Reading the news online: Effects of medium on knowledge acquisition.

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Abstract
The Internet has exerted its influence in the presentation and consumption of news. With many desirable characteristics, the Internet has become a powerful news medium. Nevertheless, studies claim that the online news medium is less effective than print for the learning of news facts. Studies measuring knowledge acquisition usually examine the ability to recall facts - factual knowledge - and often ignore the ability to connect information - structural knowledge – though the latter facilitates the process of decision making and problem solving. Employing an experimental method, this study found no evidence to support the claim that the traditional print newspaper is superior to online media in fostering factual knowledge. The study equally found no support for the prediction that the online medium – whose structure resembles the associative nature of human memory - is superior to print in fostering structural knowledge. The lack of support for these hypotheses has methodological implications and invites further investigations.

Introduction

The digital revolution has changed the media landscape. The advance of computer and telecommunication technologies has led to a convergence phenomenon - "the integration of mass media, computers and telecommunications" (Straubhaar & LaRose, 2002, p. 3). The sharing of computer-readable format language allows different media to communicate using the same protocol. As a result, conventional non-digital media are now typically also available in digital formats. The Internet with its Web application has become the principal platform for channelling various media contents and become virtually synonymous with the term 'new media'. Consequently, the distinct channels of television, film, radio, book, magazine and newspaper which were before called 'the media' are now regarded as 'the old media'. Often 'new media' is studied in relation to an understanding of 'old media'.

The renewed attention to 'medium' in the new media and information age explains the relevance of medium-oriented approaches (Yell, 2007). This is supported by Holmes (2005) who argues for a greater focus on the networks and mediums of communication. According to Yell (2007) "…new media make more manifest and in

Bolter and Grusin's terms 'remediate' the aspects of textuality and communicative practice that are nevertheless also discernible in the old media forms" (p.15). Focusing on medium effects, this study examines differences in knowledge acquisition between readers of traditional print and online media.

Understanding the new media as news medium

Newspapers have been affected significantly by the shift from old to new media. Expanding a newspaper's brands, building and engaging a wider audience (Peng, Tham, & Xiaoming, 1999) and reducing costs of production and distribution (Chaudhri, 1998) are among the reasons that news organisations have moved into online publication. These explain the growing trend worldwide for newspapers to go online, making online news sources ubiquitous and affecting newspapers' circulation and readership. Reports show an increase in online readership while print readership (Pew Research Center for the People and Press, 2006) and daily newspaper circulation have declined (Ahlers, 2006; Pew Research Center for the People and Press, 2006)

The decline stems from the popularity of the new media as a news medium. The mostly free access to the news, the accessibility of breaking news, the unlimited media choice - text, audio and videos - (Stovall, 2004) and the ability to locate information faster than through offline media (Online Publishers Association, 2004; Oostendrop & Nimwegen, 1998) are among the desirable characteristics of online news sources. Their appeal comes from the power of the medium - the Internet.

The Internet as a news medium has the advantage of capacity, flexibility immediacy, permanence, and interactivity (Stovall, 2004). As Stovall explains, it has an enormous capacity to hold news and materials in a variety of forms – text, audio and video – which can be accessed in numerous flexible ways. News can be delivered immediately and the Web qualities of immediacy offer: (1) 'variety' in reporting multifaceted news, (2) 'expansion' in covering many aspects of events, (3) 'depth' in providing the details, and (4) 'context' in giving a complete picture of an event (Stovall, 2004, pp. 8-9). The advantage of permanence, according to Stovall, relies on

properly archived and maintained data. Electronic data has the benefit of durability, while paper, videotape and audiotape all deteriorate over time. Above all, Stovall argues that "…those qualities [capacity, flexibility, immediacy and permanence] pale against the potential the Web has for interactivity" (Stovall, 2004, p. 10).

Stovall (2004) also argues that all news media have some degree of interactivity. Unlike traditional television, radio, magazine and newspapers - which allow activities of choosing channels and news to view and read - the Web has greater choices which give readers more control over what to read. The use of hyperlinks facilitates access to news by a click of the mouse and movement between different mediums such as text, audio and visual. In addition, Stovall claims that new media foster a two-way communication between journalist/editors and readers/users. The availability of techniques for channelling feedback - such as instant pools, emails, forums, bulletin boards, discussion groups, blogs and online chat - make the online news sources more interactive than the old media. In the new media environment, readers are no longer considered passive recipients of news but the source of information and communication as well.

Interactivity has been defined in various ways in communication studies. The definitions include: feedback (Newhagen & Rafaeli, 1996; Rafaeli, 1988; Rogers, 1986), degree of involvement, interaction ease, mutuality (Burgoon, Ramirez, Dunbar, Kam, & Fischer, 2002), actions followed by reactions (Heeter, 2000), control, exchange of roles, mutual discourse (Williams, Rice, & Rogers, 1988), control over the communication process (Neuman, 1991), speed of response, range – the number of parameters that can be modified – and mapping – the way in which human actions are connected to actions within a mediated environment (Steuer, 1992). Johnson, Bruner II and Kumar (2006) conceptualize a general concept of interactivity that includes reciprocity, responsiveness, speed of response, and also nonverbal information – the use of multiple channels for communicating information – as facets of interactivity.

In the context of this study, the aspects of new media interactivity generally reflect the experience of reading text or graphics from multiple sequences and various orders, and also exploring numerous links and media. It is based on a non-linear structure which is different from a fixed unitary text of traditional print media. Although print readers can still skim news and skip pages while reading, the practice of flipping pages is more likely a linear process. The Web's non-linearity, on the other hand, is well demonstrated from the use of mouse clicks to go from one page to another and the use of the scroll bar while reading.

One disadvantage of the exercise of page hopping and scrolling when using the Web, however, is that it increases reading time and decreases the memorization of information (Oostendrop & Nimwegen, 1998). Studies have shown that excessive non-linearity causes disorientation (Dillon, 1996; McDonald & Stevenson, 1996) and cognitive load (Macedo-Rouet, Rouet, Epstein, & Fayard, 2003) that impairs learning from the Web (Eveland & Dunwoody, 2001). Studies have also established that online readers pay attention to a narrower range of topics compared to those who read print newspapers (Schoenbach, Waal, & Lauf, 2005). Online readers display poorer comprehension of content (Macedo-Rouet et al., 2003) and lower recall of information about public affairs (Tewksbury & Althaus, 2000). This is central to the current study.

Learning from news media

What people learn from exposure to news media is usually measured using a recall test. The news recall test tends to probe the recall of specific facts and news stories (Wicks, 1995) and to measure the content knowledge or factual knowledge of individuals (Eveland, 2002). Previous studies have used free recall (D'Haenens, Jankowski, & Heuvelman, 2004; Eveland, Marton, & Seo, 2004; Tewksbury & Althaus, 2000; Tremayne & Dunwoody, 2001), cued recall (Eveland & Dunwoody, 2001), quizzes (Eveland & Dunwoody, 2002; Eveland et al., 2004), and comprehension tests (Macedo-Rouet et al., 2003) to measure individual knowledge. Studies that compare print and online newspapers (eg: Macedo-Rouet et al., 2003; Tewksbury & Althaus, 2000) found that exposure to the traditional print version of a

newspaper resulted in better news recall than exposure to the online counterpart. Based on the literature, this study suggests the following hypothesis.

Hypothesis 1: Factual knowledge is higher among readers of the traditional print newspaper than among readers of the online newspaper.

Scholars have employed different terms and definitions to examine knowledge. Most agree that the definition of knowledge is not simply the recall or recognition of simple facts. According to Eveland (2002) the recall test only examines individual's content or factual knowledge, and ignores the importance of structural knowledge. Jonassen, Beissner and Yacci (1993) propose three forms of relevant knowledge: (1) 'declarative knowledge' which includes anything that one is aware of, (2) 'procedural knowledge' which refers to the application of declarative knowledge in problem solving, and (3) 'structural knowledge' which denotes the interrelated concepts within a domain. They view structural knowledge as "an intermediate type of knowledge…that mediates the transition of declarative knowledge into procedural knowledge and facilitates the application of procedural knowledge" (Jonassen et al., 1993, p. 4).

Graber (2001) studies political news content and differentiates between two types of information; (1) 'denotative information' which is a simple recording of facts as captured through senses, and (2) 'connotative information' which is produced by making connections between new information and stored information. According to Graber, most studies employed a measure of political knowledge that was focused on people's ability to remember facts and ignored their ability to connect new information with existing information in memory. She further explains that connotation is important because "the ability to reason effectively depends on the ability to make connection among ideas" (Graber, 2001, p. 14).

Eveland and Dunwoody (2001) have drawn a fundamental distinction between factual content knowledge and the structure or organization of knowledge. They propose the

term 'structural isomorphism' to indicate the structural similarities between hypermedia and human cognition. The similarities are explained in terms of the way new media mimics the process of human learning, where "bits of information are organized through their connection with each other" (Eveland & Dunwoody, 2001, p. 55). On the basis of this similarity, they claim that the new media should be superior to the old media in structural knowledge acquisition. Therefore, the current study proposes the following hypothesis:

Hypothesis 2: Structural knowledge is higher among readers of the online newspaper than among readers of the traditional print newspaper.

Method

The study used experimental methods employing two different groups of print and online newspaper readers, but similar procedures and identical source. The medium was manipulated – exposure to either print or online conditions – and its effects were measured on individuals' factual and structural knowledge of current/public affairs.

Material

Australia's national daily newspaper, *The Australian* dated September 11, 2006 – on which the experiment was conducted - was used as reading material for both groups. Participants in the online group were asked to read *The Australian* online retrieved from the address: http://www.theaustralian.news.com.au/. Participants in the print group were given a copy of *The Australian* newspaper for their reading task.

Generally the news reported in the print version of *The Australian* can be found in the online version. However, there were more news stories found in *The Australian* online, particularly due to incoming breaking news that was unavailable in the print version. Like most established news organizations, *The Australian* utilizes the immediacy function of the Web in providing up-to-date information to the audience. The exercise of updating news stories is an important facet of the newspaper. The specialized column and section link called "breaking news" is dedicated for providing

the latest news stories. The updating of news in *The Australian*, however, does not involve rewriting an existing story or changing headlines constantly.

The major stories of the day were the anniversary of the September 11 attack, the war on terror, environmental issues and the Queensland election. The cues for news prominence were evident in the print version - the use of the font size and bold style of the headlines, the location of the news, the inclusion of pictures or images and their visual size. Tewksbury and Althaus (2000) refer to the use of story importance cues in a linear mode in traditional print newspaper and claim that the cues are less apparent in online news media.

Participants

Participants consisted of 48 undergraduate students from Monash University Clayton, Australia. These students were recruited on a voluntary basis. Advertisements were put up on the university's web portal and on noticeboards to attract participants from a large student population. Students were paid in return for their participation. The study obtained ethical clearance prior to conducting the experiment.

The use of a student sample has some advantages. Firstly, a younger audience constitutes "the segment of the population central to the popularity of online news" (Eveland et al., 2004). Secondly, the switch of consumers' behavior to online sources is prevalent among the young audience (Ahlers, 2006). Finally, students are familiar with the Internet (Eveland & Dunwoody, 2001, 2002; Tewksbury & Althaus, 2000) so that any difference between groups is not due to unfamiliarity to the medium.

Participants in both online and print groups used the Internet everyday – an average of seven days a week. The time spent using the Internet in a day for the online group (M = 3 hours, SD = 272.45) was greater than the print group (M = 2 ½ hours, SD = 92.23). The standard deviation for the online group is large because one of the participants reported using the Internet 24 hours in a day. More than two-thirds of the participants were international students and more than half of them were female. The proportions of their status, gender and streams of studies between the two groups were

almost the same. The average age of students participating in the study was 20. For details of the sample used in this study, see Table 1, overleaf.

Table 1: Sample description

Variable	Print Group *Mean (Std. Dev)*	Online Group *Mean (Std. Dev)*
Age	21 (1.34)	20 (1.26)
(t = .973, p = .34)		
Gender		
% Male	39	40
% Female	61	60
Status		
% Local	26	24
% International	74	76
Streams		
%Arts	42	53
%Science	58	47
Days of Web use in past week	6.74 (.689)	6.76 (.523)
(t= -.119, p = .91)		
Time in minutes spent on Web in a day	141.09 (92.23)	181.20 (272.45)
(t= -.671, p = .51)		

Note. Arts stream includes students from Arts, Law, Education, and Business and
 Economics faculties. Science stream includes students from Science, Medicine,
 Engineering, and Information Technology faculties.
*p < .05.

Design and Procedures

The experimental procedures began when students voluntarily signed up for the study. They were then randomly assigned to one of the two conditions: online and print. The random assignment was used as a control technique to ensure that individual participant variables – such as age, gender and status – were distributed randomly across groups. The briefing about the study was given in the form of an explanatory statement sent to all participants before their consent for participation was sought.

On the day of the experiment, those assigned to the print group were directed to a classroom to read the traditional print version of *The Australian* for 30 minutes. Those assigned to the online group were directed to a computer laboratory to read *The Australian* online from its website for 30 minutes. Then a questionnaire was administered to the two groups. The design of this study followed Tewksbury and

Althaus (2000) study except for the duration of the experiment. Tewksbury and Althaus (2000) conducted the experiment over a week period of time to examine the process and effects of news consumption in a cumulative fashion. Due to time and budget constraints, this study only conducted the experiment for one day akin to a study by Eveland et al. (2004). The difference in design between this study and Eveland and colleagues' study is that they examined "linked" online newspapers and "unlinked" online newspapers, instead of the paper and online version of a newspaper. A combination of the two studies (Eveland et al., 2004; Tewksbury & Althaus, 2000) was used for designing the current study.

Measures

There were two measures – factual knowledge and structural knowledge – tested by the questionnaire. Factual knowledge was examined by asking participants to answer ten true/false/don't know quiz questions. The questions were formed using facts reported in some of the news stories found in the front page and national sections of *The Australian* of September 11, 2006. Incorrect responses and don't know answers were scored as zero and correct responses were scored as one. The scores were then averaged and multiplied by 100 to form the percentage of correct responses. This measurement has been commonly used to examine factual knowledge gained from media exposure (Eveland & Dunwoody, 2001; Eveland et al., 2004). The questions are reproduced in Appendix A.

Structural knowledge was examined using a matrix of 10 x 10 concepts. Participants were asked to place a number from '0' for unrelated concepts or '1' to '5' for related concepts ranging from 'very weakly related' to 'very strongly related' in the matrix cell where the two concepts intersected. The use of the 'proximity matrix' was adopted from the work of Eveland, Marton and Seo (2004). The public affairs concepts were culled from the material used in this study. The list of concepts is available in Appendix A.

The work of Eveland et al. (2004) on structural knowledge focused on the measurement of 'density' which refers to "the degree of connectedness of [a

network's] nodes" (Astleitner & Leutner, 1996, p. 292). Eveland et al. applied studies in educational psychology (eg: Miller, Always, & McKinley, 1987; Willoughby, Wood, McDermott, & McLaren, 2000), hypermedia (Astleitner & Leutner, 1996) and social network analysis (Scott, 2000) to come out with the measurement of knowledge structure density. The veracity of individual responses on relationships between concepts, however, was not verified – an important issue addressed in the current study.

In Eveland et al. (2004), the density of knowledge structure was measured in terms of 'the presence and absence of interconnectedness' and 'the strength of interconnectedness of information in memory'. Using an experimental method, they exposed participants to a selection of 25 materials considered to be related to each other. It is important to note here that such a condition was not established in the current study. The whole newspaper – *The Australian* of September 11, 2006 – was used as material for the study. Therefore, there was a broad scope of news reported on that day and news items were not necessarily related to each other. This condition poses a shortcoming for studying density of knowledge structure.

Another shortcoming relates to the method of calculating density. Eveland et al. (2004) computed the values given by participants for each relationship between concepts, but whether or not the concepts were actually interconnected was not verified. Without verifying the accuracy of the answers, the current study found the tendency of calculating values of two 'unrelated concepts'. For example, participants may give a high score for the relationship between the documentary 'an inconvenient truth' – which is about environmental crisis – and terrorist threats, though there is no logical relationship between the two concepts. This study argues on the importance of verifying the accuracy of the answers on the basis that knowledge structure in memory is used for decision making, judgement and problem-solving. The argument stands that forming accurate structural knowledge about a particular issue leads to making correct judgements about the affair.

The current study therefore focused on the accuracy of individuals' responses as to the links between concepts. If a relation between two concepts was false and the answer given was '0', the response was scored as one. If there should be some degree of relation between two concepts and the answer given was between '1' to '5', the response was scored as one also. The responses were scored as zero if unrelated concepts were rated '1' to '5' and related concepts were rated '0'. The scores were then averaged and multiplied by 100 to form the percentage of correct responses. Similar to factual knowledge, the measurement of structural knowledge used a percentage of correct answers.

Results

Hypotheses in this study involved group differences analyses. Figure 1 illustrates the comparison between the mean scores of the two groups. The testing of the two hypotheses involved a statistical test; the independent-samples t-test. For the detailed results of group differences analyses, see Table 2, below.

Table 2: Mean group differences of factual knowledge and structural knowledge

	Print group *Mean (Std. Dev)*	**Online Group** *Mean (Std. Dev)*
Factual Knowledge ($t = 1.06$, $p = .29$)	50 (14.91)	45 (16.10)
Structural Knowledge ($t = .77$, $p = .45$)	66 (12.42)	64 (9.71)

*p < .05.

Hypothesis 1 posited that factual knowledge would be higher among readers of the traditional print newspaper than among readers of the online newspaper. Figure 1 shows that the mean score of factual knowledge for the print group was five points higher than the online group. The result was in the direction of the predicted hypothesis but the difference was very small. The statistical test showed a non-significant result (t = 1.06, p = .29). Therefore, hypothesis 1 was not clearly supported.

Figure 1: Factual Knowledge and Structural Knowledge Means, by Medium
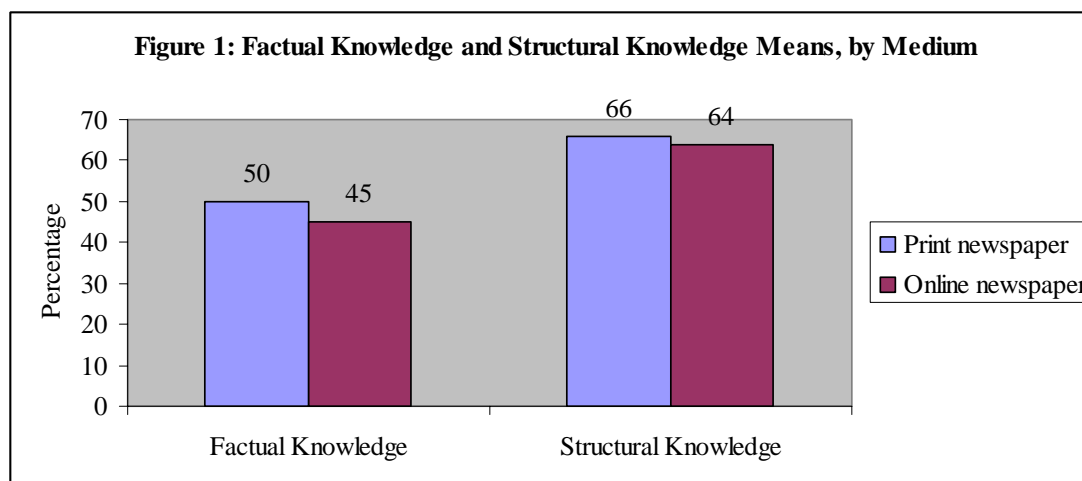
Hypothesis 2 held that structural knowledge would be higher among readers of the online newspaper than among readers of the traditional print newspaper. Figure 1 showed the opposite direction. The mean score of the print group was two points higher than the online group. Although this appears to contradict hypothesis 2, the difference was too small and insignificant to be conclusive (t = .77, p = .45). Thus, there was no support for hypothesis 2.

Discussion

The results of this study showed a lack of support for both hypotheses. Although the first hypothesis was in the correct direction, this study could not claim that the print medium is superior to the online media in fostering newspaper readers' factual knowledge. There was no evidence adduced to claim that the new media facilitates structural knowledge acquisition either. These results imply that medium has no effect on the learning from news. No significant difference in learning across conditions could suggest that the role of the new media as a news medium is almost equal to, if not better than, the established traditional print media.

Time could be an important factor. Previous studies on learning from news showed that using a traditional print newspaper resulted in better recall than using its online counterpart. This study found no significant difference in knowledge acquisition among readers of the print and online newspapers. The finding may suggest an improvement in knowledge acquisition by reading the news online. Perhaps future

research may find better knowledge acquisition among the online newspaper readers than the print newspaper readers. The projection is based on the increasing use of the Internet and online news sources. The trend is expected to continue and it will not be surprising to find people use more of the online news sources than the print media in the future.

Non-significant results have many implications. One possible implication is the 'poor power' in detecting significant difference between groups. This is based on the general assumption that "power is heavily dependent on sample size" (Stevens, 2002, p. 194). The sample size of the study is relatively small if compared to some other experimental studies of similar domain (Eveland & Dunwoody, 2001; Eveland et al., 2004). Those studies, however, reported that the majority of their participants came from specific courses, particularly mass communications and journalism studies. This suggests that those studies used a 'researcher/lecturer and students' relationship' method to recruit a larger number of participants. On the contrary, this study offered voluntarily participation to the Monash university student population at large. Though the number of participants recruited in this study was small, the sample came from a diverse background. One advantage of having a heterogeneous sample is that it resembles the real population.

The issue of small sample leads to a pertinent question of whether the sample size of this study is adequate or not. This study refers to Steven's (2002) rules of thumb in deciding an adequate sample size, that is, 15 cases per predictor. Considering the small size of the sample, this study only examines one predictor – the medium. Due to the limitation of small sample size, the possibility of poor power cannot be ruled out. It suggests that the medium effects on knowledge acquisition may exist but could not be detected due to the poor statistical power. The possibility of poor power in this study can be overcome by recommending future research to replicate the study with a larger sample size and a more representative sample.

Another implication of the findings is the existence of many other possible factors – other than the medium - that affect knowledge acquisition. Studies have shown that

factors such as motivation (eg: Anderson, 1980; Eveland, 2001), attention (eg: Chaffee & Schleuder, 1986), and elaboration (eg: Eveland & Dunwoody, 2002) predict individual learning from news media. Often other factors such as age, education, and access are controlled because they too could exert influence on knowledge acquisition. The various factors established in the literature depicted complex relationships, suggesting not only direct effects but also indirect effects among variables. Future research should extend this study by examining many possible factors to reach a more comprehensive understanding of their effects on knowledge acquisition.

There are also limitations in the method of the study. First, critiques on experimental methods usually pivot around the lack of generalizability to a real world context. This limitation, however, is made up for by the strength of experimental method in establishing causality – the cause and effect relationship (Gravetter & Forzano, 2006). As this study aims to find the effects of medium on knowledge acquisition, the choice of using experimental method apparently suits its purpose. Second, the measurement of knowledge structure in this study considered the accuracy of responses instead of knowledge density. The degree of interconnectedness of information in memory was not measured, as the problems of implementing the measure in the context of this study prevailed (refer to page 12 for the discussion about the problems). Nevertheless, this study suggests that the practice of verifying the veracity of responses should not prevent future research from employing the density measure, but should contribute towards refining the measurement of knowledge structure.

In sum, the results of the study are far from conclusive. It only examined a simple and direct effect relationship between medium and knowledge. Clearly, there is a need for more research that empirically examines the influence of the news medium factors – such as news organisation, immediacy and hyperlinks, as well as the individual factors – such as motivation, selective scanning and information processing – on knowledge acquisition of current/public affairs. However, the possibility for this simple study to produce a valid result prevails. It could be true that there is no difference in knowledge acquisition between reading the news from traditional print

and online media. Future research should strive not only to validate or disapprove this finding, but also identify the reasons behind it.

References

Ahlers, D. (2006). News Consumption and the New Electronic Media. *The Harvard International Journal of Press/politics, 11*(1), 29-52.

Anderson, J. R. (1980). *Cognitive psychology and its applications*. San Francisco: Freeman.

Astleitner, H., & Leutner, D. (1996). Applying standard network analysis to hypermedia systems: Implications for learning. *Journal of Educational Computing Research, 14*(3), 285-303.

Burgoon, K. J., Ramirez, A., Dunbar, E. N., Kam, K., & Fischer, J. (2002). Testing the interactivity principle: Effects of mediation, propinquity and verbal and nonveral modalities in interpersonal interaction. *Journal of Communication, 52*(3), 33-56.

Chaffee, H. S., & Schleuder, J. (1986). Measurement and effects of attention to media news. *Human Communication Research, 13*(1), 76-107.

Chaudhri, V. (1998). Pricing and efficiency of a circulation industry: The case of newspapers *Information Economics and Policy, 10*, 59-76.

D'Haenens, L., Jankowski, N., & Heuvelman, A. (2004). News in Online and Print Newspapers: Differences in Reader Consumption and Recall. *New Media & Society, 6*(3), 363-382.

Dillon, A. (1996). Myths, misconceptions, and an alternative perspective on information usage and the electronic medium. In J. Rouet, J. J. Levonen, A. Dillon & R. J. Spiro (Eds.), *Hypertext and Cognition* (pp. 25-42). Hillside, NJ: Lawrence Erlbaum Associates.

Eveland, W. P., Jr. (2001). The cognitive mediation model of learning from the news: Evidence from nonelection, off-year election, and presidential election contexts. *Communication Research, 28*(5), 571.

Eveland, W. P., Jr. (2002). News information processing as mediator of the relationship between motivations and political knowledge. *Journalism and Mass Communication Quarterly, 79*(1), 26.

Eveland, W. P., Jr., & Dunwoody, S. (2001). User Control and Structural Isomorphism or Disorientation and Cognitive Load?: Learning From the Web Versus Print. *Communication Research, 28*(1), 48-78.

Eveland, W. P., Jr., & Dunwoody, S. (2002). An investigation of elaboration and selective scanning as mediators of learning from the Web versus print. *Journal of Broadcasting & Electronic Media, 46*(1), 34.

Eveland, W. P., Jr., Marton, K., & Seo, M. (2004). Moving beyond "Just the Facts": The influence of online news on the content and structure of public affairs knowledge. *Communication Research, 31*(1), 82-108.

Graber, D. A. (2001). *Processing politics: Learning from television in the Internet age*. Chicago: University of Chicago Press.

Gravetter, F. J., & Forzano, L.-A. B. (2006). *Research methods for the behavioral sciences* (2nd ed.). Australia: Thomson/Wadsworth.

Heeter, C. (2000). Interactivity in the context of designed experiences. *Journal of Interactive Advertising, 1*(1).

Holmes, D. (2005). *Communication theory: media , technology, society*. London: Sage.

Johnson, J. G., Bruner II, C. G., & Kumar, A. (2006). Interactivity and its facets revisited: Theory and empirical test. *Journal of Advertising, 35*(4), 35-52.

Jonassen, D. H., Beissner, K., & Yacci, M. (1993). *Structural knowledge: Technique for presenting, conveying, and acquiring structural knowledge* Hillsdale, NJ: Erlbaum.

Macedo-Rouet, M., Rouet, J.-F., Epstein, I., & Fayard, P. (2003). Effects on online reading on popular science comprehension. *Science Communication, 25*(2), 99.

McDonald, S., & Stevenson, R. I. (1996). Disorientation in hypertext: The effects of three text structures on navigation performance *Applied Ergonomics, 27*(1), 61-68.

Miller, C. D., Always, M., & McKinley, D. L. (1987). Effects of learning styles and strategies on academic success. *Journal of College Student Personnel, 28*, 399-404.

Neuman, R. (1991). *The future of mass audience*. Cambridge: Cambridge University Press.

Newhagen, R., & Rafaeli, S. (1996). Why communication researchers should study the internet: A dialogue. *Journal of Communication 46*(winter), 4-13.

Online Publishers Association. (2004). Multi-channels media bands: Attitudinal and usage study.   Retrieved January 15, 2007, from www.online-publishers.org

Oostendrop, V. H., & Nimwegen, V. C. (1998). Locating information in an online newspaper [Electronic Version]. *Journal of Computer Mediated Communication*, *14*. Retrieved March 5, 2002 from http://www.ascusc.org/jcmc/vol14/issue1/oostendrop.html.

Peng, F. Y., Tham, N. I., & Xiaoming, H. (1999). Trends in online newspaper: a look at the US Web. [Electronic Version]. *Newspaper Research Journal*, *20*. Retrieved 28th April 2003 from http://web15.epnet.com/delivery.asp.

Pew Research Center for the People and Press. (2006). Maturing internet news audience broader than deep: Online papers modestly boost newspaper readership. Retrieved May 15, 2007, from http://www.people-press.org

Rafaeli, S. (1988). Interactivity: From new media to communication. In R. P. Hawkins, J. M. Wiemann & S. Pingree (Eds.), *Advancing communication science: Merging mass and interpersonal process*. Newbury Park , CA: Sage.

Rogers, M. E. (1986). *Communication technology: The new media in society*. New York: Free Press.

Schoenbach, K., Waal, D. E., & Lauf, E. (2005). Research note: Online and print newspapers: Their impact on the extent of the perceived public agenda. *European Journal of Communication, 20*(2), 245-258.

Scott, J. (2000). *Social network analysis* (2nd ed.). London: Sage.

Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication, 42*(Autumn), 73-93.

Stevens, P. J. (2002). *Applied multivariate statistics for the social sciences* (4 ed.). London: Lawrence Erlbaum Associates.

Stovall, J. G. (2004). *Web journalism : practice and promise of a new medium*. Boston, MA: Allyn and Bacon.

Straubhaar, J., & LaRose, R. (2002). *Media now: Communications media in the information age* (3rd ed.). Belmont: Wadsworth Thomsom Learning.

Tewksbury, D., & Althaus, S. (2000). Differences in knowledge acquisition among readers of the paper and online versions of a national newspaper. *Journalism and Mass Communication Quarterly, 77*(3), 457.

Tremayne, M., & Dunwoody, S. (2001). Interactivity, information processing, and learning on the World Wide Web. *Science Communication, 23*(2), 111.

Wicks, R. H. (1995). Remembering the news: effects of medium and message discrepancy on news recall over time. *Journalism and Mass Communication Quarterly, 72*(3).

Williams, F., Rice, E. R., & Rogers, M. E. (1988). *Research methods and the new media*. New York: Free Press.

Willoughby, T., Wood, E., McDermott, C., & McLaren, J. (2000). Enhancing learning through strategy instruction and group interaction: Is active generation of elaborations critical? *Applied Cognitive Psychology, 14*, 19-30.

Yell, S. (2007). Theorizing text as practice in the new media age. *New Zealand Journal of Media Studies, 10*(1), 14-23.

Appendix A

For the factual knowledge quiz, the instruction read: *Please answer "yes" for facts that you recalled as correct and "no" for facts that are incorrect*. The questions were:

1. The September 11 attack occurred in 2001
2. The opposition party (Labor) won the Queensland election over the coalition party
3. John Howard called for moderate Muslim to be more critical of terrorism
4. Australia is facing water shortages and cyclones caused by global warming
5. Steve Irwin died after he was pierced in the heart by a crocodile
6. Australia supports Kyoto protocol and has signed the treaty
7. Peter Brock who died in a car crash was famous for Australian Football (footy).
8. In Queensland, a Sri Lankan doctor was banned from practicing after receiving allegations of sexual misconduct
9. Hakim Taniwal, an afghan provincial governor who spent five years in exile in Australia was killed in car accident
10. Smacking children has been legally banned in Australia

For structural knowledge, the instruction read: *Please fill in each column of the 10 x 10 matrix with the following numbers (0 = unrelated concepts, 1 = very weakly related concepts, 2 = weakly related concept, 3 = moderately related concepts, 4 = closely related concepts and 5 = very closely related concepts) to indicate relations between the concepts.* The concepts are: (1) Global warming, (2) Climate Change, (3) Industrial Relation Reforms, (4) Political Campaign, (5) Documentary of Inconvenient Truth, (6) Interest rate, (7) Petrol Price, (8) Terrorist Threat, (9) Insecurity, (10) Kyoto Protocol.