Journal of Literacy and Technology
Volume 17, Number 3: Fall 2016
ISSN: 1535-0975

Online Commerce as a Digital Literacy: A Grounded Theory Approach

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Volume 17, Number 3: Fall 2016
ISSN: 1535-0975

Abstract

We present a framework to account for the ways readers gather, assess, and apply information in making a simulated purchasing decision in an online store (www.amazon,.com). Video of participants' screen activity and think-aloud protocols served as the primary data. Analysis began with open coding of two video files affording synchronous views of both the content readers viewed and think-aloud protocols generated by study participants. Higher-order codes allowed us to build on simpler descriptive findings in generating interpretive and explanatory constructs. Building on these constructs, we have defined a process-state model of this widely practiced and economically important reading-to-do task that captures many of the findings we have presented and suggests a number of potentially productive questions to guide future inquiry.

Volume 17, Number 3: Fall 2016
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There is considerable interest in the many ways that digital technologies are extending and altering literacy practices. The bulk of the research on digital literacies by literacy researchers and educators, however, focuses on academic settings typical of schools and universities. Learning management systems and massive open online courses (MOOCs) have, for example, been widely studied. But digital technologies have also had significant impact (some might argue more impact) in settings that involve social interaction, news, cultural events, and commerce (e.g., Alvermann, Marshall, McLean, Huddleston, Joaquin, & Bishop, 2012; Sturtevant & Kim, 2010). The purpose of this study is to define a framework for understanding a digital literacy that requires sophisticated reading skills in an information-rich literacy environment but that focuses on a non-academic type of task. Specifically, our work explores how readers gather, assess, and apply information in making a simulated purchasing decision in an online store.

There are, of course, long traditions of research that focus both on reader comprehension of expository text material and on the ways users respond to online materials. Theoretical frameworks adopted by literacy educators who study expository text, however, routinely assume reading materials have a fixed text structure, an assumption that is readily refuted when readers literally create a text by selecting links (McEneaney, 2006; 2011). Studies with a computer science orientation, on the other hand, while they more commonly acknowledge the interactive nature of online text, tend to focus on computer generated log files and other technical data sources that are several steps removed from the reader experience. Our goal in the present study is adopt a more process-oriented exploration that focuses on how readers experience and respond

to the reading task, while more adequately accounting for the genuinely novel problems and circumstances of an online reading environment.

Moreover, in addition to these more concrete differences that differentiate those who study literacy and those who study technology, researchers across these fields often adopt dramatically different theoretical frameworks, making it difficult to establish a single frame that does justice to both of these perspectives. Our goal in this study is to apply grounded theory (Strauss & Corbin, 1998; Holton & Walsh, 2016), a data-driven methodology, in an effort to define a theoretical perspective that honors both our focus on reading as a literacy process and the unique and quite distinctive experiences readers have in an online literacy setting. Our goal is to apply a grounded theory approach in responding to a single broad research question rather than address specific hypotheses. Our research question is: What kinds of strategies do readers use when in a complex information-rich online environment when making a purchasing decision?

Why Grounded Theory?

There are a wide range of qualitative methodologies that serve many different purposes. Case studies, for example, are well suited to detailed examination of individual cases, usually with the goal of revealing what is unique to understanding the chosen case (Creswell, 1998). Grounded theory (GT) on the other hand, typically begins with a broader view that often includes multiple study participants and has the goal of generating a *theory* to account for what is actually observed (Glaser & Strauss, 1967; Strauss, 1987; Strauss & Corbin, 1998). In keeping with the goal of generating new theory, GT advocates that prior theoretical commitments be deemphasized so that the data can be examined with a more open perspective rather than forcing it into an existing theoretical frame. In the present study, this is important because we are trying

to bring together quite different perspectives. Adopting a GT approach means we take a fresh perspective on the research question and let our data lead us to concepts and relationships rather than impose those in an a priori manner.

GT is, however, a methodological approach that is highly systematic in the sense that it explicitly seeks to move from complex and often messy data at the start of inquiry toward a more organized and systematic way of thinking about that data, with the ultimate goal of establishing a theory that might lead to new qualitative or quantitative research hypotheses (Holton & Walsh, 2016). GT, therefore, also serves as a kind of methodological bridge connecting the primarily qualitative educational research literature on digital literacies (e.g. Cho & Afflerbach, 2015; Zhang & Duke, 2008) to the more quantitative tradition on user navigation of online text and consumer decision-making (McEneaney, 2001; Häubl & Trifts, 2000). In short, GT provides a starting point for examining a rich and complex data set (in this case, video data) with the goal of defining a potentially generalizable theoretical frame that is intended to support further study, whether qualitative or quantitative.

Other Perspectives

Although we have chosen to adopt a grounded theory approach (Glaser & Strauss, 1967; Strauss, 1987; Strauss & Corbin, 1998), we acknowledge other perspectives that have been important in helping us situate this work and interpret our results. Transactional theory (Rosenblatt, 2004), for example, provides a general frame for thinking about literacy and meaning making that has been useful, particularly in helping us refine concepts of reader stance and the temporal nature of the reading event. Work by Mosenthal (1996), Mikelecky & Drew (1991), and Sticht (1977) on the cyclical nature of expository reading tasks also has also helped us make important conceptual connections useful in understanding our findings. Work by

Suchman (2007) provides an anthropologically oriented view of technology that highlights the mutual influences artifacts and users exert on one another, and work by researchers in marketing and consumer behavior (Hausman & Siekpe, 2009; Rosen & Rurinton, 2004) have helped us better understand the design principles behind complex interactive software.

The focus of our work as a grounded theory study, however, begins with immersion in our data as we seek to understand how readers use a complex online resource and explore what their patterns of use reveal about the ways they understand and make meaning in this environment. Methodologically, our work draws on analytical techniques developed for verbal protocols (Ericsson & Simon, 1993; Pressley & Afflerbach, 1995; Kucan & Beck, 1997), interaction analysis (Jordan & Henderson, 1995), and video data analysis (Abasi & Taylor, 2007; Helwig, 2011). Our goal, however, is primarily qualitative and generative — to define a preliminary theoretical framework to support future study rather than test specific empirical hypotheses or predictions.

Methodology

A total of 25 college-age study participants (22 female) were recruited from students in a school of education at a medium-sized Midwestern university in the US. The research protocol was reviewed and approved by a university review board. Data collection took place in a private office and began with a researcher briefly explaining the informed consent form, the nature of the research task, and participant requirements and protections. All participants had normal or normal-corrected vision, normal hearing, and were compensated with a gift-card to a local coffee shop. Some participants who were students earned extra course credit for contributing data.

The reading task presented to participants required that they search an online commerce site (www.amazon.com) for a digital camera that met researcher-specified criteria. Individual

data collection sessions began with a brief explanation of the simulated purchasing task. A scenario was described in which a friend asked for help selecting a digital camera as a gift for a relative. Participants were also presented a short printed description of the criteria to use as they completed the task (e.g., a "stylish" but "pocketable" camera that would cost less than $200 and appeal to an 18 year-old female). Study participants also watched a short video demonstrating a concurrent think-aloud (Ericsson & Simon, 1993) prior to reading. Each participant was provided a new anonymous customer account for their session so that participants' prior histories would not influence the behavior of the site. Participant instructions for the think-aloud procedure adhered to those advocated by Ericsson and Simon (1993). Camtasia software (Techsmith, 2007) used in data collection recorded all screen activity and the think-aloud protocols generated by study participants with a screen-mounted webcam. Video of participants' screen activity and think-aloud protocols served as the primary data for analysis. Data preparation began with separation and synchronization of the two video streams (i.e., screen capture and think-aloud) and extraction of audio wav files to support preliminary coding of speech and silence. The primary analytic tool for viewing and coding video data was the Eudico Linguistic Annotator or ELAN (See Figure 1, Helwig, 2011). TraMineR (Gabadinho, Ritschard, Müller, & Studer, 2011) served as the primary tool for analyzing and visualizing sequential data.

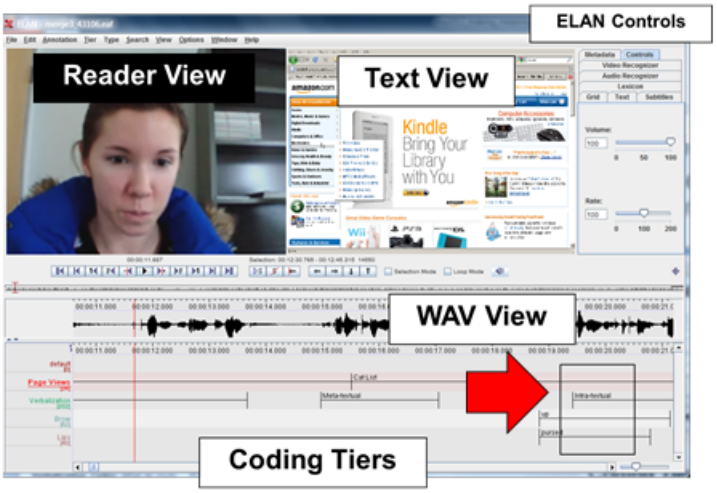

Figure 1. Screenshot of ELAN displaying the reader, page view, and wav media streams, ELAN controls, and coding tiers at the bottom with overlapping codes indicated by an arrow.

Data Analysis: Video Coding and Reliability

Video was coded in five phases. The first "Observing" phase focused on viewing all 25 participant videos (with simultaneous screen and reader views as illustrated in Figure 1) *without* attempting to code what was observed. The purpose of the observing phase was to develop general familiarity with participants' responses to the task prior to coding. The second "Describing" phase focused on detailed exploration of three exemplar participants whose videos exhibited salient general patterns (e.g., page visit patterns) or other potentially "codeable" qualities (e.g., pronounced facial expressions) with the goal of generating first draft codes. In the third "Generalizing" phase of analysis, a larger sample of six video files were chosen for tentative coding using the codes generated with exemplars in the descriptive phase. Coding in the generalization phase, however, was still exploratory and cyclical. As familiarity with the data developed, the coding model was refined, sometimes requiring recoding of previously coded video. When the third phase of coding was complete, a fourth "Refining" phase began with a thorough review of coding techniques and the goal of articulating stable, well-defined coding procedures and conventions. This phase concluded with calculations of inter-rater reliabilities for all video-based coding categories based on a subset of six cases. In the fifth and final "Theorizing" phase of analysis, higher-level codes that crossed categorical boundaries were identified with the goal of defining theoretical constructs and explanations. All findings and interpretations presented are based on codes that emerged from the fourth and fifth phases of analysis (Refining and Theorizing).

By the end of the third phase of analysis (Generalizing), three distinct types of code had emerged (See Table 1.) Nine different page view codes were based on the page content and

participant action displayed in the screen capture video. Verbalization codes indicated what participants talked about during the think-aloud as they completed the task. Finally, two distinct facial expression codes focused on participant affect as indicated by position of participant brows and lips. Page view codes relied primarily on the screen stream video depicted in the "Text View" section in Figure 1, while facial codes relied primarily on the think-aloud video stream depicted in the "Reader View" section in Figure 1. Verbalization coding relied primarily on the think aloud stream, but we sometimes found the screen stream helpful in coding verbalizations as on-screen events sometimes served as useful indicators of attention and verbal intent. In the fourth "refining" phase of coding we focused on developing a shared understanding of the coding process and assessing reliability of the codes we were generating.

Table 1
Codes that emerged from the third phase of coding (Generalizing).

Coding Tier	Coding Vocabulary & Description
Page View Codes	Search – reader enters text into a search. Menu – mouse enters or clicks a menu bar. Category List - a list of multiple items sorted by one or more criteria. Leader – top of an item page (image of a camera at the upper left). Details – text-based information in the middle of an item page. Reviews – individual or summary reviews of cameras or vendors. Vendors – a list of merchants that sell an item. Shipping – shipping information from a specific vendor. Cart – the reader is viewing item(s) in the Amazon cart.
Verbalization Codes	Silence – no verbalization. Filler – Non-semantic verbal mannerisms (um, hm, sniffs, etc.) Intra-textual – comments on content (including oral reading). Inter-textual – comments about another page not currently viewed Meta-textual – comments about the participant's search strategy. Prompt – comments about the prompt defining the task. Experiential – comments about personal knowledge or prior experience. Critical – comments that are explicitly evaluative and task related.
Facial Codes: Brow	Up, Down, Neutral
Facial Codes: Lips	Pursed, Neutral

Assessing reliability considered both temporal and nominal coding accuracy. Temporal accuracy refers to agreement between coders on *when* events begin and end. Nominal accuracy refers to agreement between raters in the assignment of codes to specific segments in the video stream. Because video presents a continuous observational stream, we adopted a time-interval analysis based on segmented intervals (Olswang et al., 2006; Jansen et al., 2003). Pairs of raters provided independent codes for the same individual on the four coding tiers (page views, verbalizations, brow, and lip). Codes generated by paired raters were displayed beside one another and the video stream was segmented into five second intervals. Raters were judged to have agreed if, within a five second interval, there was *both* temporal and nominal code agreement across at least 50% of the interval. This approach requires raters to agree both about what code is assigned (nominal accuracy) and when that code begins and ends (temporal accuracy). When there was at least 50% agreement across the five-second interval, that segment was coded as a "hit." If there was less than 50% agreement, either because there was a difference in the code identified or there was a difference of more than 2.5 seconds in when events were coded as beginning or ending that segment was coded as a "miss." Inter-rater reliability of codes ranged from good to excellent. The percentage agreement of coders across the four coding tiers were: verbalizations = 79%, page views = 92%, lip position = 94%, and brow position = 95%. We concluded that our coding had good reliability, with both temporal and nominal accuracy.

Data Analysis: Simple and Higher-order Analyses of Video Codes

Following assessment of reliability, video codes were subjected to both simple and higher-order analyses. Simple analyses looked for general descriptive patterns within each categorical coding tier analyzed separately (e.g., what are the relative proportions of the different types of verbalizations coded?). Although our goal is to define a broader theoretical framework

that crosses categorical boundaries, we believe the relatively simple analyses based on single coding categories is useful both in describing our preliminary findings and in setting the stage for the more complex higher-order analyses that follow. In addition to the simple analyses, we also carried out five different higher-order analyses. Cross-categorical analyses sought to define patterns that crossed categorical coding tiers (e.g., are codes in one tier associated with codes in another tier?) Sequential analyses sought to define sequential patterns within a single coding tier (e.g., Are there recurrent code sequences within a single coding tier?) Two of the higher-order analyses focused on relationships across coding tiers (i.e., overlap analysis and transition analysis) and three of the higher-order analyses focused on sequential patterns (transversal analysis, modal state analysis, and cluster analysis.)

Overlap analysis refers to the generation of new codes that define higher-level coding units where two existing codes co-occur, a coding process that can be automated in ELAN. In one case, for example, we crossed codes for verbalization and facial expressions to define a higher level verbalization-affect code, suggesting that certain types of verbalization were more likely to be associated with expressions of affect. Transition analysis refers to an examination of the ways codes change in one tier depending on code boundaries defined in another tier. One transition analysis we describe below looked at whether there were changes in the type of verbalizations that occurred immediately preceding a specific kind of page transition, suggesting that metacognitive commentary was more likely to precede reader clicks.

We also carried out three sequential analyses, all focusing on page view data. The goal of sequential analyses was to explore more general patterns of page and tool use by participants in the study. In order to carry out these analyses, we needed to define a common timeline to accommodate variability in total reading time by individuals. The scale we adopted was based on

dividing the continuous page view data from the video stream of each participant into 100 "percentage" intervals. Codes were then assigned to intervals based on the code that occupied the largest part of each interval. Standard rounding conventions were employed in assigning codes to intervals, assigning a code if it occupied 50% or more of an interval. One exception to our coding practice was if rounding would result in eliminating data. For example, in cases of longer reading times, a brief interval of searching might occupy less than one half of an interval. Since each interval was limited to a single page view code, standard rounding procedures would have eliminated data by rounding short page views down to 0 and excluding this data from the final coding sequence. In order to retain the full data sequence, we coded all page view durations of 1% or less as a single interval. As a result of this rounding procedure, the number of intervals across participants sometimes exceeded 100, with missing data markers used to fill out shorter sequences. In all cases, however, sequential analyses ignored missing data.

A transversal analysis was applied to explore the reading task as an individually adjusted *process*, defined in terms of participants' progress from the beginning to the end of their individual reading episode (Gabadinho et al., 2011). Our goal in this analysis was to explore whether certain types of page views tended to dominate portions of the reading process. Following up on the transition analysis, we carried out a modal analysis to highlight the most common page views displayed at each interval in the process. Finally, a cluster analysis sorted reader types based on similarity of sequential page view patterns across the reading process, resulting in a preliminary reader typology.

Presentation of the research results will consider each analysis separately. Following presentation of the research results, we explain how these separate findings fit together within a larger theoretical whole.

Research results: Simple Analyses and Findings

Figure 2 presents overall percentages of time allocated by readers to different types of page views and verbalizations during the reading task, with Table 1 providing more specific information about how each code should be interpreted. Our analysis of page view codes led us to two main conclusions regarding page views.

1. Three page view codes dominate this reading task, with about 70% of total reading time consistently devoted to CatList, Leader, and Detail page views for most readers.
2. Readers seem to have a clear preference for browsing (rather than searching), with Search and Menu page views accounting for only about 6% of total reading time, although search fields and pop-up menus were available on nearly every page.

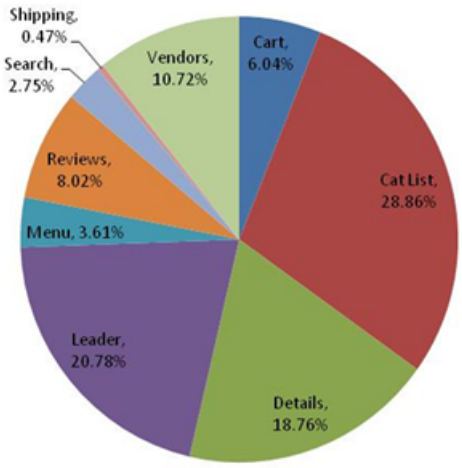

Figure 2A. Page views across the task.

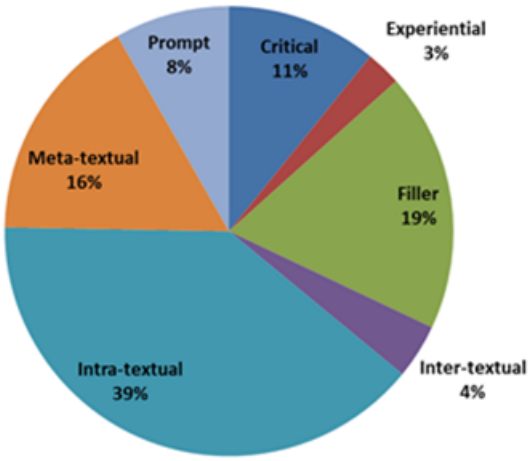

Figure 2B. Verbalizations across the task (excluding silence).

Our analysis of the think-aloud protocols led us to four main conclusions regarding verbalizations.

1. Verbalizations are dominated by intra-textual commentary and most commonly reflect text vocalization during reading (an artifact of the think-aloud methodology).
2. Readers demonstrated relatively high levels of meta-textual commentary (16% of all verbalizations), suggesting engaged and reflective reading.
3. Past experience appears to be a good predictor of the task outcome — of seven participants who stated they owned a certain brand of camera, four selected that brand.
4. Finally, we noted that more effective think-aloud participants (i.e., who produced less silence) tended to generate relatively more critical and experiential verbalizations.

Unlike the verbalization and page view data, facial expression codes for brow and lip movement were infrequent, accounting for only about 5% of the video stream. We did not, therefore, attempt simple analyses of facial expressions. We were, however, curious about whether facial expression codes might be more informative when considered in conjunction with other codes and began our higher-order analyses with an overlap analysis exploring relationships between facial expressions (collapsed into a single facial expression code) and verbalizations. An example of this kind of cross-categorical overlap of codes is identified by the arrow highlighting the region in Figure 1 where simultaneous codes appear for page view, verbalization, and both lip and brow movement. We discuss higher-order findings in the next section.

Higher-order Analyses and Findings

Our first higher-order analysis was an overlap analysis that examined the relationship between indicators of affect (facial expressions) and verbalizations. We began by establishing a baseline for the relative frequency of verbalization types for all participants across the entire reading task. We then recomputed relative frequencies for verbalizations that co-occurred with measures of affect. The results of the overlap analysis are displayed in Figure 3 displaying the

relative proportions of verbalizations in general on the left and relative proportions of verbalizations during displays of facial affect on the right. Comparison reveals that filler and intra-textual commentary increase during facial affect, with decreases in other verbalization categories, suggesting that readers may limit their more substantive task-related commentary during episodes of more intense internal activity, as suggested by displays of affect such as furrowed brows and pursed lips.

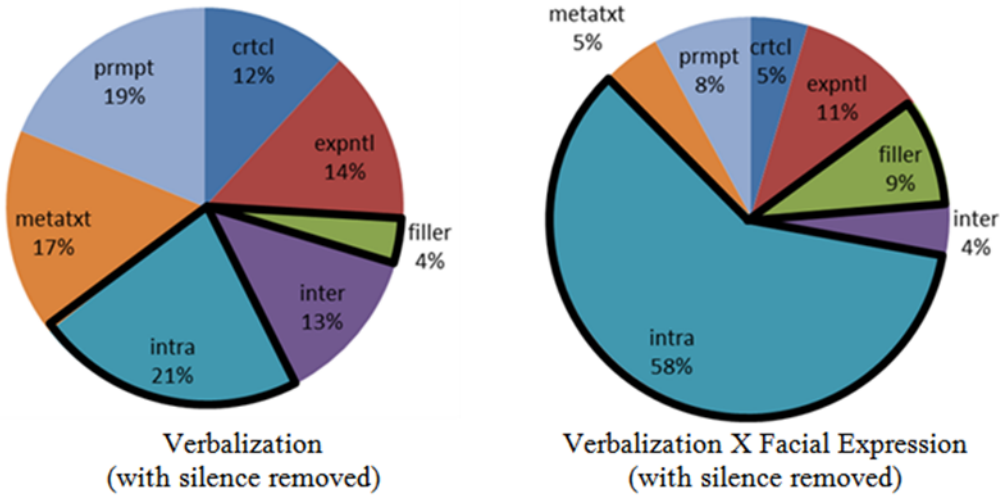

Fig. 3. Relative proportions of verbalization codes overall (left) and when overlapping with facial expression (right.)

Our next three higher-order analyses explored transition relationships between page views and other codes. We were particularly interested in looking at page transitions from the more global CatList page view with numerous images of different cameras to

4A. A CatList page view. **4B.** A Leader page view.

Fig. 4. An illustration of a transition from the more global CatList view (4A) to the more specific Leader view (4B).

the more specific local view of an individual camera provided by a Leader page view (See Figure 4) since this transition most clearly captured the intent of the reading task to select an individual camera from among the many that were available. We addressed three specific questions about the association between page view page transitions and other codes:

Table 2

Results of cross-categorical analyses examining associations between CatList-to-Leader page transitions and other coding categories.

Verbalization	χ^2 (6, n=164) = 33.61, p < .0001
Brow Movement	χ^2 (2, n=164) = 12.73, p < .005
Lip movement	χ^2 (1, n=164) = .7097, p > .05

1. Do certain verbal codes tend to precede CatList-to-Leader page transitions?
2. Do brow movements tend to precede CatList-to-Leader transitions?, and
3. Do lip movements tend to precede CatList-to-Leader transitions?

In each case, we carried out a chi-square goodness-of-fit analysis comparing the observed frequencies of codes in the five-second period before the click to overall frequencies across the reading task as a whole that served as our expected values. Results (see Table 2) indicated that meta-textual commentary tended to increase and verbal filler tended to decrease in the period immediately preceding the click. In addition, brow movement (down) also increased, but there did not appear to be any difference in lip movement.

Our last series of higher-order analyses focused on what sequential patterns within page view data might reveal about the reading process. As noted earlier, in order to analyze the reading task as a temporal process it was necessary to establish a standard percentage time scale to account for variability in participants' total reading times (mean = 12.24 minutes, sd. = 6.23 minutes). Results of the percentage-scaled data visualization are illustrated in Figure 5A with each page view code represented by a different color and identifier with individual reader contributions weighted by total reading time. The relative height of each bar corresponds to the

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weighted sum of individual values at each percentage interval. As noted earlier, values on the horizontal time scale exceed 100 as a result of the rounding procedure we adopted to avoid data loss. Results at the far right of each chart are therefore based solely on those participants for whom data was available and as a result become increasingly sensitive to individual readers, and therefore less reliable, at the far right-hand side of the scale.

One pattern evident in Figure 5A, for example, elaborates on the general pattern of page views illustrated in Figure 2A, highlighting page view variation across the reading task as a whole. Figure 2A, for example, indicates three page views dominate the reading process but does not reveal how these page views are used across the reading process, something that Figure 5A illustrates in considerable detail. CatList page views, for example, clearly dominate the earliest stages of the task as readers orient themselves to what is available. Beyond the first 10% of the task, however, CatList page views subside, stabilizing at a lower level and Leader, Detail, and Review pages assume a larger proportion of combined page views totaling between 60% and 80% until the task approaches 90% completion, at which point Cart and Vendor page views assume larger proportions as readers make their choices.

Moreover, the page view patterns we see in 5A become still clearer in the modal page view chart illustrated in figure 5B, where only the most common page view code is displayed for each interval in the reading process. As in 5A, the dominance of the CatList view in the earliest stages of the task is evident. Once readers complete the first 10% of the task, however, they adopt two distinct cyclical reading patterns. A local reading cycle involves participants moving back and forth between the more general information about a specific camera provided by the Leader view and the more specific information provided by the Detail and Review page views. The second more global cycle involves participants moving back and forth from the higher-

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ground perspective afforded by the CatList views and views that focus on specific individual cameras (i.e., Leaders, Details, and Reviews.) Moreover, the page view evidence in support of this global cycle is reinforced by the prior transition analyses showing that verbalization and

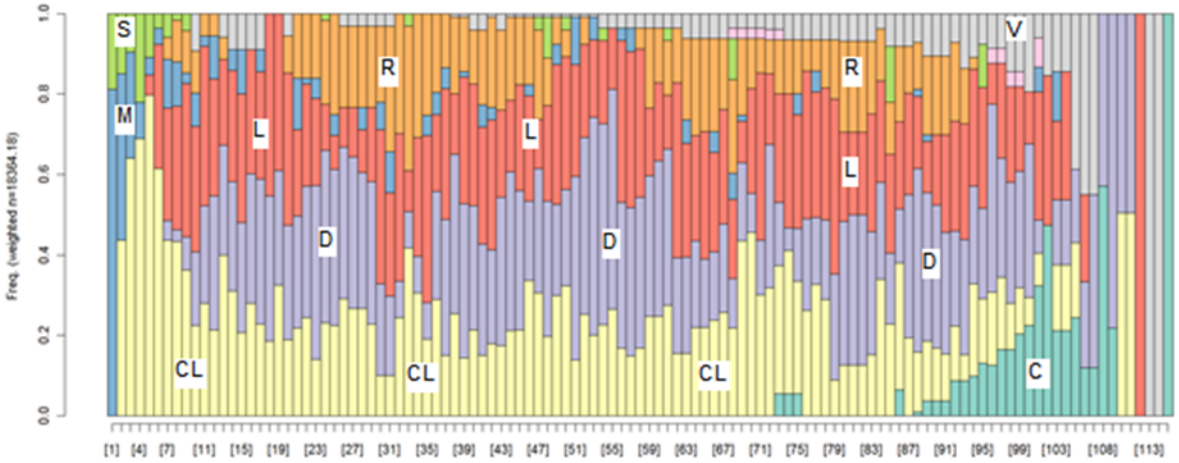


Fig. 5A. Proportions of page view codes for all participants by percentage of the reading task completed. Proportions are weighted by the overall time to complete the task by each reader.

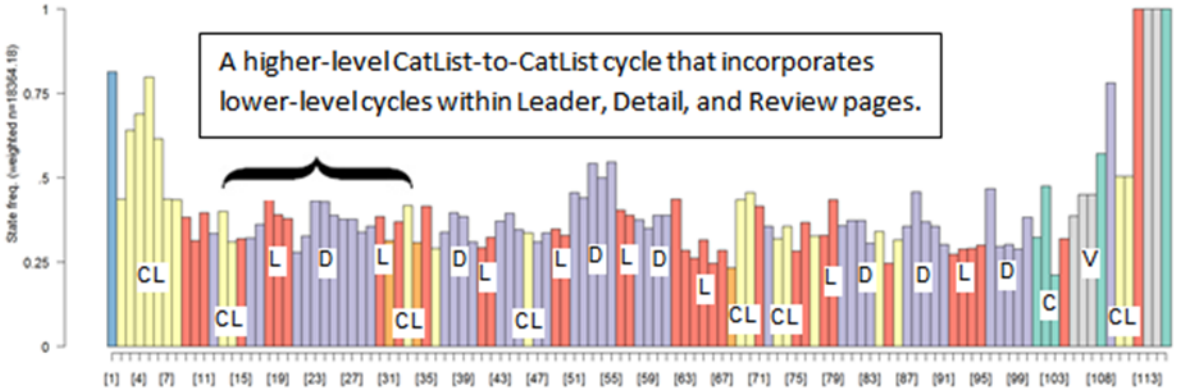
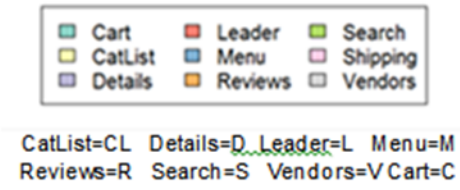


Fig 5B. Most frequent page view across all participants during the reading with position in the process based on percentage of the task completed. The curly bracket illustrates a global CatList cycle with several local cycles within, drawing on Leader, Details, and Reviews.

Fig. 5. Normalized traversal analyses for all page view codes (5A) and for most frequent (i.e., modal) page view codes (5B) across the reading task. Percentages exceed 100% due to rounding up of percentage values less than 1 to avoid eliminating data. Legend appears at the right.



affect change across this global-local boundary. Finally, the significance of this boundary across the reading process as a whole is reinforced by the presence of CatList page views up until the reading process is almost complete, at which point the Cart page views gradually replace it. In effect, evidence from our sequence data identifies two distinct reading cycles, one that is more local, focusing on gathering information about specific items (i.e., the local cycling within Leaders, Details, and Reviews) and a higher-level global cycle that tests whether the information that has been gathered is sufficient to make a decision and, if not, reorients the reader's focus as the reading process continues.

In our final series of cluster analyses we sought to define a reader typology based on sequential page view data. The heart of this exploratory technique is to sort participants based on the similarity of the page view patterns during reading. Briefly, participants are sorted into groups based on an optimal matching distance measure (Levenshtein, 1966) that accounts for both a more basic similarity measure relying on shared subsequences (Elzinga, Rahman, & Wang, 2008) and a more flexible measure based on the number of steps required to transform one pattern into another when insertions, substitutions, and deletions are allowed (Abbott, 2001; Abbot & Forrest, 1986). Results of the cluster analyses suggest three distinct reader types based on the page view patterns illustrated in Figure 6.

Cluster 1 identifies seven "social" readers who used CatList page views to initially orient themselves but subsequently relied heavily on reviews posted by other consumers on the online commerce web site in making their decision. Social readers also tend to read longer than other reader types (mean = 14.75 minutes, sd = 3.59), and although they make use of Leaders and Details, these views are secondary to the larger frame provided by the CatList views depicted at the bottom and the Review page views at the top. Cluster 2 identifies a small group of four

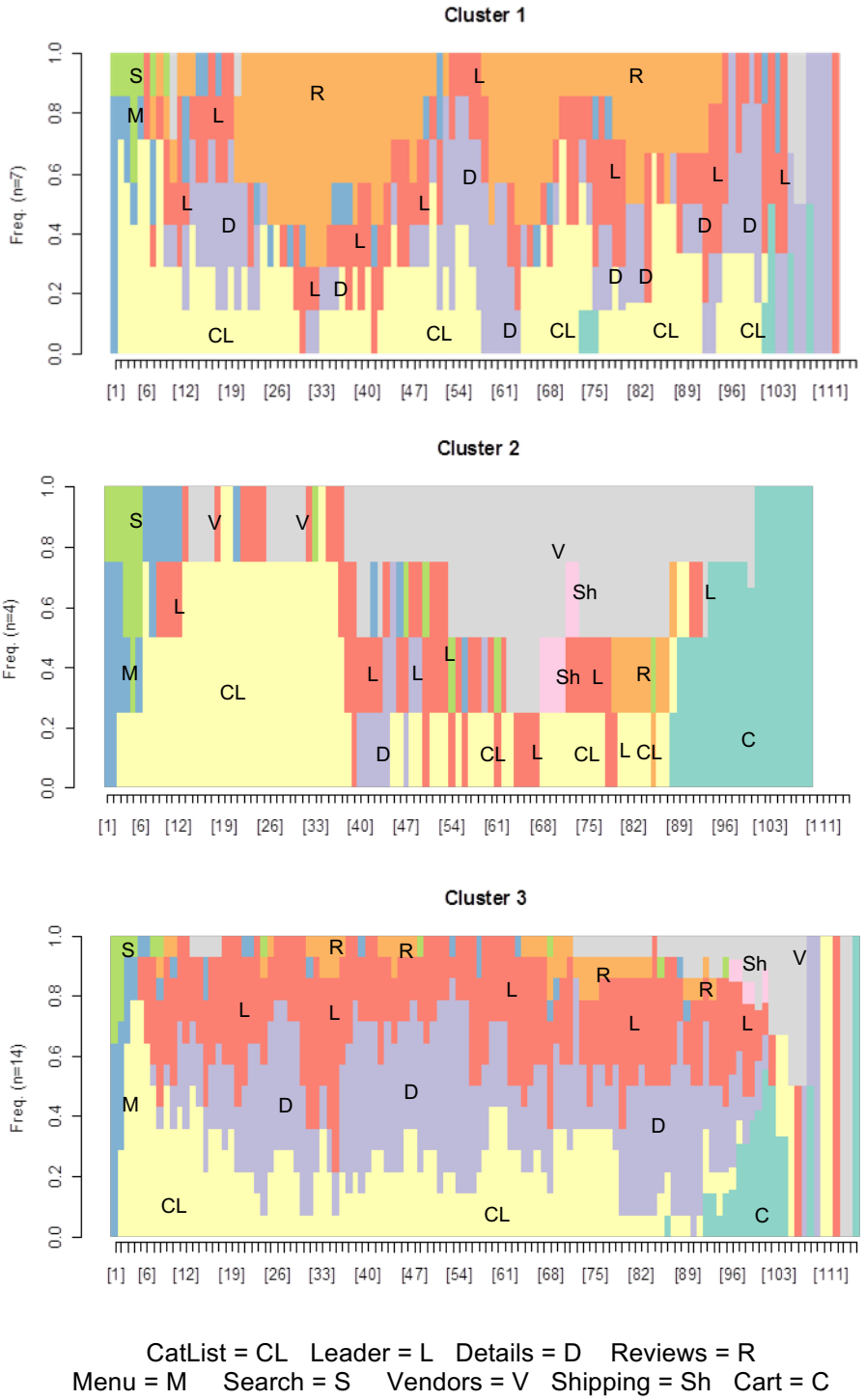


Fig. 6. Reader types based on optimal matching distances. Width of each chart varies depending on overall reading time of group members as a result of rounding. Color

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conversions to grayscale vary across clusters to highlight differences between adjacent color regions.

"surface" readers whose reading process tends to be brief and relies on a heavy early emphasis on CatList pages followed almost immediately by heavy reliance on Vendor page views that emphasize task-closure activities primarily focused on price and shipping. Surface readers spend the shortest period of time reading (mean = 7.12 minutes, sd = 3.03) and make relatively little use of Leader and Detail pages across the reading task. Decision making by surface readers appears to rely on a fairly cursory reading of available information but an unusual emphasis

(compared to the other two reader groups) on vendor information. Cluster 3 is the largest group, with 14 readers, who adopt a more "strategic" approach to the reading task, seeking out a fuller view of available options in a systematic way. Strategic readers (mean = 12.453 minutes, sd = 7.22) are most clearly distinguished from the other two groups by a more data oriented and systematic approach to decision making that relies on both a wider range and a more even dispersal of page types across the reading task as a whole. Strategic readers seek out CatList pages for higher-level views, Leaders and Details for specific information about individual items, and Reviews that provide a social perspective. In short, strategic readers use a wider variety of page views in a more complex fashion that does not adhere to the simpler blocking patterns evident in the cluster patterns of the other two groups.

A Preliminary Theory

In this penultimate section we step back from our data and findings in an effort to define more general principles and explanatory mechanisms to account for what we have observed. Our goal is to present a theoretical framework that both explains our findings and leads us to new questions that will serve to guide further inquiry. In reviewing our findings we converged on two theoretical constructs that support much of what we have seen: cyclical processing and reader states defined in terms of perspective and strategy. Cyclical processing seems to be the construct operating at the highest level, so we begin our theorizing by presenting a general process model based on page view data that seeks to capture the flow of reader attention across the reading task as a whole (see Figure 7.)

Cyclical Processing in the Preliminary Theory.

In the model we advocate, Leader, Detail, and Review page views focusing on specific cameras (labeled "Item Review" in Figure 7) are at the heart of this reading task. These three page views represent the local cycle that drives the reading process as readers gather and weigh information about their choice. In addition to this local cycle, there is another higher-level cycle that allows readers to step back from views of individual items so they can consider a broader perspective. The CatList page view typically anchors this broader cycle, with most readers relying on a CatList view to reorient themselves between local cycles (although there are occasions when Search and Menu page views serve this role.) We also note that there is a clearly developmental process that seems to operate across this task, with relatively larger proportions of Menu, Search, and CatList views early in the process and relatively larger proportions for Vendor, Shipping, and Cart views late in the process. Overall, readers spent 36% of their time in more global views and 48% of their time in local views associated with individual items, with these percentages rising even higher when the orientation and conclusion phases at the beginning and end of the reading task are excluded. In short, our data point to a cyclical process model like that depicted in Figure 7 in which readers cycle between more global and more local views until there is a decision that the task criteria have been met.

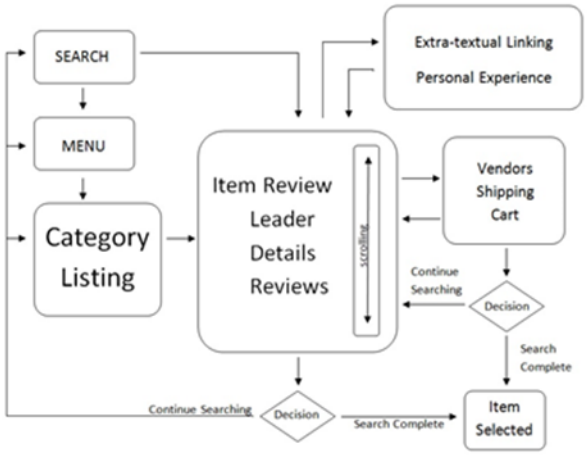

Fig. 7. A flowchart modeling processing in the reading task including scrolling within local item review and transitions across global and local perspectives using menus, links, and search fields.

Both our transitional and our process analyses support this hierarchical cycling framework. The curly bracket identifying a subsequence of the normalized modal page view data

presented in Figure 5B, for example, clearly depicts local cycling between Leader and Detail views framed within a higher-level cycle defined by CatList codes representing transitions to a higher-level perspective between local cycles. Overall, readers tend to adopt a three-stage developmental sequence across the task as a whole, with an opening stage defined by high-ground views on the left (i.e., CatList, Search, and Menu), a hierarchical cycling stage in the middle alternating between local and global cycles as they work through the bulk of the reading task, and then transitioning to page views associated with task-closure (i.e., Vendors, Shipping, and Cart) as they converge on their decision. We also noted informally from the think-aloud protocol that participants tended to verbalize an intention to "go back" when they left a local view (i.e., an item review page view) to move to a higher-level CatList page view. Finally, as we noted in the discussion of transition analyses, the frequency of meta-textual commentary and filler verbalizations change when readers cross a global-local boundary, suggesting that these transitions reflect cognitively significant events in the reading process.

We would argue as well that cyclical process models have been widely adopted by many other reading theorists and researchers. Cyclical processing is, for example, the hallmark of interactive theories of reading whether they adopt a neurocognitive (Rumelhart, 2004, Seidenberg, 2007) or a traditional psycholinguistic orientation (Goodman & Goodman, 2004; Smith, 2004). More immediately relevant in the present context, Mosenthal's (1996) reading-to-do document processing model incorporates a clearly hierarchical cyclical structure that accommodates both local and more global decision making in solving a reading task. Finally, in other closely related work, studies of reading in hypertext have shown reader sensitivity to, and use of hierarchical cycling as evidenced by link selection (Lawless, Brown, Mills, & Mayall, 2003; Lawless, Schrader, & Mayall, 2007; McEneaney, 2001; McEneaney, Li, Allen, &

Guzniczak, 2009), suggesting that, while there are novel aspects in the hierarchical cycling observed in our work, this theme is well rooted in the literature on reading.

Finally, the cyclical model we advocate also finds support in the reader typology that emerged from our cluster analysis, with all three distinct reader types providing consistent evidence for transitions across global-local boundaries across much of the reading task even when there was only limited evidence of cycling within global or local page views. Strategic and social readers, for example largely ignored global page views (Menu, Search, Vendors, Shipping) except for the CatList views that anchored their hierarchical cycling. Surface readers, on the other hand, largely ignored Detail and Review pages, but regularly returned to the Leader page views that anchored their hierarchical cycling. Moreover, as we became more sensitive to the role of cycles in the page view data, we noticed as well that reader states seem to cycle in ways that parallel the page view data, with four distinct states defined by two relatively independent constructs that reflect reader attention.

Reader States in the Preliminary Theory.

The concept of reader state, like cyclical processing, has well-established precedents in prior reading research. Explicitly cognitive models often define reader states in precise operational ways, but even philosophical theories of reading (e.g., Rosenblatt, 2004; Iser, 1978) acknowledge that both reader and text express state values that change over time, and in online reading materials this notion of both reader and text as capable of transitions to new states has become quite literal (McEneaney 2006; 2011).

In the present context, two reader state constructs are most relevant for modeling how readers respond in this reading task: perspective and strategy (see Table 3.) Perspective refers to the level of the view that the reader adopts at any given point in the reading process, while

strategy refers to whether the reader's attention is focused on gathering information (i.e., a focus on content) or managing the reading process as a whole (i.e., a focus on the task). Furthermore, these two reader state constructs are distinct enough to define four relatively discrete reader states that map in a straightforward fashion onto the developmental sequence revealed by Figure 5A.

Specifically, the earliest stage of reading falls clearly in the lower left-hand corner of Table 3 (i.e., the Task-Global quadrant) as evidenced by the dominance of Menu and Search page views. Readers quickly moved, however, from using Search and Menu tools to a more content-driven browsing approach. As a result of this, the dominant reader state shifts into the Content-Global quadrant in the upper left for the remaining portion of the first tenth of the reading process, with CatList page views dominating this period.

In the span ranging from about 10% to about 90% completion of the reading process, readers tend to either move back and forth between global and local views within the content

Table 3
Reader states defined by the concepts of perspective and strategy in the reading task with examples of verbalizations associated with these states

	Global Perspective	**Local Perspective**
Content Strategy	Quadrant II: Content-Global Gathering information about general options (camera makes, prices, etc.), driven either by past experience or search and menu tools. The goal is to narrow options by browsing. **("Let's see what SONY has.")**	Quadrant I: Content-Local A focus on careful review of qualities of available options. The goal is to size up a specific camera in a general way, usually independent of the task prompt. **("This one has a good review.")**
Task Strategy	Quadrant III: Task-Global Systematic search for specific qualities, often based on the task requirements. The goal is to sort and eliminate general options to narrow the pool of specific cameras that must be considered. **("I'll put in less than $200.")**	Quadrant IV: Task-Local A focus on evaluating qualities of specific cameras that are usually tied to the task requirements. The goal is to sort and/or eliminate specific cameras on the basis of the qualities specified in the prompt. **("Good, this one's under $200!")**

strategy row (because of their preference for browsing) or move up and down in the local perspective column (because they are either gathering or evaluating information about specific cameras.) Finally, in the last tenth of the reading process Vendor and Cart page views begin to dominate, signaling that the process as a whole is converging on a solution and gradually pinching off the Leader, Detail, and CatList views that are the primary drivers of the reading process. In short, the reading process appears to begin and end in the Task-Global quadrant with the bulk of reading between the 10 and 90 percent intervals relying on two distinct types of cycles: a local process cycling between content and task strategies within a local perspective (i.e., cycling between quadrants I and IV) and a content-oriented process cycling between more global and more local perspectives (i.e., cycling between quadrants I and II). Figure 8 presents an illustration of this integrated process-state model indicating dominant states associated with each process stage.

Implications and Applications

The results and interpretations we have presented suggest that, although online literacies like the one we have studied present genuinely novel challenges for readers, there are clear connections linking our results with findings reported for reading both traditional expository text and online materials. Perhaps the most significant overlap we observe in connection with prior work is the observation that readers cycle between cognitive and meta-cognitive states as they gather information from a text and make decisions about what strategies are working. Even though readers only rarely made explicit statements about this cycling, three distinct findings suggest this represents an important operating principle. One finding is the association between metacognitive commentary and subsequent clicks that led readers to new content. A second finding is the pattern of page views over time, documenting a cycling of attention between more

global and more local perspectives. Finally, a third finding is that the so-called "strategic readers," whose reading evinced the most consistent use of multiple strategies over the full course of the reading event made up nearly 60% of all readers, suggesting that this cycling pattern is typical of a large proportion of the participants in the study.

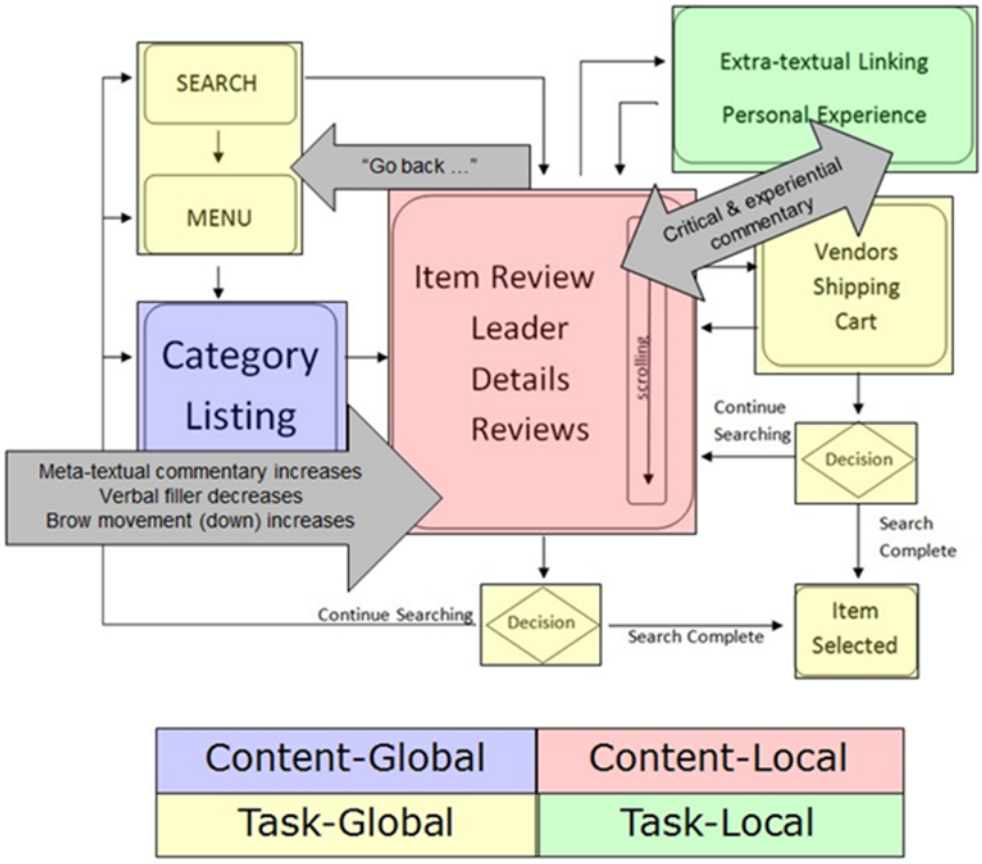

Fig. 8. An integrated process-state model for the reading task with examples of reader response markers associated with state transitions.

The fact that readers do not seem to be consciously aware of this cycling process suggests, however, that an interactive reading environment like Amazon.com could be modified to better support the reading process by tracking reader behaviors and offering support that aligns with a reader's current state and strategy. Interactive tools might also be able to tailor support or

tools for different reader types since the needs and interests of surface, social and strategic readers are quite distinct. Furthermore, these strategies might also have a more general pedagogical potential, as a vocabulary for teaching people how to adopt a more conscious and strategic approach to using complex online resources.

Conclusions, Limitations, and Questions for Further Inquiry

We have presented a grounded theory for an online reading-to-do task. Our work began with open coding of multiple streams of video data that afforded us synchronous views of both the content that readers viewed online and think-aloud protocols generated by study participants. Our primary codes relied exclusively on native video data and were found to have good to excellent inter-rater reliability. Higher-order codes helped us move us from primarily descriptive findings to more interpretive and explanatory constructs. Building on these constructs we have defined a process-state model that captures many of the findings we have presented and suggests a number of potentially productive questions to guide future inquiry. We offer the following conclusions.

1. Cross-categorical analyses suggest that verbalization and displays of affect are associated with specific reader state transitions defined by the grounded theory we propose.
2. Analyses of the reading process adjusting for individual differences in reading time suggest a general developmental sequence across the reading task.
3. Cluster analyses of reading process patterns suggest three reader types (social, surface, and strategic readers) who use provided resources in three distinctly different ways.
4. This reading-to-do task relies on two interacting cyclical processes, a local cycle focused in individual items and a more global cycle focused on the reading process as a whole.

5. Two functionally defined conceptual constructs (reader perspective and strategy) complement and extend the cycling process model that emerges from our data.

One important limitation of this work is its focus on a fairly narrow type of reading transaction tied to online commerce. The prodigious growth of this specific literacy practice over the past decade, however, is well documented and there is a compelling case in support of the significance of this specific literacy practice as a basic literacy life-skill. Whether or not this research will inform us in broader ways remains to be seen. We would argue, however, that this specific literacy practice warrants the attention of both literacy researchers and educators as a consequence of its practical and economic significance. A second important limitation of the work we present is that we have no clear answer to what extent the findings we report and the model we advocate can be applied to other settings or other populations of readers. We would point out, however, that we have developed a conceptual framework that is sufficiently well articulated to support predictions that will help better assess the extent to which generalization is warranted. A second important limitation we note is that this work is exploratory and based on a small sample (n=25) drawn from a specific population (college students at a suburban Midwestern university in the US.) As a result of this limitation we would emphasize that we do not make any claims to broad generalizability of these findings. Nevertheless, we view these findings as well-supported for the population we have studied and believe these results warrant further work.

We close with a number of questions that continue to guide our inquiry. Because of the design of this study, one important question that remains unaddressed has to do with the relative "effectiveness" of the approaches adopted by different readers. Because the task was framed as a choice that did not require justification and the task requirements were general in nature, we

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cannot say much about the qualities that distinguish more- and less-effective readers, although our reader typology seems to suggest at least one promising line of inquiry. As noted earlier, surface readers seem to hurry through the task. Strategic readers, on the other hand, seem to adopt an approach that is both more systematic and more thorough. We would like to know more about what different types of readers learn from this kind of reading task, but did not include a debriefing measure to assess this.

Another important set of questions follow up on the finding that certain types of verbalizations tend to precede certain types of page view transitions. We are interested in further transition analyses to explore relationships across coding categories that are defined by transitions. We are also interested in exploring two specific theoretical questions related to findings 3 and 5. One theoretical question focuses on whether the reader typology based on social, surface, and strategic readers is generalizable. Are these patterns observed in other similar reading-to-do contexts and populations of readers? We believe the theoretical frame we have developed is sufficiently detailed to support a larger-scale empirical test and we believe this test could both further clarify the model and support new avenues for research. Finally, we hope to identify other observable indicators associated with the constructs of reader perspective and strategy since these constructs are central to the hierarchical cycling model we advocate. Are there other codes that are reliably associated with either global or local cycling transitions similar to the meta-textual verbalizations noted when readers transition from a CatList to a Leader page view? Although the four reader states we have defined seem to work quite well in explaining what we have seen, we would like to define these constructs in more specific operational terms so that the empirical adequacy of the model we propose can be tested. In short, although we believe this work presents us with a relatively well-formed grounded theory, its major

contribution to our continuing work is the opportunity it provides to push our thinking in ways that will support new questions and more rigorous assessments of its adequacy

References

Abasi, A. R. & Taylor, M. C. (2007). Tackling the issues and challenges of using video data in adult literacy research. *Australian Journal of Adult Learning*, *47*(2), 289-307.

Abbott, A. (2001). *Time matters. On theory and methods*. Chicago: Chicago Press.

Abbott, A. & Forrest, J. (1986). Optimal matching methods for historical sequences. *Journal of Interdisciplinary History, 16*, 471-494.

Alvermann, D. E., Marshall, J. D., McLean, C. A., Huddleston, A. P., Joaquin, J., & Bishop, J. (2012). Adolescents' we-based literacies, identity construction, and skill development. Literacy Research and Instruction, 51, 179-195.

Cohen, J. (1960). A coefficient for agreement for nominal scales. *Educational and Psychological Measurement*, *20*, 37-46.

Creswell, J. W. (1998). Qualitative inquiry and research design. Thousand Oaks, CA: Sage.

Elzinga, C., S. Rahmann and H. Wang (2008) Algorithms for Subsequence Combinatorics, *Theoretical Computer Science, 409*(3), 394-404.

Ericsson, K. A. & Simon, H. A. (1993). *Protocol Analysis: Verbal Reports as Data*. Cambridge, MA: MIT Press.

Gabadinho, A., Ritschard, G., Müller, N.S. & Studer, M. (2011), Analyzing and visualizing state sequences in R with TraMineR. *Journal of Statistical Software, 40*(4), pp. 1-37.

Glaser, B. & Strauss, A. (1967). *Discovery of Grounded Theory*. Chicago: Aldine.

Goodman, Y. M. & Goodman, K. S. (2004). To err is human: Learning about language processes. In R. Ruddell & Norman J. Unrau (Eds.), *Theoretical models and processes of reading*, 5th Edition. (pp. 1363-1398). Newark, DE: IRA.

Häubl, G. & Trifts, V. (2000). Consumer decision making in online shopping environments: The effects of interactive decision aids. Marketing Science, 19(1), 4–21.

Hausman, A. V. & Siekpe, J. S. (2009). The effect of web interface features on consumer online purchase intentions. *Journal of Business Research*, *62*(1), 5-13.

Helwig, B. (2011). *EUDICO Linguistic Annotator* (Version 4.1) [Computer software and manual.] Retrieved June 30, 2011 from http://www.lat-mpi.eu/tools/elan/.

Holton, J. A. & Walsh, I. (2016). Classic grounded theory: Applications with qualitative and quantitative data. Thousand Oaks, CA: Sage.

Iser, W. (1978). *The act of reading*. Baltimore, Maryland: Johns Hopkins University Press.

Jansen, R. G., Wiertz, L. F., Meyer, E. S., & Noldus, L. P. J. J. (2003). Reliability analysis of observational data: Problems, solutions, and software implementation. *Behavior Research Methods, Instruments, & Computers*, *35*(3), 391-399.

Jordan, B. & Henderson, A. (1995). Interaction analysis: Foundations and practice. *The Journal of the Learning Sciences*, *4*(1), 39-103. Available online: http://www.jstor.org/pss/1466849

Kucan, L. & Beck, I. L. (1997). Thinking aloud and reading comprehension research: Inquiry, instruction, and social interaction. *Review of Educational Research*, *67*(3), 271-299.

Lawless, K. A., Schrader, P. G., & Mayall, H. J. (2007). Acquisition of Information Online: Knowledge, Navigation and Learning Outcomes. *Journal of Literacy Research, 39*(3), 289-306.

Lawless, K. A., Brown, S. W., Mills, R. & Mayall, H. J. (2003). Knowledge, Interest, Recall and Navigation: A Look at Hypertext Processing. *Journal of Literacy Research, 35*(3), 911-934.

Levenshtein, V. (1966). Binary codes capable of correcting deletions, insertions, and reversals. *Soviet Physics Doklady, 10*, 707-710.

McEneaney, J. E. (2011). Web 3.0, Litbots, and TPWSGWTAU. Journal of Adolescent and Adult Literacy, 54(5), 376-378.

McEneaney, J. E., Li, L., Allen, K., & Guzniczak, L. (2009). Stance, navigation, and reader response in expository hypertext. Journal of Literacy Research, 41(1), 1-45.

McEneaney, J. E. (2006). Agent-based Literacy Theory. Reading Research Quarterly, 41(3), 2-21.

McEneaney, J. E. (2001). Graphic and numerical methods to assess navigation in hypertext. International Journal of Human-Computer Studies, 55, 761-786. (PR)

Mikulecky, L. & Drew, R. (1991). Basic literacy skills in the workplace. In R. Barr, M/ L/ Kamil, P. B. Mosenthal, & P. D. Pearson (Eds.), *Handbook of reading research* (Vol. 2, pp. 669-689). New York: Longman.

Mosenthal, P. B. (1996). Understanding the strategies of document literacy and their conditions of use. *Journal of Educational Psychology, 88*(2), 314-332.

Olswang, L. B., Svensson, L., Coggins, T. E., Beilinson, J. S., Donaldson, A. L. (2006). Reliability issues and solutions for coding social communication performance in classroom settings. *Journal of Speech, language, and Hearing Research*, *49*, 1058-1071.

Pressley, M. & Afflerbach, P. (1995). *Verbal protocols of reading*. Hillsdale, NJ: Erlbaum.

R Development Core Team (2011). *R: A language and environment for statistical computing. R Foundation for Statistical Computing*, Vienna, Austria. ISBN 3-900051-07-0, URL: http://www.R-project.org/.

Rosen, D. E. & Purinton, E. (2004). Website design: Viewing the web as a cognitive landscape. *Journal of Business Research*, *57*(7), 787-794.

Rosenblatt, L. (2004). The transactional theory of reading and writing. In R. Ruddell, M. R. Ruddell, & H. Singer (Eds.), *Theoretical models and processes of reading*, 5th Edition. (pp. 1363-1398). Newark, DE: IRA.

Rumelhart, D. E. (2004). Toward an interactive model of reading. In R. Ruddell, M. R. Ruddell, & H. Singer (Eds.), *Theoretical models and processes of reading*, 5th Edition. (pp. 1149-1179). Newark, DE: IRA.

Seidenberg, M. S. (2007). Connectionist models of reading. In G. Gaskell (Ed.), Oxford *Handbook of Psycholinguistics*, pp. 235-250. New York: Oxford University Press.

Smith, F. (2004). *Understanding reading*. Mahwah, NJ: Erlbaum.

Sticht, T. (1977). Comprehending reading at work. In M. A. Just & P. A. Carpenter (Eds.), *Cognitive processes in comprehension* (pp. 221-246). Hillsdale, NJ: Erlbaum.

Strauss, A. (1987). Qualitative analysis for social scientists. Cambridge: University of Cambridge Press.

Strauss, A. & Corbin, J. (1998). *Basics of Qualitative Research* (2nd Ed.) Thousand Oaks, CA: Sage.

Sturtevant, E. G. & Kim, G. S. (2010). Literacy motivation and school/non-school literacies among students enrolled in a middle-school ESOL program. Literacy Research and Instruction, 49, 68-85.

Suchman, L. A. (2007). *Human-Machine Reconfigurations*. Cambridge: Cambridge University Press.

TechSmith (2007). *Camtasia Studio* (Version 4.0.2) [Computer software.] Okemos, MI: TechSmith.

Volume 17, Number 3: Fall 2016
ISSN: 1535-0975