Stance, Navigation, and Reader Response in Expository Hypertext

John E. McEneaney, Ledong Li, Kris Allen, and Lizabeth Guzniczak

Department of Reading and Language Arts
Oakland University

This article reports on two studies investigating reader stance, navigation, and response in expository hypertext. Subjects in the studies included 69 and 147 adult readers prompted to adopt either an efferent or aesthetic stance when reading a 36-node expository hypertext. Reading was followed by recall and essay writing tasks. Results of the studies indicate that prompts can be designed to induce readers to adopt more efferent or aesthetic stances. Main effects for stance on navigation and the essay response measures were found. Aesthetic readers were found to attain higher levels of understanding and tended to rely more heavily on a built-in reading path that was part of the hypertext interface. Graphic analyses revealed wide variability in the navigational strategies of readers, with distinctive visual patterns that appeared to be related to reader stance. Exploratory analyses examining data collapsed across both studies suggest node size may play a role in navigation and response and may interact with reader stance. The studies suggest that navigation has an important role in online literacy transactions and that usability of online materials may be enhanced by accounting for reader variables such as stance in the design of interface elements.

Correspondence should be addressed to John E. McEneaney, 490 E. Pawley Hall, Department of Reading and Language Arts, Oakland University, Rochester, MI 48309, USA. E-mail: mceneane@oakland.edu
Este artículo reporta resultados de dos estudios que investigaron la posición, navegación y respuesta del lector hacia hipertextos expositivos. Los participantes fueron 69 y 147 adultos en cada estudio a quienes se les pidió asumir una posición eferente (leer con el propósito de conseguir información) o estética (leer con un enfoque en las imágenes, asociaciones y sentimientos que el texto genera) al leer un hipertexto expositivo compuesto de 36 nodos. Después de la lectura, los participantes hicieron recuentos y ensayos escritos. Los resultados de los estudios indican que las versiones cortas de los hipertextos indujeron a los lectores a asumir más posiciones eferentes o estéticas. Se encontraron efectos principales al tener en cuenta la posición del lector en la navegación del texto y la respuesta en el ensayo. Se encontró que los lectores estéticos adquirieron altos niveles de comprensión y tienden a apoyarse más en el marco de lectura impuesto en el hipertexto. Los análisis gráficos mostraron una amplia variabilidad en las estrategias de navegación de los lectores, con patrones visuales diferenciados aparentemente relacionados con la posición del lector. Los análisis exploratorios que examinaron la información de ambos estudios sugirieron que el tamaño del nodo puede jugar un papel importante en la navegación y la respuesta del lector, además que puede también interactuar con la posición del lector. Los estudios sugirieron que la navegación tiene un importante papel en las transacciones lectoras de texto en línea y que el diseño de materiales de lectura en línea se puede mejorar por medio del reconocimiento de variables tales como la posición del lector.
Résumé
Auszug


Transactional theory (Rosenblatt, 1994, 1995, 2004) represents one of the most significant frameworks for conceptualizing reading and writing developed in the 20th century and continues to have a powerful influence on literacy researchers and practitioners. Two ideas at the core of transactional theory are:

1) Meaning is viewed as an event or process that requires simultaneous attention to both reader and text, and
2) The understanding a reader creates depends in a critical way on stance, where the term stance refers to the purpose or general orientation of the reader. Stance is typically characterized as a continuum anchored by
aesthetic and efferent poles, where an efferent stance involves a reading goal tied to subsequent action and an aesthetic stance focuses on a lived-through experience of the reading act (Rosenblatt, 1994, 2004).

Although researchers routinely acknowledge stance as a continuum and emphasize that any reading event incorporates elements from both ends of this spectrum, both theoretical and empirical work has focused almost exclusively on the aesthetic stance, largely ignoring problems and issues specific to efferent reading. Even in those instances where there is an effort to study an efferent stance, literary narratives remain the dominant text type (Guzniczak, 2004; Guzniczak & Allen, 2005). While a focus on aesthetic reading is not necessarily problematic, research adopting a one-sided view of the stance continuum may skew efforts to understand transactional theory as a general framework (Rosenblatt, 1994, pp. 22–47). Moreover, the claim that transactional theory is intended as a general framework supporting both efferent and aesthetic orientations is more explicit in other recent work (Rosenblatt, 2004, p. 1069; Karolides, 1999), but even in these elaborations the exploration of the efferent stance and its consequences does not go beyond the limited analyses carried out in earlier work. Consideration of the aesthetic transaction ranges from the escapism of “trashy” fiction (Rosenblatt, 1994, p. 143), to sophisticated critical interpretation of the Iliad (1994, p. 122) and examples from American and British literature. In contrast with these many examples, the examination of explicitly efferent transactions is confined to identifying generic types of efferent reading material (e.g., “a newspaper, scientific text, or cookbook,” 1994, p. 22) and one analysis concerning the reading of a label to determine appropriate treatment for ingested poison (1994, pp. 23–24; 2004, pp. 1372–1373). The absence of more serious exploration of efferent transactions is, moreover, somewhat surprising given that important foundational work cited by Rosenblatt (Dewey, 1938; Dewey & Bentley, 1949) focuses on the efferent end of the transactional continuum. While Rosenblatt certainly is not misleading about her focus on aesthetic reading and provides a rationale for her commitments, it seems reasonable to ask whether a general theory of reading can rely so heavily on one stance without risk of distortion or omission.

A second aspect of transactional theory (and reading theory in general) we address in these studies concerns the disconnect between theories of literacy and theories developed to support many of the new literacy technologies that are changing the ways people read and write (Leu, 2000). Although transactional theory has traditionally been framed as a pragmatic natural-language phenomenology of reading, there are practical reasons for considering an approach that better connects with frameworks used to define and describe online literacy environments from a computing perspective. One reason is the transformation of literacy practices with the widespread use of the Internet and computer-
based literacy tools (Leu, Kinzer, Coiro, & Cammack, 2004). These technologies challenge some of our most fundamental assumptions about readers and text (Landow, 1992; Reinking, 2001; McEneaney, 2006) and all are, to some extent, grounded in technical frameworks. Literacy theory, however, generally operates as an independent theoretical layer, separated from the conceptual frameworks that support the new technologies of literacy. While it would be both unwise and unproductive to demand that all literacy theory be defined within a framework that also accounts for literacy technologies, there are important points of contact where literacy theory and theoretical frameworks supporting new technologies of reading and writing can and should be explored.

Our studies address questions related to stance, navigation (i.e., reader link selection), and reader response in expository hypertext. This work focuses on the three aspects of transactional theory we have briefly reviewed above by: 1) adopting expository reading material, 2) framing our work within a context that incorporates theoretical perspectives from both literacy and hypertext studies, and 3) examining the influence of short text prompts in shaping reader response. A central concept supporting our work is the view that hypertext structure and a reader’s navigational choices during reading are expressions of the reading transaction and that digital artifacts can provide a window on this transaction (Herder, 2002; Joiner & Issroff, 2003; McEneaney, 2001, 2003). The two studies we present explore the reading transaction as a “path,” a concept used in multimedia studies for some time (e.g., Lawless & Kulikowich, 1993; Barab, Bowdish, Young, & Owen, 1996; Lawless & Brown, 1997; Lawless & Kulikowich, 1998; Lawless, Brown, Mills, & Mayall, 2003). We use the concept of a path in several different ways to analyze reader decision making during reading. One form of analysis is based on a graphical method that illustrates individual and group paths as navigational maps. A second approach involves analyzing reader paths according to the content of reading material that appears to be driving navigational decision making. A third form of analysis relies on quantitative measures related to reading rate and navigation (e.g., Coulston & Vitolo, 2002; Pohl & Purgathofer, 2004; McEneaney, 2001). We have four research questions.

1) Can short text prompts induce more aesthetic and more efferent reader stance?
2) Does reader stance influence navigation or response on recall and essay measures?
3) Are there associations between navigational patterns and reader response measures?
4) Are there changes in reading rates or navigation strategies during the reading episode?
The remainder of this paper consists of six sections. In the next section we present a context for viewing our work within the broader tradition of inquiry in transactional theory. Following this broader contextualization, we review prior empirical work exploring the concept of stance with the goal of defining this concept in operational terms. We then outline the theory of hypertext structure used in our analyses of navigation. Following these reviews, we present the general method adopted in both studies. The review of method is followed by the presentation of results, taking each study separately and then examining the data from both studies collapsed into a single dataset. The paper concludes with general discussion, a summary of findings, and implications.

THEORETICAL PRELIMINARIES

We have adopted transactional theory as a central theoretical framework in our work. Our application of this framework, however, differs from the broader tradition of work adopting this perspective. The purpose of this section is to highlight and address these differences so that the context for our work is clear.

One important difference between our work and much of the prior work in the transactional tradition is that we employ quantitative methods. Work adopting transactional theory often relies on phenomenological or ethnographic methods, sometimes with the implication that quantitative methods represent a pretransactional paradigm of inquiry. It is our position, however, that both transactional theory and the pragmatist philosophy in which it is grounded do not require rejection of quantitative methods. Also, we believe that the division of quantitative and qualitative methods into incommensurable domains of inquiry is one of the dualisms that pragmatism and transactional theory rightly reject (Ercikan & Roth, 2006). One of our goals, therefore, is to respond in a concrete way to Cunningham and Fitzgerald’s observation that “researchers studying from a transactional view need different sorts of methods, ones that allow ways of making readers’ stances and responses public (Cunningham & Fitzgerald, 1996, p. 58).” While we do not deny aspects of the reading event that are experienced in a private way (i.e., the “poem”), our focus is on making readers’ stances and responses more public.

A second important difference between our work and the broader tradition in transactional theory is our explicit focus on nonliterary text. Although transactional theory is advocated as a general theory of reading, the literature is dominated by a focus on readers who adopt an aesthetic stance in reading literary works. We believe this emphasis on an aesthetic stance and literary text reflects the historical origins of the transactional theory as a reaction to a prior tradition that subjugated readers to texts and the sanctioned interpretations that were thought to represent the “true” meaning of those texts. Rosenblatt was not
shy about her challenge to the dominance of text or her goal to bring readers into the spotlight. We believe, however, that the overemphasis in the transactional tradition on aesthetic reading of literary text has limited the potential of this framework to contribute to a broader view of reading that more adequately addresses nonliterary texts and efferent reading and learning. We view our work as a modest step in beginning to reveal this potential.

Finally, it is an explicit goal of our work to take seriously Rosenblatt’s call to warrant assertions about the meanings we create, particularly with respect to our assertions about transactional theory. One example of this is our effort to operationally define the concepts of stance and response through the use of rubrics and prompts so that we can begin to distinguish more aesthetic or more efferent reading and response. While we do not claim that these operational definitions are the final word on stance, we view definitions like these as essential to our inquiry, and perhaps more important, we are willing to test them against the data we collect as a warrant for the claims we make. We believe the concept of warranted assertability is absolutely central to transactional theory. This concept, and this concept alone, prevents transactional theory from slipping into a relativism that would deny both public meanings and inquiry itself. “In short, the concept of warranted assertability, or shared criteria of validity of interpretation in a particular social context, recognizes that some readings may satisfy the criteria more fully than others (Rosenblatt, 1994, p. 1079).” It is our goal to rely on both quantitative (i.e., statistical) and qualitative (i.e., graphical) warrants in support of the interpretations we present.

We realize that our effort to “push the envelope” of transactional theory has risks. Some researchers who identify their work as transactional might be alarmed at our efforts to operationalize concepts such as stance, thinking we are advocating an assault on the autonomy of readers. Our goal, on the contrary, is to apply an explicitly transactional perspective in understanding how reading environments influence reader stance and response. In our view stance does not simply emerge from a reader ex nihilo; it is as much a consequence of the context within which reading occurs as it is an expression of a reader’s intent. We believe there are significant gaps within the transactional framework that quantitative work can address, particularly in developing a more public and operational definition of stance grounded in empirical warrants that others can build on or refute. We also believe there are good reasons to think that transactional theory can and will be productively applied in understanding reading online as other recent work has suggested new ways of thinking about transactional theory in these environments (McEneaney, 2003, 2006). We view this kind of re-interpretation of transactional theory as the essence of a transactional perspective; new meanings can and will emerge as readers and literacy contexts change and the changes wrought by online reading technologies have been both broad and deep. The power of transactional theory is not that it can resist change but that
it can evolve along with social and technological contexts within which it is applied.

THE CONCEPT OF READER STANCE

Reader stance has been an important concept in reading theory and literary interpretation since Rosenblatt’s (1938) ground-breaking work. Transactional theory, elaborated in numerous subsequent works (Rosenblatt, 1994, 2004; Karolides, 1999), defines stance in terms of a continuum. At one end of this continuum the purpose for reading is more experiential, intrinsic, and aesthetic; readers focus on their immersion in the text. On the other end of this continuum the purpose for reading is more practical, extrinsically oriented, and applied, with readers focused on using information in subsequent action. Some theorists have defined stance in different terms, taking on perspectives that are more psychological (Benton, 1983) or social (Fish, 1980, 1987). Others have chosen to adhere to Rosenblatt’s general pattern of a tension between opposing forces such as Britton’s (1982, 1984) balancing of spectator and participant roles and Iser’s (1978, 1980a, 1980b) contrast between reader anticipation and retrospection. Ultimately, however, none of these alternatives has been nearly as influential as transactional theory; modern thinking about the concept of stance has crystallized around Rosenblatt’s emphasis on purpose and the aesthetic-efferent continuum.

But not all researchers who rely on Rosenblatt’s concept of stance have adopted her phenomenological approach. Others have adopted empirical methods, beginning with the work of Squire (1964) who conducted content analyses of readers’ responses in a structured think aloud. Based on his analyses, Squire defined seven categories of reader response that he used in subsequent quantitative analyses examining the relationship between stance and other reader characteristics. More recent empirical work, however, has adhered to Rosenblatt’s continuum-based model. In two related studies, Cox and Many (1989, 1992) defined and applied a one-dimensional five-point rating scale for assessing reader stance and a four-point rating scale for level of understanding in a study of fifth-grade students responding to a story or short film. A stance score of “1” indicated a strongly efferent response, while a score of “5” indicated a strongly aesthetic response. An understanding score of “1” indicated a literal response while a score of “4” indicated an abstract generalized understanding. Pearson correlation interrater reliabilities for the stance and understanding ratings were .84 and .79, respectively. Subjects in the study were prompted to “Write anything you want.” about the stories or films and had as much time as desired to write. Like Squires’ (1964) work, Cox and Many analyzed free response writing by students but also sought to incorporate theory related to reader stance (Rosenblatt, 2004,
and four types of mental activity associated with aesthetic reading (Corcoran, 1987).

Many (1991) applied these two rating scales in another study with fourth-, sixth-, and eighth-grade readers. Subjects were presented general open-ended prompts, with stance and understanding ratings based on written responses following reading. As before, interrater reliabilities were good, with a stance reliability of .79 and a level of understanding reliability of .81. Results of this study replicated Cox and Many’s (1989) finding associating an aesthetic stance with higher understanding scores. Shortly thereafter, two studies broadened the empirical examination of stance and response. Many and Wiseman (1992) studied the influence of different instructional approaches on the stance adopted by third-grade readers in postreading written responses using a general open-ended prompt. Results showed that instruction and stance were associated but the design of the study did not support causal inferences. Many and Anderson (1992) used a categorical system (efferent focus, aesthetic focus, no primary focus) to explore associations between stance and specific types of intertextual and autobiographical connections in written responses. Results indicated there was no association. In another study, Wiseman and Many (1992) explored stance in education undergraduates, showing that students exposed to either aesthetic or efferent instructional strategies tended to respond using the same stance in their reading.

Finally, work by Many, Wiseman, and Altieri (1996) replicated findings about the influence of instructional approach and response with third-grade readers but also introduced the idea that response might be influenced by the use of stance-specific prompts that direct readers to be more aesthetic or efferent. As in Many and Wiseman (1992), the teaching approach the students experienced was found to influence stance, but one anomalous finding was that both the efferent and the aesthetic prompts resulted in less aesthetic responses. Students whose instruction had emphasized an aesthetic response and received an aesthetic-specific prompt responded less aesthetically than those who received a generic prompt. Many et al. interpreted this result as indicating the students might have felt “restricted in not being free to choose their own stance (p. 25),” but it seems to us the timing of the prompt was probably also relevant. Students saw prompts after reading but before writing. Readers may have been put in the position of reconciling two different stances, one chosen for the reading and a second (perhaps different) stance they were directed to adopt in writing.

Three conclusions from our review of prior empirical work seemed particularly important in designing our studies. One conclusion was that there is at least one well-documented variable influencing reader stance: instruction. In addition, while the design of the Many, Wiseman, and Altieri (1996) study does not indicate how stance-specific prompts influenced readers, this study does provide evidence of an influence, and it seems likely that adult readers with broader
skills and experience will be more sensitive to such prompts. Work in schema theory, for example, shows that even small differences in initial conditions such as a title or illustration can result in dramatically different reading outcomes (Anderson, 2004; Bransford, 2004). We decided, therefore, that developing a better understanding of the ways stance-specific prompts influence readers was a research objective that was both worthwhile and within reach. A second conclusion was that the use of rating scales to assess stance through written responses following reading has been productive and appears to offer a reliable measure for operationalizing the construct of reader stance. Although there is still much to learn about the psychometric qualities of the one-dimensional rating scale commonly adopted in stance research, its reliability has been good and its grounding in the transactional framework provides good construct validity, warranting its use in more systematic study (Linn & Gronlund, 1995). A third and final conclusion was that the work we reviewed provided a suitable foundation for more carefully controlled studies of reader stance. Open-ended exploration plays an important role in the early stages of defining a domain of study but as that domain matures it is essential for literacy researchers to develop more specific testable hypotheses (Pearson, 1999; Stanovich & Stanovich, 2003a).

HYPERTEXT STRUCTURE AND READER NAVIGATION

Our goal in this section is to provide a summary of the theoretical framework we adopt in thinking about reading as “navigation” in hypertext. Interested readers will find fuller descriptions of this framework in McEneaney (2001, 2003). Briefly, our analyses of navigation in hypertext distinguish three types of hypertext structure: virtual structures that specify what kinds of navigation are possible (Botafogo, Rivlin, & Shneiderman, 1992; Park, 1998), episodic structures that specify outcomes of individual reading transactions (Bernstein, 1998; Canter, Rivers, & Storrs, 1985; Rosenberg, 1996), and emergent structures that specify broader shared structures based on transactions of multiple readers (McEneaney, 2003). Virtual structure is defined by the nodes and links that make up a hypertext and can be viewed as a property of the text itself. Episodic structure, on the other hand, results from a specific transaction involving a reader and text and corresponds to the structure an individual reader creates during reading. Finally, emergent structures are structure patterns based on the aggregation of episodic structures generated by multiple individual readers.

The framework we apply in assessing and visualizing reader navigation is based on the traditional node-and-link model of hypertext. Although not without drawbacks, this model of hypertext has been widely used in both theoretical and empirical work. Alternative modeling frameworks such as Petri nets (Stotts & Furuta, 1989; De Bra, Houben, & Kornatzky, 1995; Stotts, Furuta, & Cabarrus,
statecharts (Turine, de Oliveira, & Masiero, 1997; Oliveira, Turine, & Masiero, 2001), and context-free grammars (Park, 1998) have also been applied with success, but none of these approaches retains the conceptual simplicity and the visual elegance of the node-and-link model. The simpler formalism of nodes-and-links meets our analytic needs while also providing a better framework for visual displays of user navigation.

Central to the node-and-link framework we adopt is the idea that a hypertext can be conceptualized as nodes that represent content (e.g., Web pages) and links (e.g., clickable text or images) that represent large-scale structure. At least part of the popularity of the node-and-link model can be attributed to two simple but powerful formalisms that support analysis in this model: adjacency matrices that are well suited to mathematical analysis, and graphs that present structural information in a readily interpreted visual format. Briefly, an adjacency matrix is a table that records each link in a hypertext document. Typically, an adjacency matrix consists of a table of zeroes and ones with labeled rows and columns. A “1” in cell (a,b) indicates a direct link from node a to node b. A “0” in a cell indicates that there is no direct link between the two nodes. In Figure 1A, for instance, the two entries of “1” in the first row indicate that there is a direct link from node 0 to nodes 3 and 5. Zeroes appear in all other positions in this row because no other direct links are present. Figure 1B illustrates this hypertext, demonstrating that the document consists of 8 nodes (numbered 0–7) and 13 links (note that the arrow connecting node 0 and node 3 is double-headed and thus represents 2 links, since it operates in both directions.)

A. Adjacency matrix for the graph in B.  
B. A node and link representation of the adjacency matrix presented in A.

FIGURE 1 An adjacency matrix (A) and its graphical representation (B).
What makes these formalisms powerful is that they retain mathematical and visual simplicity yet succeed in capturing important structural features that can be transformed to create other useful measures to assess and display the paths of both individual readers and groups. Moreover, diagrams of this sort are widely used in hypertext research as a basis for visual analyses that can reveal structure difficult to discern in numerical formats (Chen, 1997; Mukherjea & Foley, 1995; McDonald, Paap, & McDonald, 1990). Two measures of special interest in previous work are the concepts of network compactness and stratum (Botafogo, Rivlin, & Shneiderman, 1992; Rivlin, Botafogo, & Shneiderman, 1994), measures that have been adapted to assess navigational structure in terms of the concept of a reader path (McEneaney, 2001; Shih, Muñoz, Sánchez, & Maté, 2004; Gwizdka & Spence, 2005; Kalczynski, Senecal, & Nantel, 2006; Scheuer, Mühlenbrock, & Melis, 2007). Path compactness refers to the connectedness or complexity of the episodic structure created by a reader, yielding values close to zero for simple, sparsely connected structures and values close to one for densely connected structures. Path stratum, on the other hand, refers to the degree of linearity of an episodic structure, as indicated by the extent to which the structure is organized so that certain nodes are always read before others. More linear navigation results in path stratum values closer to one, while less linear paths are closer to zero. The significance of path measures, however, is that they appear to be related to recall and problem solving with text.

Recent work has explored the relationship between navigational choices readers make in hypertext and their success in a variety of reading and problem-solving tasks (e.g., Smith, 1996; Lawless & Kulikowich, 1998; Lawless, Brown, Mills, & Mayall, 2003). Results of this work indicate that navigation can plausibly be interpreted as reflecting user strategies in deciding what links to follow and relative success in cognitively modeling the domain represented by a hypertext. For example, in a series of studies exploring relationships between navigation and hypertext use, subjects who generated more shallow, hierarchical episodic structures matching the virtual structure of the hypertext they were reading were more successful than were those who adopted more linear paths (McEneaney, 1999, 2000b, 2001). Moreover, the informal visual interpretation of more and less successful navigational patterns was quantitatively corroborated by numerical measures that were significantly correlated with performance in a hypertext reading task.

METHOD

Previous work is unequivocal in supporting the claim that readers’ perceptions about goals and purpose for reading have a significant impact on reading process and outcomes (e.g., Many, 1991; Hartman, 1995; Rosenblatt, 1995, 2004). The
potentially intrusive nature of “think aloud” methods, however, in which readers are required to interrupt or recall the reading process may make it difficult to generalize from such studies (Laing & Kahmi, 2002; Magliano, Trabasso, & Graesser, 1999; Pressley & Afflerbach, 1995). Moreover, in electronic reading environments, real-time data about reader decision making and allocation of attention can be assessed in direct and nonintrusive ways as a result of the interactive nature of link selection. The work we describe capitalizes on the interactive potential of online reading environments, capturing this real-time data and applying it to addressing our research questions.

Subjects in both studies were advanced undergraduate or masters education students at a medium-sized public midwestern university in the United States. Consistent with this population, there were more females (184) than males (32), but analyses indicated that the sex of subjects did not influence navigation or response variables in either study. There was also no evidence of interaction with prompts. Similarly, subjects’ level of educational attainment was not found to be related to dependent variables in either study. Students were provided extra course credit for participation. Both studies were reviewed to assure compliance with human subjects guidelines. We did not assess subjects’ knowledge of transactional theory, although we did ask them to self-report their skill in browsing the Web and how frequently they engaged in this type of reading.

Reading sessions were conducted in a computer lab and began with subjects logging into a Web server that provided access to experimental materials. This Web server also collected information about the pages subjects read and the amount of time each subject spent reading each page. Two different sets of prompts were used in the studies (see Appendix B), but in both studies one prompt was designed to induce a more aesthetic response and the other a more efferent response. Subjects were allowed to take handwritten notes during the reading session. Following the reading session, subjects put away notes and completed a true-false recall measure. Following the recall measure, students were allowed to use notes to write an essay responding to the reading and the prompt they were provided before reading. At the conclusion of the experimental session, data collected during reading were written to a server-based file.

Recall scores were based on two forms of a true/false measure. Study 1 used a 72-item assessment requiring handwritten response; study 2 used a 36-item computer-based assessment. All notes were handwritten, but essays, like the recall measure, included both handwritten responses (in Study 1) and computer-based responses that relied on keyboard or mouse input (in Study 2). Word counts were calculated for both essays and reader notes. Essays were also scored using two rubric-based rating scales. One scale provided a stance rating (SR) score indicating the extent to which an essay response was more aesthetic or more efferent in nature. The second scale was a level of understanding rating (UR). Both measures were based on measures developed by Cox and Many (1989,
Prompts and Rubrics

Prior to reading, each subject was provided one of two prompts. One prompt was intended to promote a more aesthetic response, directing the reader to focus on his or her personal experience reading the hypertext. The second prompt was developed to promote a more efferent response, directing readers to focus on the information presented and its educational significance. Obviously, prompting a reader to read expository text for aesthetic purposes in an empirical study leads to a different kind of reading than curling up with a favorite book on a rainy day. Our goal was not, however, to promote “pure” aesthetic reading, but simply to induce readers to read more aesthetically than they might otherwise, within the context of our study. Likewise, our efferent prompt did not have the real-world urgency of Rosenblatt’s classic example of the efferently reading mother who fears her child has ingested a poisonous material. Our goal in this case was to see if our prompt would induce readers to read more efferently than they might otherwise. Our experimental prompts were probably much closer to one another on the stance continuum than curling up with a book and the frantic reading of a mother. The important question, however, is if they identify different points on the stance continuum, not if they represent “pure” exemplars. Transactional theory, after all, adopts an explicitly pragmatic perspective that explores observable differences rather than philosophical dualisms. As a result, we believe that our effort to design stance-specific prompts is a natural expression of a transactional approach and that our goal of inducing predictable measureable differences in reading responses will contribute to Cunningham and Fitzgerald’s call for “making readers’ stances and responses public” (1996, p. 58).

As we noted earlier, our review of the literature revealed that a study by Many, Wiseman, and Altieri (1996) had used stance-specific prompts but their study was designed in a way that confounded the effect of the prompts with the timing of their presentation. In addition, subjects in the Many et al. study were third graders reading narrative fiction, quite different from the population and the reading material we intended to use. We concluded our circumstances required different prompts and more careful attention to the timing of prompt presentation. In designing new prompts, we focused on the information presented in the efferent prompt and the experience of reading the hypertext in the aesthetic prompt. Both prompts used in Study 1, however, asked subjects to be prepared to cite parts of the hypertext that influenced their response. Although directing a student to attend to the text might suggest a more efferent stance, Rosenblatt (1995, 2004) emphasizes the need to anchor the aesthetic experience in the text.
if readers are to go beyond a superficial response. Moreover, as we note later, the stance-specific prompts worked as expected in Study 1. When we eliminated the phrase to cite parts of the hypertext from the aesthetic prompt in Study 2, there were no statistically significant differences in the responses between the two studies. We are only beginning to understand how stance-specific prompts shape reader response but the prompts work as theoretically predicted, suggesting we are on the right track.

Two rubrics are central to the work we report in this paper. This subsection explains why we chose a written reading response measure as a basis for assessing stance and how we adapted two existing rubrics (Cox & Many, 1989) to address our questions. Although other researchers (e.g., Squire, 1964) have used think-aloud techniques to assess reader stance during reading, it was our judgment that it would be unwise to interrupt the hypertext reading task to assess stance. Specifically, prior work suggests that hypertext materials are more cognitively demanding than traditional print (McEneaney, 2003b; Conklin, 1987; Egan et al., 1989; Wenger & Payne, 1996). Even skilled readers of print may experience orientation problems as they move around within hypertext networks (e.g., Van Dam, 1988; Neilsen, 1989; Edwards & Hardman, 1989). We judged, therefore, that interrupting readers to comment on or explain their experience could be problematic and we chose to adhere to the more common practice of a written response following reading to assess stance.

In our review of the literature we found that many studies examining reader stance have used or adapted two scales developed by Cox and Many (1989), one providing a five-point stance rating and the other a four-point level of understanding rating, both of which have good reliability. Our goal was to adhere as closely as possible to the rubrics, but we found that our choice of expository reading material required changes. The existing stance rubric had defined efferent reading in terms of literary analysis because all prior work had relied on narrative text. We decided to retain the five-point scale and the indicators of analysis that could be generalized to include expository text, but we felt that the specifically aesthetic indicators (Corcoran, 1987) used in the original scale were not appropriate in a more general stance measure. We focused on language, analysis based on external standards, and the emotional color of the response (see Appendix A). In considering the level of understanding rating, we adopted a three-point scale, with level 1 reflecting a primarily literal understanding tied to content or unexplained personal response, level 2 reflecting a level of understanding that at least partially explained connections to self or world, and level 3 reflecting a generalized understanding about the hypertext reading experience or the potential impact of hypertext on learning and society. As we report later, reliability for both the stance and understanding scales was good, and there is evidence that the scales tap conceptually distinct sources of variance. The same rubrics were used in both studies. Ratings were
based on blind review, with different rater pairs scoring stance and understanding.

Hypertext Reading Material

The hypertext adapted for use in the study was an article published in *Reading Online* (McEneaney, 2000a) consisting of 36 nodes that presents a brief history of hypertext and hypertext research. This material was selected because it provides an authentic expository hypertext, originally written in hypertext format that had appeared in an online journal. The material used in Study 1 presented the article with only minor modifications. The material used in Study 2 presented a shorter version of the article, revised so that scrolling was not required to view content. None of the subjects reported having read the hypertext previously.

The hypertext was structured as a grid with columns representing six historical eras and rows representing six themes (see Figure 2). Flesch-Kincaid grade level readabilities for the long and short versions of the hypertext were 13.47 and 12.51, respectively. During reading, the reader’s location within the hypertext was indicated by an “x” on the hypertext grid (see Figure 2), providing an

![FIGURE 2](image.png)
immediate visual cue for the reader’s position. Headers at the top of each node indicated the era and theme, and navigational buttons at the upper right allowed readers to navigate by historical era, topical theme, or along a built-in path across all 36 nodes. Readers could also click on nodes in the grid image to jump directly to a page. Subjects were told they would have 40 minutes to read the hypertext, after which they would respond to a true/false recall assessment and write a short essay, neither of which would be timed. We adopted a 40-minute reading period because we believed this would be sufficient time to read the hypertext, and we were concerned that more time might overemphasize note taking. Navigational data were stored in a browser cookie during reading and uploaded to a database when readers clicked an “End Session” button (see Figure 2). For students in Study 2 who used the computer assessment format, clicking the “End Session” button also presented electronic versions of the online recall assessment and the essay response form.

Students were presented either an efferent or an aesthetic prompt before they began reading and again at the time that they wrote essays. Students were allowed to take notes during the reading session but were not allowed to use them with the true/false recall assessment. Students were, however, allowed to refer to notes when writing essays. The recall assessment was administered first to all subjects. Both studies adopted a one-way factorial General Linear Model (GLM) ANOVA to assess the influence of prompts on stance ratings in addressing the first research question, factorial GLM MANOVAs with follow-up univariate analyses to explore the influence of prompts on navigation and response in addressing the second question, correlational analyses to assess associations between navigation and reader response in addressing the third question, and GLM repeated measures analyses to examine changes in subjects’ reading rates and episodic structures in addressing the fourth question. All MANOVAs relied on Hotelling’s Trace as a basis for overall F tests. In repeated measures analyses where Mauchly’s test of sphericity suggested the sphericity assumption might have been violated, the Huynh-Feldt correction was applied. All analyses are based on two-tailed tests with \( \alpha = .05 \). Preliminary analyses focused on assessing interrater reliability of the two rubric scoring procedures.

Dependent variables included rubric-based stance and understanding ratings, word counts in subject notes and essays, recall scores, unique numbers of pages viewed, viewing time per page, and three different path measures. One path measure (Path Score) reflects the extent to which readers made use of a built-in path through the hypertext by simply clicking on the “Path” button at the upper right of the interface. Path stratum and compactness measures provided indicators of the relative linearity and complexity, respectively, of the episodic structures generated by readers, but only path stratum was used in analyses because of the large correlation between path compactness and path
stratum. Visual analyses relied on displays from the Graphviz layout tool (AT&T, 2006).

**STUDY 1 RESULTS**

Study 1 included 69 readers (59 female, 10 male) prompted to adopt either a more aesthetic or a more efferent stance in reading a 36-node expository hypertext. Following reading, subjects completed a true/false recall measure, followed by an essay writing task.

**Interrater Reliability of Rubric-based Scoring**

Rubrics were used to score the stance and level of understanding of each subject’s essay. The stance rating, based on an instrument developed by Cox & Many (1989), adopted a five-point scale, with a “1” indicating a strongly efferent response focused on article content and a score of “5” indicating a strongly aesthetic response focused on the reading experience. The understanding rating, also adapted from a measure developed by Cox & Many (1989), used a three-point scale, with a “1” assigned to essays that simply stated facts or described personal response without connections to self or world; a “2” assigned to those essays that mixed facts with text-to-self, text-to-text, and text-to-world connections; and a “3” assigned to essays that articulated generalized understandings about the reading experience or the article content. Each essay was scored by two pairs of raters, with stance and understanding averages used in analyses. A rater average intraclass correlation coefficient (ICC; Shrout & Fleiss, 1979) was computed for both rubric-based measures. The 5-point stance scale had an ICC reliability of .8236 ($F(67) = 5.6696$, $p < .0001$) and the 3-point understanding scale had an ICC reliability of .9252 ($F(67) = 13.363$, $p < .0001$).

**THE INFLUENCE OF PROMPTS ON STANCE**

Prior work exploring reader response has usually relied on general prompts not intended to evoke a specific type of response or otherwise influence the stance readers take. The present study, however, sought to treat reader stance as an independent variable through the mediating action of prompts. Since the SR scale represents an extreme efferent response as a “1” and an extreme aesthetic response as a “5,” we hypothesized that the average essay stance score for the aesthetic prompt group would exceed the score for the efferent group.
A one-way GLM ANOVA was carried out to assess the influence of the prompts on subjects’ essays. The essay stance measure served as the dependent variable and the prompt group (aesthetic or efferent) served as a fixed independent variable. Results of the analysis indicated statistically significant differences in the SR scores for the aesthetic and efferent groups ($F(1, 66) = 50.698$, $p < .001$) with a robust effect size ($\eta^2 = .434$) given this was our first attempt to write prompts to influence reader stance. As expected on the basis of the theory supporting the prompts and the SR measure, subjects in the aesthetic group produced essays with significantly higher stance ratings (mean = 3.72, sd = 1.092) than those of the efferent group (mean = 2.05, sd = 0.807). Prompts had influenced reader stance as we predicted.

Influence of Stance on Navigation and Reader Response

Our examination of the influence of stance on navigation and response began with two factorial MANOVAs using stance as a fixed independent variable and two sets of dependent variables, one set focused on reader navigation and the other on reader response. Navigation-related variables included path stratum, a path score variable representing the degree to which readers adhered to a built-in reading path, and number of unique pages viewed. Response variables included average stance and understanding ratings, word counts for essays and notes, and the recall score. The logic of using MANOVAs was that both the theory on which this work is based and prior studies suggest these variables are conceptually distinct but related, leading us to conclude that individual ANOVAs might miss a difference that a MANOVA could detect.

Results of the navigation MANOVA showed a statistically significant difference between the stance groups (Hotellings Trace $F(3, 65) = 2.983$, $p = .038$, $\eta^2 = .121$) but a univariate between-subjects effect only for the unique pages variable ($F(1, 67) = 4.486$, $p = .038$), with readers in the aesthetic stance group reading more unique pages than those in the efferent stance group. The effect size, however, was small ($\eta^2 = .121$), and the observed power (.678) was less than generally desired (Cohen, 1988). Results of the reader response MANOVA showed there was a statistically significant difference between the stance groups on the five reader response variables (Hotellings Trace $F(5, 61) = 14.728$, $p < .001$), with univariate between-subjects effects for the SR already discussed, the UR ($F(1, 65) = 12.016$, $p = .001$, $\eta^2 = .156$) and the notes word count ($F(1, 65) = 7.799$, $p = .007$, $\eta^2 = .107$). Aesthetic readers had higher scores on the level of understanding scale and generated more notes, although in each case the effect size was small. No between-subjects effects were noted for the recall score or the word count in the essays. Descriptive statistics are reported in Table 1.
TABLE 1
Study 1 GLM Follow-up Analyses: Descriptive Data

<table>
<thead>
<tr>
<th>PROMPT</th>
<th>Path Stratum</th>
<th>Path Score</th>
<th>Unique Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic Mean</td>
<td>.7429</td>
<td>2.9775</td>
<td>27.19</td>
</tr>
<tr>
<td>(sd)</td>
<td>(.3180)</td>
<td>(1.1674)</td>
<td>(6.769)</td>
</tr>
<tr>
<td>N</td>
<td>37</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>Efferent Mean</td>
<td>.7275</td>
<td>2.5969</td>
<td>23.69</td>
</tr>
<tr>
<td>(sd)</td>
<td>(.2605)</td>
<td>(1.2453)</td>
<td>(6.940)</td>
</tr>
<tr>
<td>N</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Total    Mean</td>
<td>.7357</td>
<td>2.8010</td>
<td>25.57</td>
</tr>
<tr>
<td>(sd)</td>
<td>(.2907)</td>
<td>(1.2103)</td>
<td>(7.022)</td>
</tr>
<tr>
<td>N</td>
<td>69</td>
<td>69</td>
<td>69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROMPT</th>
<th>Stance Rating</th>
<th>Understanding Rating</th>
<th>Essay Words</th>
<th>Notes Words</th>
<th>Recall Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic Mean</td>
<td>3.7222</td>
<td>2.0694</td>
<td>141.14</td>
<td>90.19</td>
<td>40.14</td>
</tr>
<tr>
<td>(sd)</td>
<td>(1.0918)</td>
<td>(.5092)</td>
<td>(56.839)</td>
<td>(75.814)</td>
<td>(3.416)</td>
</tr>
<tr>
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<td>36</td>
<td>36</td>
<td>37</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>Efferent Mean</td>
<td>2.0469</td>
<td>1.6094</td>
<td>126.31</td>
<td>147.78</td>
<td>40.41</td>
</tr>
<tr>
<td>(sd)</td>
<td>(.8068)</td>
<td>(.6688)</td>
<td>(44.044)</td>
<td>(92.403)</td>
<td>(5.272)</td>
</tr>
<tr>
<td>N</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Total    Mean</td>
<td>2.9338</td>
<td>1.8529</td>
<td>134.26</td>
<td>116.90</td>
<td>40.26</td>
</tr>
<tr>
<td>(sd)</td>
<td>(1.2781)</td>
<td>(.6292)</td>
<td>(51.479)</td>
<td>(88.161)</td>
<td>(4.356)</td>
</tr>
<tr>
<td>N</td>
<td>68</td>
<td>68</td>
<td>69</td>
<td>69</td>
<td>68</td>
</tr>
</tbody>
</table>

Following MANOVAs, we examined episodic structure diagrams for individual readers. As illustrated in Figure 3, there was wide variation in episodic structures, with some readers adopting more linear approaches, while others created more complex patterns. We also noted similarities across widely divergent episodic structures based on whether readers chose to rely more on topical themes or historical eras in reading. Subjects 46 and 16, for example, present visually distinct episodic structures, but both relied primarily on historical eras to navigate the text. Similarly, subjects 10 and 28 generate quite different episodic structures but both chose to rely primarily on topical themes in viewing content. Subject 60, on the other hand, did not rely on a single approach, adopting a mix of both era- and theme-based navigation. Path scores closer to 1 in Figure 3 indicate more consistent adherence to the built-in path.
Associations Between Navigation and Reader Response Measures

The third question we addressed in Study 1 was whether previously documented associations between navigation and reading outcome measures would replicate. A correlation matrix was generated crossing three navigational measures and five reader response measures. One navigational measure (Path Score) represents the extent to which readers relied on the path built into the interface. Path compactness ($C_P$) and stratum ($S_P$) were also included, two measures of episodic structure used in a number of recent studies (McEneaney, 2001; Shih, Muñoz, Sánchez, & Maté, 2004; Kalczynski, Senecal, & Nantel, 2006; Scheuer, Mühlenbrock, & Melis, 2007). Reader response variables included the true/false recall score, the rubric-based ratings for stance and understanding, and word counts for the essay and notes. As indicated in Table 2, although there was a large negative correlation between path stratum and path compactness as a result of the way these measures are defined, these measures did not correlate
significantly with response measures. The path score measure, however, seems to tap other sources of variance, resulting in statistically significant negative correlations with the essay and notes word count.

Reading Rate and Navigation During Reading

Two factorial GLM repeated measures analyses were carried out to examine whether there were changes in reading rate and episodic structure during reading. The first analysis explored subjects’ reading rates depending on their relative position within the navigational path. The goal of this analysis was to determine whether there were changes in the time readers spent on pages at various points during reading. If, as has been suggested (McEneaney, 2001, 2003; Schroeder, 1994), reading in an unfamiliar hypertext begins with a more complex exploratory orientation that gradually shifts to a more linear approach as familiarity...
increases, it seems reasonable to expect differences in the time allocated to reading pages depending on where they appear in the navigational sequence. Pages early in the sequence would be expected to be allocated more reading time, but as familiarity with the document increases, time per page should decrease. The second repeated-measures analysis assessed whether there were changes in episodic structures that were early (positions 1–11), middle (positions 12–22), and late (positions 23–33) in the reading session. If familiarity with a hypertext structure reduces the need for backtracking and exploratory navigation, the linearity of reader navigation (i.e., path stratum) should increase toward the end of an extended reading episode. As a result of requiring a minimum of 33 total pages viewed, however, repeated measures analyses were limited to 25 of the 69 subjects.

Mean time per page, plotted as a function of position in the path sequence is illustrated in Figure 4. Although there appears to be a general visual trend toward longer reading times early in the path sequence, the trend appears to be due to longer reading times in the first few positions in the path. The GLM repeated-measures analysis of time per page supports this interpretation with no significant difference (Hotellings Trace $F(10,15) = .803, p > .05$). There was, however, a medium effect size ($\eta^2 = .356$) and relatively low observed power (.270), suggesting that further exploration of this relationship was warranted. The GLM repeated measures analysis of path stratum also was not significant.

![FIGURE 4](image_url) Mean time per page by position for readers in Study 1 with paths of at least 33 hypertext content nodes, beginning with the first content node (the third node).
(Hotellings Trace $F(2,23) = .694, p > .05$) but, as in the case of reading rate, power was low at .153.

Study 1 Discussion

Study 1 provides evidence that the two rubric-based scoring procedures are reliable and that prompts influence stance as predicted, with a fairly strong effect size. Our findings of relationships between stance and navigation indicate that aesthetic readers read more unique pages and appear to make greater use of the built-in navigational path that was part of the reading interface. One possible explanation for both results is that readers who rely on built-in navigation mechanisms do not need to allocate as much time to navigational decision making and, therefore, have more time to focus on content and response. Readers who adopt built-in navigational mechanisms, however, have been characterized as adopting a more “passive” approach to the text and in previous work have tended to perform at lower levels (e.g., Beishuizen, Stoutjesdijk, & Van Putten, 1994; McEnaney, 2001). Our results did not replicate findings associating reliance on a predetermined path with lower reading outcome measures.

One important difference between Study 1 and previous work is that we designed stance-specific prompts to induce a more efferent or aesthetic stance prior to reading and responding. In doing this, we set out to create a more carefully controlled reading environment that would support inferences about the influence of stance on navigation and response. A second, important difference between Study 1 and prior work is the nature of the reading materials employed. Most prior studies exploring reader stance have employed print materials that relied on literary narratives as a basis for exploring stance and its relationship to understanding, while Study 1 adopted expository material. Finally, even among studies using hypertext, prior work has relied on hierarchical or network-like hypertext (e.g., Lawless, Brown, Mills, & Mayall, 2003; Nilsson & Mayer, 2002; McDonald & Stevenson, 1996; Rosenfeld & Morville, 2002), while ours adopted a grid-like virtual structure.

Possibly related to our use of a hypertext with a grid-like virtual structure, statistically significant correlations previously noted between navigation and outcome measures were not observed. This finding is consistent with the hypothesis that using episodic structure as a predictor of success in reading probably requires consideration of virtual structure as well. One final conclusion we drew from these results is that our observation of a moderately strong effect size in our examination of changes in reading rate ($\eta^2 = .356$) in combination with low statistical power suggested further exploration was warranted. Consequently, we set out to refine our experimental design, materials, and procedures in an effort to extend the findings from Study 1.
STUDY 2 RESULTS

As a consequence of our analyses of data and informal reviews of materials and procedures in Study 1, we planned and carried out a second study incorporating changes to our research design, experimental materials, and procedures. One change had to do with page lengths in the hypertext. In Study 1, some pages required use of the browser scrollbar and a few subjects had suggested providing more time for reading. Since we were not considering the role of scrollbars and we did not want subjects to feel pressured by time, we revised the content of pages in the hypertext so that all content on each page could be displayed without scrolling. This revision to article content reduced the average page word count from 282 to 185. A second change in our experimental materials involved revising prompts in an effort to both simplify them and sharpen their stance-specific focus (see Appendix B). A third change was that, while Study 1 relied on handwritten responses on the recall assessment and essay, Study 2 presented these tasks and collected data using keyboard and mouse input. In addition, since we had reduced the content of the article, we reduced the recall assessment from two items for each page (72 items) to a single item for each page (36 items). A fourth change was that we increased the number of subjects to address concerns about statistical power. Our goal in making changes was to address a number of specific practical concerns while minimizing our deviation from the original design.

Influence of Stance on Navigation and Reader Response

Study 2 included 147 subjects (125 females, 22 males), about twice the number who had participated in Study 1. As in Study 1, subjects were prompted to adopt a more aesthetic or more efferent stance prior to reading a 36-node expository hypertext and then completed a recall and essay response task. Preliminary analyses were carried out to assess reliability of our rubric-based ratings. Intraclass correlation coefficients (ICC) indicated good reliability for both the stance rating (F(145) = 3.6219, p < .0001; ICC Alpha = .7239) and the level of understanding rating (F(145) = 18.9576, p < .0001; ICC Alpha = .9473). Replicating results from Study 1, a one-way GLM ANOVA resulted in a moderate effect size for prompts (F(1,144) = 75.178, p < .001, η² = .343) in the SRs of essays with an aesthetic mean of 3.73 (sd = .8064) and an efferent mean of 2.46 (sd = .9222).

Results of the navigation MANOVA indicated a statistically significant difference between stance groups (Hotellings Trace F(3,142) = 3.771, p = .012, η² = .074). There were between-subjects follow-up effects for the unique pages variable (F(1,144) = 5.963, p = .016, η² = .040) and the path score variable (F(1,144) = 6.338, p = .013, η² = .042), with efferent readers reading more unique pages while aesthetic readers had higher path scores indicating they relied
more heavily on the built-in path. There was no between-subjects difference for path stratum. Results of the reader response MANOVA indicated there was a statistically significant effect for stance on the response vector (Hotelling's Trace F(5,140) = 31.504, p < .001). As noted earlier, there was a statistically significant between-subjects effect for prompts on SR in the theoretically predicted direction. There was also a between-subjects effect on the level of understanding variable (F(1,144) = 8.547, p < .005, \( \eta^2 = .056 \)), with aesthetic readers scoring higher, although the effect size was small. Finally, although stance influenced subjects' written responses (F(1,144) = 42.994, p < .001, \( \eta^2 = .230 \)), the effect in Study 2 was on essays rather than the notes (as in Study 1). Furthermore, in Study 2 the efferent prompt group produced longer essays, although they had generated lower word counts in notes in Study 1. There were no observed stance effects on the recall measure or the notes word count in Study 2. Descriptive statistics are reported in Table 3. Observed power

<table>
<thead>
<tr>
<th>PROMPT</th>
<th>Path Stratum</th>
<th>Path Score</th>
<th>Unique Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic</td>
<td>.7063</td>
<td>3.2328</td>
<td>30.11</td>
</tr>
<tr>
<td>(sd)</td>
<td>.3673</td>
<td>.8461</td>
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</tr>
<tr>
<td>N</td>
<td>64</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>Efferent</td>
<td>.6370</td>
<td>2.8292</td>
<td>32.48</td>
</tr>
<tr>
<td>(sd)</td>
<td>.3486</td>
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<td>Total</td>
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<tr>
<td>(sd)</td>
<td>.3573</td>
<td>.9262</td>
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</tr>
<tr>
<td>N</td>
<td>146</td>
<td>147</td>
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</table>

<table>
<thead>
<tr>
<th>PROMPT</th>
<th>Stance Rating</th>
<th>Understanding Rating</th>
<th>Essay Words</th>
<th>Notes Words</th>
<th>Recall Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic</td>
<td>3.7266</td>
<td>1.6953</td>
<td>91.75</td>
<td>107.75</td>
<td>21.47</td>
</tr>
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<td>(.8064)</td>
<td>(.5165)</td>
<td>(35.823)</td>
<td>(100.551)</td>
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</tr>
<tr>
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<td>64</td>
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<td>64</td>
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</tr>
<tr>
<td>Efferent</td>
<td>2.4634</td>
<td>1.4146</td>
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<td>102.75</td>
<td>20.61</td>
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<td>(83.630)</td>
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<td>146</td>
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</tr>
</tbody>
</table>
was good (i.e., >.8) for all three between-subjects effects, but was low for the notes word count (.072) and the recall score (.417). Following these quantitative analyses, we again examined episodic structure diagrams for individual readers. There was, as before, considerable variation in navigational patterns, even within groups of readers who appeared to rely primarily on eras or themes to guide their reading.

### Associations between Navigation and Reader Response Measures

A correlation matrix was computed crossing the same three navigation and five response measures employed in Study 1. Results of this analysis are presented in Table 4. As in Study 1, path compactness and path stratum had a strong negative correlation ($r = -.856$, $p < .001$). In Study 2, however, the path score

<table>
<thead>
<tr>
<th><strong>Navigation/Response Variables</strong></th>
<th><strong>Path Score</strong></th>
<th><strong>$C_P$</strong></th>
<th><strong>$S_P$</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Path Score</strong></td>
<td>Pearson $r$</td>
<td>1</td>
<td>-.336**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.025</td>
</tr>
<tr>
<td></td>
<td>$N$</td>
<td>146</td>
<td>146</td>
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<td><strong>Path Compactness ($C_P$)</strong></td>
<td>Pearson $r$</td>
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<td>1</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>$N$</td>
<td>146</td>
<td>146</td>
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<tr>
<td><strong>Path Stratum ($S_P$)</strong></td>
<td>Pearson $r$</td>
<td>.186*</td>
<td>-.856**</td>
</tr>
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<td></td>
<td>Sig. (2-tailed)</td>
<td>.025</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>$N$</td>
<td>146</td>
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<td><strong>Stance Rating</strong></td>
<td>Pearson $r$</td>
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<td></td>
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<td>$N$</td>
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<td>145</td>
</tr>
<tr>
<td><strong>Understanding Rating</strong></td>
<td>Pearson $r$</td>
<td>.215**</td>
<td>-.162</td>
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<td></td>
<td>Sig. (2-tailed)</td>
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<td>.051</td>
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<tr>
<td></td>
<td>$N$</td>
<td>146</td>
<td>145</td>
</tr>
<tr>
<td><strong>Essay Word Count</strong></td>
<td>Pearson $r$</td>
<td>.020</td>
<td>-.013</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.810</td>
<td>.879</td>
</tr>
<tr>
<td></td>
<td>$N$</td>
<td>147</td>
<td>146</td>
</tr>
<tr>
<td><strong>Notes Word Count</strong></td>
<td>Pearson $r$</td>
<td>.072</td>
<td>-.215**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.388</td>
<td>.009</td>
</tr>
<tr>
<td></td>
<td>$N$</td>
<td>147</td>
<td>146</td>
</tr>
<tr>
<td><strong>Recall</strong></td>
<td>Pearson $r$</td>
<td>.077</td>
<td>-.068</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
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<td>.414</td>
</tr>
<tr>
<td></td>
<td>$N$</td>
<td>147</td>
<td>146</td>
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</tbody>
</table>
had statistically significant correlations with path compactness \( r = -0.336, p < 0.001 \) and path stratum \( r = 0.186, p = 0.025 \). In addition, although there were no statistically significant correlations with the word count measures as in Study 1, there were statistically significant correlations between the path score and scores for stance \( r = 0.226, p = 0.006 \) and understanding \( r = 0.215, p = 0.009 \). Finally, there were also statistically significant correlations between the notes word count and both path compactness \( r = -0.215, p = 0.009 \) and path stratum \( r = 0.261, p = 0.001 \).

### Reading Rate and Navigation during Reading

As before, we carried out two repeated-measures analyses to examine how readers allocate time and navigate during reading. One analysis focused on time per page as a function of position in the path sequence. The second analysis examined whether there were changes in episodic structure during the reading session, using stratum as a dependent variable. In Study 1, neither repeated measures analysis had resulted in significant differences, but low power and a moderately strong effect size suggested further study was warranted. In Study 2 we replicated these repeated-measures analyses of reading rate and episodic structure using subject paths that included at least 33 pages, resulting in a total of 97 subjects from the original total of 147.

Mean reading time as a function of position in the path sequence is illustrated in Figure 5. The general trend toward shorter page reading times later in the path sequence is apparent and the repeated-measures analysis of time across position in the path sequence supports this interpretation with significant differences in both the general test (Hotellings Trace F(10, 87) = 7.161, p < 0.001, \( \eta^2 = 0.451 \)) and in the within-subjects test corrected for possible violation of the sphericity assumption (Huynh-Feldt F(7.820, 750.695) = 17.564, p < 0.001, \( \eta^2 = 0.155 \)).

The repeated measures analysis of path stratum values for path position spanning 1–11, 12–22, and 23–33 also resulted in statistically significant differences in both the general test (Hotellings Trace F(2,95) = 5.506, p = 0.005, \( \eta^2 = 0.104 \)) and in the within-subjects test corrected for possible violations of sphericity (Huynh-Feldt F(2,192) = 5.225, p = 0.006, \( \eta^2 = 0.052 \)). Stratum means (and standard deviations) for the initial, middle, and final paths were 0.904 (±0.160), 0.961 (±0.135), and 0.951 (±0.155), respectively. Observed statistical power was good with values exceeding 0.8 for both tests.

### Study 2 Discussion

Results of Study 2 replicate findings on the reliability of the rubric-based measures and provide further support for the thesis that reader stance is influenced in predictable ways by short text prompts. Results of Study 2 also
suggest that the failure to discern a stance effect in the navigation MANOVAs in Study 1 was due to low power. In Study 2, when the sample size was increased, both the MANOVA and between-subjects tests revealed statistically significant effects. Exploration of the association between path compactness and stratum and the response measures, however, does not show statistically significant associations between these measures of episodic structure and the recall or essay tasks. Unlike prior work that has documented modest but replicable correlations between reader performance and both path compactness and stratum, our results suggest that understanding reader navigation in hypertext will probably require simultaneous consideration of both episodic and virtual structures.

Study 2 also helps elucidate questions Study 1 failed to resolve about reading rate and changes in episodic structure at different points in the reading session. Results of Study 2 support the thesis that the average time per page depends on when a reader encounters a page. Pages early in the reading session are viewed for longer periods of time than those later in the session. In addition, analysis of reader-generated episodic structures across three discrete portions of the reading session indicates a shift to more linear structure with time, consistent with the interpretation that readers adopt a more exploratory approach to navigation early in reading and gradually adopt a more linear approach as they develop familiarity with the hypertext.
EXPLORING THE INFLUENCE OF STANCE AND NODE SIZE

The two studies described address common research questions within a common framework. As a result of both formal analyses and informal feedback from participants, we introduced four changes in Study 2:

1. nodes in the article were shortened,
2. the recall measure was shortened,
3. readers responded to recall and essay measures online rather than in handwritten form, and
4. the stance prompts were revised.

Although it was clear to us that the changes we had introduced would make an examination of effects attributable to node size somewhat speculative, we felt that the exploratory nature of our work and the nature of the changes introduced to experimental procedures warranted further analyses that might be useful in framing subsequent research. Furthermore, a number of analyses suggested that changes in our prompts and assessment methods did not result in statistically significant differences across the two studies, suggesting these changes had not had an impact on subjects’ reading and response.

Our review of the literature suggested that one area where the response format (i.e., computer entry of responses versus handwritten) might be expected to result in differences was in the essay length. Studies on the effects of word processors on writing, for example, have shown that computers can result in longer written responses (Handley-More, Deitz, Billingsley, & Coggins, 2003; Nuvoli, 2000; Peterson, 1993; Li Nim-Yu, 1990). One-way GLM ANOVAs, however, did not indicate significant differences in word counts for either notes (F(1, 209) = 1.262, p = .262) or essays (F(1, 209) = .111, p = .740) between Study 1 and Study 2. In addition, there were no significant correlations between self-reported computer skill or frequency of browser use with essay length, suggesting all students had sufficient skills and experience so that the computer or handwritten format did not influence response. In considering changes to the prompts, we examined average stance ratings across the two studies. No statistically significant differences in average stance ratings were found, with readers in Study 1 generating an average SR of 2.95 (sd = 1.28) and readers in Study 2 generating an average SR of 3.02 (sd = 1.07). Furthermore, there was no significant difference in the variance observed between the two groups of subjects, suggesting that the two sets of prompts were functionally equivalent in terms of their influence on reader response.

As a result of these analyses we carried out exploratory MANOVAs of navigational and response measures using a dataset created by collapsing the
data from both studies into a single large dataset so that we could explore the influence of node size on reader navigation and response. Readers in Study 1 provided a “large node” condition with an average of 282 words per node. Readers in Study 2 provided a “small node” reading condition with only 185 words per node. While collapsing data from the two studies to generate a single larger dataset obviously involved a degree of risk, our analyses of variables most likely to be influenced by the changes suggested these variables were not significantly influenced, and we judged that the uncertainties introduced were outweighed by the potential benefit of this broader view to help us begin our exploration of hypertext node size as a factor in reading. We emphasize, however, the tentative nature of the results and interpretations in this section.

Our analyses using the combined dataset began with two factorial MANOVAs of navigation and reader response variables. In these analyses there were two fixed factors: stance prompt and node size, with subjects from Study 1 serving as our large node condition and subjects from Study 2 serving as our short node condition. Navigation related variables included path stratum, a path score variable representing the degree to which readers adhered to a built-in reading path, and unique pages viewed. Response variables included average stance and understanding ratings, word counts from the essay and notes, and the recall score as a percentage correct. We began with a MANOVA, following up with GLM ANOVAs targeting specific variables.

Results of the MANOVA F test for navigation indicated a statistically significant effect on the navigation vector for node size (Hotellings Trace $F(3,209) = 15.001, p < .001, \eta^2 = .177$), a marginally nonsignificant difference for stance (Hotellings Trace $F(3,209) = 2.502, p = .060, \eta^2 = .035$), and a stance by node size interaction (Hotellings Trace $F(3,209) = 3.833, p = .019, \eta^2 = .046$). Follow-up GLM ANOVAs for individual navigation measures indicated a statistically significant stance effect on the path score ($F(1,211) = 6.528, p = .011, \eta^2 = .030$), with aesthetic readers more likely to rely on the built-in navigational path provided by the interface. In addition (and not surprisingly), there was a follow-up node size effect for the unique pages measure ($F(1,211) = 36.836, p < .001, \eta^2 = .149$) with subjects reading more pages in the short node condition. Finally, a statistically significant prompt by node size interaction (see Figure 6) was observed for the unique pages measure ($F(1,211) = 9.856, p = .002, \eta^2 = .045$) with efferent readers showing a greater gain in pages read in the short node condition than aesthetic readers.

Results of the MANOVA on the response vector indicated significant effects for stance prompt (Hotellings Trace $F(5,205) = 33.480, p < .001, \eta^2 = .450$), node size (Hotellings Trace $F(5,205) = 5.502, p < .001, \eta^2 = .118$), and an interaction effect (Hotellings Trace $F(5,205) = 8.611, p < .001, \eta^2 = .174$). There were stance prompt follow-up effects for SR ($F(1,209) = 126.77, p < .001, \eta^2 = .376$), with aesthetic readers producing more aesthetic responses,
STANCE, NAVIGATION, AND READER RESPONSE IN EXPOSITORY HYPERTEXT

FIGURE 6 Number of unique pages viewed for aesthetic (1) and efferent (2) readers in large (left) and small (right) node sizes.

UR (F(1,209) = 20.419, p < .001, η² = .089) with aesthetic readers producing higher levels of understanding, and number of words in essays (F(1,209) = 10.216, p = .002, η² = .047) and notes (F(1,209) = 4.161, p = .043, η² = .020), with efferent readers producing higher word counts in both. There was no observed effect on the recall score, transformed to account for different numbers of items in the two assessment measures.

Follow-up node size effects were observed for the UR (F(1,209) = 12.333, p = .001, η² = .056) and the recall measure (F(1,209) = 5.276, p = .023, η² = .025) with long-node subjects scoring higher on both. Stance by node size interaction effects were observed for the number of words in essays (F(1,209) = 23.867, p < .001, η² = .102) and notes (F(1,212) = 6.263, p = .013, η² = .029). The only interaction with an effect size exceeding .1, however, was that on the number of essay words (see Figure 7), with efferent readers producing longer essays in the short node condition, while the opposite was true for aesthetic readers.

GENERAL DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

Although transactional theory presumes readers can control stance and prior empirical work supports the claim that external factors influence stance, we
believe our studies are the first to treat stance as an independent variable through the use of short text prompts. Our data replicate prior findings that readers adopting an aesthetic stance achieve higher ratings for understanding, but it is not clear why this is the case. In prior studies this finding might have been attributed to the use of literary reading materials traditionally associated with an aesthetic stance. In our studies, however, readers were presented with expository material and if the relative “fit” of stance and material was important, we would expect efferent readers to perform at a higher level, something we did not observe. We considered the possibility that the two rating scales might not be conceptually distinct, perhaps resulting in a systematic scoring bias producing higher understanding scores for aesthetic readers. Three kinds of evidence led us to conclude that it was unlikely that systematic bias had influenced our results. One source of evidence was that both our review of the literature and the data from our studies showed that the two rating measures had good construct validity and reliability. Second, an informal review of our scoring procedures and the replication of results by different researchers using these rating measures suggests a shared understanding about how to use them. Finally, we generated a frequency chart crossing stance and understanding scores and found instances both of high scoring efferent readers and low scoring aesthetic readers with clear rubric-based rationales, a result inconsistent with systematic scoring bias. We concluded that, while caution is appropriate as with any rubric-based rating, the scales provide appropriate measures to address our questions.
We believe two related aspects of our exploration of reader navigation warrant further consideration. One has to do with the absence of correlations linking episodic structure to reading performance. Despite prior replication, statistically significant correlations of path stratum and compactness with performance in reading were not found. One explanation is that the difference in the types of response tasks (locating information versus essay) is responsible. Another possibility is that using a navigational measure as a predictor of reader effectiveness may require a broader view of hypertext structures: virtual structure to account for text constraints, episodic structure to account for reader choice, and emergent structure to account for broader social patterns of use relevant in understanding group differences.

Consider, for example, the emergent structures illustrated in Figure 8. These diagrams collapse the episodic structures from all aesthetic ($n = 100$) and efferent readers ($n = 114$) into aggregated displays, where links represent a minimum of 15 reader transitions. Although path compactness and stratum measures failed to discern differences between these stance groups, graphical differences are apparent. While the aesthetic reader group generated a daisy-like pattern with two central cycles defined by the People and Places themes (i.e., rows 1 and 2) and “petals” defined by eras (i.e., columns), the efferent reader group generated a web-like pattern. While path compactness and stratum do not capture the features evident in these displays, however, consistent differences between the reader path scores of efferent and aesthetic readers suggest one

![FIGURE 8 Emergent structure diagrams for aesthetic (left) and efferent (right) prompt groups. The link transition threshold for these diagrams required at least 15 transitions by subjects within groups for a link to be displayed.](image)
plausible explanation: aesthetic readers rely more heavily on the built-in path emphasizing era-based navigation, resulting in the prominent era “petals.”

Other navigation-related findings that warrant further attention are the repeated measures effects for reading time and navigation across the reading session, both of which are consistent with the idea that patterns of navigation change as readers become familiar with the structure and content of hypertext documents they are reading (Schroeder, 1994; McEneaney, 2003). Early in the reading episode, readers seem to adopt a more exploratory approach. After learning more about a document, readers become better judges of the purpose of links and path stratum (i.e., linearity) increases. This, in turn, suggests a general framework that, like Gough and Tunmer’s (1986) classic simple model of reading, views reading in hypertext (RH) as a conceptual composite that integrates navigational (RN) and traditional print reading components (RT) to understand online literacy (i.e., RH = RN x RT). Moreover, this way of thinking about hypertext reading is consistent with results in both studies, where readers who relied on the “Path” navigation button scored higher on the UR scale, suggesting that relying on a built-in path (i.e., reducing attention allocated to RN) can assist readers by freeing attention for traditional reading processes (i.e., RT). This interpretation is also consistent with subjects’ self-reported technology skill and use measures. Self-reported technology skill (r = .235, p = .001) and frequency of use (r = .2515 p = .031) were both positively correlated with the UR. Skill was also positively correlated with the number of unique pages viewed (r = .146, p = .036). One reasonable interpretation of these correlations is that less time and attention are allocated to navigation by more skilled technology users, leaving more attention available for more traditional reading processes. No other significant correlations between the self-reported skill and use measures were noted.

Finally, analyses treating both node size and stance as fixed factors reinforced results from Studies 1 and 2 focusing on stance but also suggested node size may have an independent impact on navigation and response. Not surprisingly, readers in the smaller node size condition read a larger number of unique nodes than those in the large node condition. More interesting is the observation that this effect is significantly more pronounced for efferent readers than it is for aesthetic ones, suggesting that navigation seems to depend on stance. There was also an interesting interaction noted in the essays, with aesthetic readers tending to write shorter essays in response to shorter nodes while the opposite was true of efferent readers.

Results of our work lead us to the following conclusions:

1. Reader stance can be influenced through the mediating action of short text prompts.
2. Aesthetic readers achieved higher levels of understanding.
3. Correlations between reading performance and episodic structures (path compactness and stratum) documented in prior work were not replicated in this study.
4. Reading rates changed during hypertext reading sessions with more time allocated to pages early in the reading session.
5. Reader navigation changed during reading with more complex episodic structure early in the session and more linear episodic structure late in the session.
6. Stance influenced the way readers used interface elements, with aesthetic readers making more extensive use of a built-in path than efferent readers.

In addition to these primary conclusions we note more tentatively that our analyses of data collapsed across both studies indicate that hypertext node size appears to influence both navigation and reader response, with suggestive evidence that node size interacts with stance.

These results have implications for online literacy practice and pedagogy, hypertext design, and future study of online reading environments. With respect to practice and pedagogy, it seems clear that navigation is influenced both by reader objectives and by properties of the hypertext that define a space of possibilities within which readers create episodic structure. Perhaps as a result of the greater demands for reader interaction and the less conventionalized (and, therefore, less predictable) structures of electronic texts, readers may allocate more attention to navigational decisions early in a hypertext reading episode, resulting in a strategy of slower reading and more complex exploratory navigation at first and more rapid and linear reading later on, as familiarity increases. Although it would be premature to suggest this as a pedagogical practice, this strategy corresponds to text previewing (Huffman, 1996; Sanders, 1997; Spires, Gallini, & Riggsbee, 1992) a widely practiced instructional strategy intended to help students acquire a broader view of the organization of text as a means to support comprehension.

Results of the studies reported here have also shown that stance, induced by short text prompts prior to reading, appears to influence how readers use interface elements, with results from both studies indicating aesthetic readers are more likely to rely on a built-in path than are efferent readers. Given this, it may be important for hypertext interface designers to consider how stance shapes the ways readers perceive and use technology. There is suggestive evidence as well that node size has an impact on reading and should be considered in making design decisions. Finally, we believe our demonstration that reader stance can be experimentally manipulated is an important step in a more systematic program of research applying concepts from transactional theory to our understanding of online literacy.
REFERENCES


APPENDIX A: RUBRICS

Stance Rating Rubric

<table>
<thead>
<tr>
<th>Continuum Indicators</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response is dominated by analysis based on external standards</td>
<td>Most efferent</td>
</tr>
<tr>
<td>Content or presentation is reported in “objective” non-emotional terms</td>
<td>SR = 1</td>
</tr>
<tr>
<td>Citations to text or world are used to illustrate or support analysis.</td>
<td></td>
</tr>
<tr>
<td>Response <em>usually</em> relies on analysis based on external standards but emotionally charged terms may be present.</td>
<td>Primarily efferent</td>
</tr>
<tr>
<td>Description of content or presentation may incorporate a personal perspective that is justified.</td>
<td>SR = 2</td>
</tr>
<tr>
<td>Citations usually rely on text or world connections but text to self connections may illustrate or support analysis.</td>
<td></td>
</tr>
<tr>
<td>Response includes personal likes and dislikes <em>that are explained</em>.</td>
<td>Balanced SR = 3</td>
</tr>
<tr>
<td>There are references to an external standard.</td>
<td></td>
</tr>
<tr>
<td>Emotional content is clearly present, but moderated by analysis.</td>
<td></td>
</tr>
<tr>
<td>The essay author’s “voice” may be apparent</td>
<td></td>
</tr>
<tr>
<td>The author’s voice plays a large, but not dominating, role in the essay.</td>
<td>Primarily aesthetic</td>
</tr>
<tr>
<td>Response <em>usually</em> relies on a subjective perspective but one or more external standards might be cited.</td>
<td>SR = 4</td>
</tr>
<tr>
<td>Description of content or presentation is mostly personal but with at least some justification or explanation.</td>
<td></td>
</tr>
<tr>
<td>Commentary usually relies on text to self connections to illustrate or support analysis.</td>
<td></td>
</tr>
<tr>
<td>Response is dominated by “gut level” response that is not explained or justified.</td>
<td>Most aesthetic</td>
</tr>
<tr>
<td>Content or presentation is described in personal and/or emotional terms.</td>
<td>SR = 5</td>
</tr>
<tr>
<td>Citations to text are described in emotional terms or simply listed without comment.</td>
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Understanding Rating Rubric

<table>
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<tr>
<th>Continuum Indicators</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Records a list of facts/statements from the text, or a list of statements related</td>
<td>UR = 1</td>
</tr>
<tr>
<td>only to the hypertext structure/presentation.</td>
<td></td>
</tr>
<tr>
<td>Reflects a combination of facts/statements from the text, or about the hypertext</td>
<td>UR = 2</td>
</tr>
<tr>
<td>structure/presentation, and some connections to self or to world.</td>
<td></td>
</tr>
<tr>
<td>Reaches a generalized understanding about the use of hypertext technology, and</td>
<td>UR = 3</td>
</tr>
<tr>
<td>synthesizes, analyzes, or summarizes to form general statements about either the</td>
<td></td>
</tr>
<tr>
<td>benefits or limitations of hypertext technology on society.</td>
<td></td>
</tr>
</tbody>
</table>

APPENDIX B: PROMPTS

Prompts Used in Study 1

**Efferent Prompt:** From an educator’s perspective, identify the most important ideas presented in this hypertext article and briefly explain why these ideas are important. Please be specific by citing parts of the hypertext article that influence your response.

**Aesthetic Prompt:** How does the hypertext format alter your experience as a reader compared to print? Please be specific by citing parts of the hypertext article that influence your response.

Prompts Used in Study 2

**Efferent Prompt:** Identify and comment on the most interesting/important ideas presented in this hypertext article. Please cite parts of the article that support your response.

**Aesthetic Prompt:** Please write about your personal response to the way information is presented in this online article.

John E. McEneaney is Professor of Reading and Language Arts at Oakland University in Rochester, MI. Professor McEneaney is the 2007 recipient of the Albert J. Kingston Award from the National Reading Conference. His work
has appeared in a variety of journals including Reading Research Quarterly, International Journal of Human-Computer Studies, Journal of Reading, Journal of Educational Computing Research, The Reading Teacher, and the Journal of Artificial Intelligence in Education. His current research focuses on applications of transactional theory to online environments, reader navigation in hypertext, and the role of agency attribution in shaping human-computer interaction. He can be reached at 490E Pawley Hall, Department of Reading and Language Arts, School of Education and Human Services, Oakland University, Rochester, MI 48309-4494, USA, or by email at mceneane@oakland.edu.

Ledong Li is an associate professor of Education and Instructional Technology at Oakland University, Rochester, Michigan. Dr. Li was the recipient of IRA’s Dissertation of the Year Award in 2002. His recent work involves digital literacy in K-12 classrooms and Web-based learning in diverse instructional environments. His research also focuses on educational technology advancement and its impact on pre-service teacher education and in-service teacher professional development. He can be contacted at the School of Education and Human Services, 490F Pawley Hall, Oakland University, Rochester, MI 48309. E-mail: L1Li@oakland.edu

Kris Allen is a doctoral student in the Department of Reading and Language Arts at Oakland University in Rochester, MI. Her research interests include writing pedagogy and online reading/learning. She can be contacted at Department of Reading and Language Arts, Oakland University, 2200 N. Squirrel Road, 460G Pawley Hall, Rochester, Michigan 48309. Email: kjallen@oakland.edu.

Lizabeth Guzniczak is a lecturer of Reading and Language Arts at Oakland University in Rochester, Michigan. Dr. Guzniczak studies how adolescents comprehend information in digital literacies. Her focus is on comprehension and instructional strategies in nonlinear and linear print. She can be contacted at Oakland University, 2200 N. Squirrel Road, 460G Pawley Hall, Rochester, Michigan 48309. Email: laguznic@oakland.edu or lguzniczak@yahoo.com.