaking, however, teachers all too often narrow the possibilities for the development of critical thinking by offering a narrow window of opportunity for invention in the research experience. The student writer may be better served if teachers broaden the purposes and means of researched writing to enable students to engage in the knowledge making activities of research in an extended fashion.

It seems useful, then, to shift the computer's significance, from strictly communication and print technology newer than my Brother typewriter, to a possible learning facilitator, further expanding the visions of Bush, Nelson, and Engelbart. The time has come to develop courses and endorse student texts that promote a more

genuinely recursive writing and research experience.
Compositionists might find it valuable to explore
alternative research methods that allow for invention
throughout the writing process. Melding hypertext research
with the act of writing, and encouraging active research
further along into the writing process, is, perhaps, such a
method. A followed link beckons the student toward
invention and learning, and hypertext affords access to a
pool of information too great and varied to go untapped.
The greater the opportunities to "play" with the ordering
of thoughts while following links, the greater the
potential for discovery and invention. Critical thinking
relies on the ability to relate many things to one another.

Meaning often develops within nontraditional Internet
sources that are collaborative and multi-authored.
Professor Michael Day points to the changing informational
resources held in the hypertext environment, as more and
more scholars share and develop ideas via scholarly blogs,
e-mail exchanges, and discussion groups. Such scholarly
oriented sites can be useful and relevant to student
research, as they allow a glimpse into scholarship's
conversation, method, and meaning-making process, while

gaining access to the most current discussions and information within the given field.

Researched writing has the potential to better prepare students for life beyond the academy. Composition scholar and professor Johndan Johnson-Eilola argues for composition pedagogy that teaches hypertext as a forum for social and political activity, asking students to critique, cross, and restructure borders typically separating disciplines and discourses, both functional (instructional databases) and literary, from political perspectives. Hypertext is "a *social* technology" that allows acts of reading and writing to be "transformed and appropriated" by widely diverse communities (author's emphasis; Johnson-Eilola 7). As such, hypertext might work to redefine composition by broadening the perception (border) of composition to include online documentation, databases, and electronic messages sent back and forth in bulletin boards and on the Internet. Such sources are actually texts and "maps that suggest and validate ways of thinking and acting" (Johnson-Eilola 6). In other words, blurring lines between what has been deemed high and low culture makes it possible to consider a text in terms of its social significance rather than its canonized literary or philosophical value.[9]

Students need projects that enable them to work toward "tangible goal[s]" that are "cognitively mapped to large social arenas" and have the capacity to "expose" the way in which students are "articulated by the ideologies of books, technological society, late capitalism, and so forth," while providing ways to voice the need for change within that ideology (Johnson Eilola 182). My call for a reconsideration of invention and process, focusing on research, writing, and computer technology, is such a project.

Within this project, the hypertext environment is understood as a postmodern space, challenging the notions of order and stability. Since postmodernism constantly questions authority, both textual and social, the issues of borders and informational legitimacy surface for the student writer.[10] In this regard, hypertext research pedagogy may be understood as consistent with and participating in current postmodern views of composition studies.

Borders suggest restriction, limitation, and separation. The tag, "border crossing," has been and continues to be a rhetorical and oft-used catch phrase, in university English departments and outside the discipline.

Students, as they research to write, must navigate through and between both visible and invisible borders. "Writing has always been about borders, about the processes of mapping and remapping the lines of separation between things" (Johnson-Eilola 3). The key to thinking about borders is in considering borders "both real and contingent," acknowledging the border currently exists and, at the same time, considering reasons it should not be there (Johnson-Eilola 16). Students would be wise to approach the information system seeking legitimate information during the quest for invention. Yet, considering postmodern notions, if the "classic author" holds no authority (truth) over textual meaning and interpretation, how can a student writer or reader believe their own writing and interpretation can hold any validity for mapping, and how can students move confidently from one place to another on a map (Johnson-Eilola 15)? If there is, in fact, *no* authority, *no* ground with which to measure validity, how can students assume one map is good and another bad? Given no authority, *should* students find one map more truthful than another?

Researching via hypertext puts students squarely in circumstances that ask them to recognize and grapple with

the consequences of being a subject of discourse. Such issues are complex, but offer the opportunity to discuss and strategize what kinds of authority a writer may achieve and how to confidently and ethically establish it. Given the political nature of writing, one way to begin addressing such issues might involve looking at the ways in which a project is defined when dealing with textual truth. As Johnson-Eilola points out, with the postmodernist lens, *questioning* authority is somehow erroneously viewed as *denying* the existence of any authority (author's emphasis; 15). However, he warns, authority cannot simply be dismissed. Rather, we must "use *common sense;*" we must read and interpret perspicaciously, since maps recognize, participate in, suggest and "authoriz[e] ways of living" (Johnson-Eilola 15).

Borders work to retain focus and disciplinary identity (composition studies spent decades defining and validating the discipline within the university system); however, borders may inhibit the potential for change. And rhetoric speaks loudly. Composition theorists, teachers, and students may remain "trapped in (or rebuffed by)" the postmodern theoretical discourses (Johnson-Eilola 21).[11] While the humanities continue dialogue over *crossing*

borders and boundaries, business has put in to practice a different rhetoric. John Chambers, Chairman and CEO of Cisco Systems, speaks of the importance of understanding technology's role in education, as it relates to preparing students for the workforce and competing in "a *borderless* digital world" (my emphasis; *Forbes.com*).

Yes, the rhetorical goals of business cause many in the humanities to cringe. Yet, business and science successfully developed postmodernism into a philosophy of networking, flexibility, structures, and practices. It seems wise to borrow from any discipline that offers increased possibilities for student agency and critical thinking. Electronic media has made possible so many connections and contacts between minds and stored information that "either the definition of research will change, or we'll have to come up with a new word for what electronic research will have become" (Day, abst. par. 1). Call it what you like. Hypertext research, however, may provide research more than a new word; it may prove, for many, to enhance critical thinking.

The Down Side

While hypertext may present richer environments for exploration and discovery, it also poses risk. The volume of information available on the Web is astounding, and sifting through, to make meaning and relevance, can be tedious. The potential for information overload expands with each click, and the researcher may become bogged down, tangled in his or her own Web of knowledge.

For that reason, students and teachers should be mindful of learning concerns relating to *cognitive load*, a term that refers to the working memory, or short term memory. Short term memory is limited to "chunks" of information (Miller, qtd. in Kearsley, "Information"). Based on Cognitive Load Theory, (CLT), working toward coherence in hypertext's nonlinear presentation of new information may result in ineffective cognitive load that will ultimately hinder learning (Sweller, cited in Kearsley, "Cognitive"). "If the mental work required to establish necessary relevance between local and global units of meaning is too demanding compared to the cognitive benefit of the reading, only the most motivated reader will choose to devote time to the text." (Engebretsen 4.3.4.3).

Moreover, research must, at some point, come to an end. The writer must *stop* researching, in order to achieve a completed work. The writer's task, therefore, involves both working within an assignment's particular time frame and maintaining focus on the goals and scope of the project.

While I believe the university may be better served by including and, perhaps, promoting hypertextual research, students must continue to insure reliability of their sources. Reference links within scholarly journals are becoming increasingly unreliable, according to a study of articles in three major medical publications by researchers at the University of Colorado and published fall of 2003 in the journal *Science*. According to a 2004 article in *Academe*, a journal published by American university professors, internet pages cited in scholarly journals tend to be unavailable over time, and after two years, links that lead to error messages were found in up to 13 percent of the references, thus, supplemental information was inaccessible. The article suggested a need for new policies for documenting and archiving Internet information used for scientific research. Nelson's early rebuff of the Web's "short-sightedness" has proved relevant, and his concern

over broken links remains in the conversation. Albeit the case that the Web's nature raises questions of textual stability, an expanding technology-based society feeds this trend toward the use of digital information, given a cultural interest in immediacy, visualization, and interaction; culture, then, will most likely fuel correction.

Simple economics may work to suppress future print publication, given low readership and the high cost of production. Funding for libraries is in danger with the move toward "efficiency." Word-processing, databases, e-mail, the Web, and computer graphics are often supplanting printed communication, and we are living in what Bolter calls "the late age of print," meaning not the death of print, rather, print as a changed system (2-3). Internet technology is commonly understood and used. Online resources award new and additional choice to the researcher, and digital books, journals, newspapers, letters, videos, e-mail discussions and online chats may provide a richer environment overall.

Final Thoughts

Most of today's university students, and even most of their parents, were not yet born when Vannevar Bush, knowing the value of research, began pressing for greater connections among disciplinary fields, understanding that specialization and the lack of connectedness stymied the growth of knowledge and contributed to both cultural and political strife. In light of post-process understandings of language, and recent studies in hypertext and learning theory, it seems beneficial to examine different possibilities for researched writing that technology now makes available. Developing new pedagogies, as DeWitt accomplished, and learning to use technology in a new way, particularly given its rapid rate of change, is challenging. But for instructors who work at institutions where computer resources and labs are available, a more in depth investigation and use of hypertext-based research and pedagogy may be a powerful means to encourage students to more reflectively engage in the processes of critical thinking and knowledge construction. Moreover, composition scholars and researchers can promote such pedagogical approaches by continued theorizing and researching into some of the connections I have outlined. The cognitive

aspects of invention that hypertext and learning theory

engage adds another dimension to our understanding of

knowledge and writing as social processes, and helps us

locate the cognitive position of an individual learner

within the communal nature of learning.

[1] The science of cognition is an interdisciplinary study of the mind, drawing from philosophy, psychology, linguistics, neuroscience, mathematics, computing science, and artificial intelligence. Traced back to an information theory symposium at M.I.T. in 1956, researchers from various disciplines began forming a perception that human psychology, theoretical linguistics, and computer simulations of cognitive processes were all parts of a larger whole. In other words, understanding human cognition required the efforts of several disciplines. The connecting premise within disciplines understand the mind as an information processor, of sorts, that receives, stores, retrieves, transforms, and transmits information. (Thagard)

[2] In the 1930s Dr. Bush, later Director of the Office of Scientific Research and Development and founder of the National Science Foundation, proposed, built, and patented a machine designed to rapidly select from vast amounts of information stored on microfilm. The "rapid selector" was plagued by inadequate technology but was a precursor to the theoretical machine Bush called a "memex," proposed in "As We May Think," a 1945 essay in *The Atlantic Monthly*. His

"memex" was intended as a personal use machine to help

people think, functioning to manage information overload

and enhance human memory by allowing the user to both store

and retrieve documents linked by associations, similar to

what has come to be known as hypertext, as well as share

information and associative "trails," as Bush called them,

with other scholars. Like the computer, the "memex" had a

viewing screen and keyboard; the user, however, would add

their own information and links to other documents stored

based on their own associative interests. Further, the

conceptual "memex" was without connectability to an outside

source, such as the Internet. (Bush; Klaphaak; Griffin)

[3] By a collective "human intellect" Engelbart means

technical and non-technical elements such as tools,

language, customs, knowledge, and the like, that had slowly

co-evolved over centuries but, with rapidly evolving

digital technology, now had the capacity to automate

people's activities and improve society's collective

capabilities. By 1968, Engelbart realized his vision of

augmented support structures to improve organizational

activities, having assembled the first multi-media

demonstration of a networked computer system, debuting his

computer "mouse," two dimensional display editing, in-file

object addressing and linking, multiple windows with flexible view control, and on-screen video conferencing. ("MouseSite")

[4] As a graduate student at Harvard University in 1960, Nelson invented computer-based hypertext for a term project. His vision was of a system with the capacity to see origins of all quotations, thereby providing a valid legal and literary copyright system. Nelson calls the World Wide Web (WWW), a system "far more raw, chaotic and short-sighted" than his own Project Xanadu, and an entity that "trivializes our original hypertext model with one-way ever breaking links and no management of version or contents." With the success of the Web and its notions of hypertext as a flexible and interactive system, Nelson's vision of "deep links" and trackable change, Project Xanadu, lives, but has eluded fruition. (See http://www.xanadu.com/index.html and www.xanadu.com.au/ted/XUsurvey/xuDation,html; see Whitehead interview with Nelson.)

[5] Reader-response theory emphasizes the role of the reader and is concerned with how individuals read, or understand, the same text in a variety of ways. According to reader-response theory, a text cannot be understood, has no "meaning," apart from that which a reader assigns to it.

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For such theorists, the reader is a producer rather than a consumer of meaning. (*Norton*)

[6] French philosopher Roland Barthes is known for his work in literary and critical theory, particularly as it relates to structuralism and semiotics, the study of signs. Semiology aims to take in any system of signs, whatever their substance and limits; images, gestures, musical sounds, objects, and the complex associations of all these, which form the content of ritual, convention or public entertainment. These constitute, if not languages, at least systems of signification. ("Elements")

[7] Composition studies does not generally understand the cultural shifting from print to electronic media, from word toward image, to be a result of technological determinism, that is, technology as an agent of change. Technologies themselves "do not determine the course of culture or society, because they are not separate agents that can act on culture from the outside." (Bolter 19)

[8] Stevan Harnad, Department of Electronics and Computer Science at Southampton University, United Kingdom, singles out speech, writing, and print as revolutionary because all three, he asserts, had a dramatic effect on how we thought as well as on how we expressed out thoughts, so arguably

they had an equally dramatic effect on what we thought. Harnad designates computer-mediated communication as the fourth revolution in human cognition. The first revolution, speech, allowed communication at a speed approximately that of human thought. Writing, the hand-copying of text, and second revolution, was slower than speech and less interactive but provided greater reliability and systemization by preserving words and thoughts of others. The third revolution came with movable type, and print restored a more interactive element, particularly by way of the scholarly periodical, due to more rapid and widespread distribution of printed text; a wider social reach was achieved. Harnad call the fourth revolution "electronic skywriting" (42). In this revolution, writing allows us to communicate with speeds approaching that of speech, which is much closer to the speed of thought than writing or printed text, echoing Nelson's 1960 interest in a structure paralleling the brain. This fourth revolution is particularly relevant to scholarly communication, as it allows escape from the bogged down process and time element of the printed scholarly text. By the time scholarship is submitted for publication, reviewed, revised, edited, printed, read, and integrated into new research, an author

has moved beyond and on to other thoughts. The written

medium, according to Harnad, "is hopelessly out of synch

with the thinking mechanism and the organic potential it

would have for rapid interaction if only there were a

medium that could support the requisite rounds of feedback,

in tempo guisto!" (44). The fourth cognitive revolution is

that medium Harnad discussed in 1991, hypertext, which made

it possible to return scholarly communication to a pace

closer to the brain's natural potential and still carry the

strictness, discipline, and permanence of printed text.

(Harnad)

[9] Johnson-Eilola warns against hierarchical structures that

ordain high status to creative writing (fiction or

nonfiction, essays or literature) and low status to

functional writing (instructions databases), citing

postmodernist notions about artistic creativity and high

versus low culture.

[10] The issue over authority, or power, and who the power

serves, has been and remains a critical question in

composition studies. The traditional qualities good

literature allocates are stability, monumentality, and

authority (Bolter 162). Having created a monument, the

author, by the very perception of "monument," becomes an

authority while imparting stability, the immortality of both author and text. The printed text, that is, the fixed word, traditionally carried greater stability and authority because of its visual representation, rather than oral, and its reproducibility. Like the memex of Vannevar Bush, fixed text was intended to extend the human memory. As a result, fixed text may work to fix ideas, to reinforce and replicate the cultural status quo.

[11] Like many composition theorists and writing teachers, Johnson-Eilola has found the need to move through postmodernism and adopt new lenses, those of cultural studies and critical pedagogy, citing postmodernism's inability to "self-critique and rehabilit[ate]" (29). The ideology of cultural studies fits well in to Johnson-Eilola's interest in blurring borders and helps us understand the complex process by which borders are constructed and deconstructed. Cultural studies critics examine discourses relating to pop culture and the masses, including television, cinema, advertising, digital media, minority and popular literature, among others, focusing on how such materials are produced, distributed, and consumed, questioning the ideas, values, beliefs, and representations embedded in and promoted by any culture or group

(*Norton* 26-7). Deconstructing, then rearticulating new,

positive constructs, for Johnson-Eilola, enables positive

social change and opens the door to working across and

within interdisciplinary discourses. Deconstruction,

however, becomes "vacant," says Johnson-Eilola, when it

does not act for resistance toward the governing

conventions (17). Technologies, including hypertext, must

be understood as "political structures and activities

rather than neutral, easily demarcated and isolated

objects" (17). (For more on cultural studies, see Katz)

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