

Transactive Memory and the Internet: Implications for Pedagogy

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I. Introduction

The availability of the Internet and access to instant information impacts the way memories are formed and how learning occurs. As a result, teaching pedagogies, learning activities, and assessment methods will also change. The following literature review has three purposes; to examine the ways in which memory and learning are changing, to explore the benefits and drawbacks of forming transactive memories with the Internet, and to discuss implications of forming transactive memory with the Internet on education.

II. An examination of the ways in which memory and learning are changing

Transactive memory is the phenomena in which certain memory tasks are delegated to outside sources, traditionally, to other people or groups of people (Wegner, D.M., Ward, A.F., 2013). This structure of memory allows the immediate benefits of enlarging the overall memory capacity of a group of transactive partners, as well as freeing mental faculties to allow for deeper learning, broader understanding, and more robust knowledge in some areas, while relegating the duty for creating such knowledge to others in other areas. With the advent of the Internet, the choice of transactive memory partners is shifting. Now, for the first time, humans have been afforded a limitless store for information, knowledge, and concepts, accessible at the click of a mouse or the touch of a finger.

In 2008, Nicholas Carr noted that the way his own thinking operated had changed with the increased use of the Internet in recent years. He described how difficult it was to focus on longer texts and that he was constantly "...dragging my wayward brain back to the text." He goes on to note that the immediate and easy access the Internet provides us means the way we read has changed. We no longer deeply engage with a text, we simply scan it. Two concerns arise out of this new way of reading; first, will this reduced ability to engage with long texts mean the loss of written cultural gems? And second, with deep reading comes deep processing and understanding; does allowing the computer to do the work for us ultimately mean our intelligence will become artificial, residing within a computer rather than within our minds?

Studies are now beginning to emerge which aim to identify and analyze the ways in which human memory formation and retrieval are changing with the prominence and accessibility of the Internet and all that it holds. Sparrow, Liu, and Wegner (2011) discuss four such experiments. The first experiment involved pairing a Stroop task with answering trivia questions. Participants were asked trivia questions ranging in difficulty, and then asked to perform a Stroop task; a task where typed words are presented and the participant is to name the color of the font, not the word itself. This study found that following difficult trivia, participants had slower response times in the Stroop task for words related to the Internet. This shows that attention was fixed on the term itself, rather than the color of the font, suggesting that participants were thinking about the Internet as a means to answer the difficult trivia. Wegner and Ward (2013) discuss the same experiment but add to the discussion the variable of self-ratings of cognitive self-esteem. In this condition, participants were asked to rate statements such as "I am smart" or "I am good at remembering things". When the Internet was available to assist in answering questions, people tended to rate themselves higher in these statements. That is, people feel smarter, and more confident in their knowledge, knowing that Google is available. As a control, one internet-less group was given false positives on their responses to the

trivia questions to level the scores with those accessing Google. Even with equal “correct” responses, those with access to Google still rated themselves as smarter or having better memory than those without access. This presents the possibility that people are beginning to consider the Internet not as a tool, but as an extension of themselves. The second study had participants copy factoids into a computer. Half of the sample was told the information entered would be saved, and the other half were told it would not be saved. Participants who believed the information they entered would not be saved, had better recall of the information. This suggests that the computer was being utilized as an external memory store. There is little point in laboriously committing a factoid to organic memory, when it can simply be recalled from an external store as needed. The third experiment was similar to the second, but for each fact entered the computer responded with either “saved”, “saved to x location”, or “erased”. Findings indicated memory was best for items believed to have been erased and participants often had a sense of approximate location of factoids. The final study discussed by Sparrow, Liu, and Wegner (2011) again had participants entering trivia statements into a computer. In this case, the computer would indicate where an item was saved. It was found that ability to recall the trivia itself was weaker than the ability to identify where the item had been saved.

Ferguson, McLean, and Risko, (2015) wondered how access to the Internet impacted a person’s willingness to offer answers to trivia questions. In two test conditions, Internet access or no Internet access, participants were asked trivia questions. Following each question, participants were asked to respond with “I know” or “I don’t know”. In both conditions, if participants answered, “I know”, they then gave their answer. In the Internet access condition, following a response of “I don’t know”, participants looked up the answer and then provided it. Results showed a couple of interesting patterns. First, participants in the no access condition offered more answers and more correct answers than in the access condition. In addition, in the access condition, participants were faster to decide whether they knew the answer or not, but would respond, “I don’t know” more often than the no access condition. These results could be effect of two factors, and, in fact, subsequent conditions confirmed both factors. First, access to the Internet decreases feelings-of-knowing, that is, the Internet knows more than an individual person, so he is less likely to say, “I know” when in comparison with the Internet. And second, report criteria increases with access to the internet, that is, one requires more evidence to be able to confidently say, “I know” when access to the Internet is available. Regardless of the underlying mechanisms, access to the Internet appears to decrease a person’s willingness to offer information without looking it up first. Not only have memory formation and access changed with the introduction of the Internet, but also the way humans interact with their own memory structures. It has been shown that a) focus and attention have shifted away from the ability to read long texts, b) people turn to the internet readily to find out unknown information, c) access to the Internet makes people believe they are smarter and more capable of providing information, d) information is less likely to be stored if it is believed that later access will be available, e) people tend to remember the location of information, rather than the information itself, and f) people are more willing to answer knowledge questions in the absence of the Internet. This leads to the question; Are these observed changes in memory negative, positive, neutral, or some combination?

III. An exploration of benefits and drawbacks of forming transactive memories with the internet

There is a tendency, when analyzing the impacts of technology on brain functions, to cast changes in a negative light. However, the advent of the Internet has, in fact, proven to be very beneficial for several stakeholders affected. Robert Clowes (2013) acknowledges that the way memory functions has changed, but he sees this as a progressive and positive change, advantageous to those utilizing electronic memory (E-Memory). He highlights implications for those suffering from memory deficiencies, but also the possibility for those with fully functioning memories. He hypothesizes that E-memory can be incorporated into traditional, organic memory (O-Memory) and act to extend the mind, or create a hybrid mind. Four factors affect the extent to which E-Memory and O-Memory will be merged. The first identified factor is totality. Totality is the idea that an external, electronic device is far superior to organic memory in storing complete and accurate memories. So long as it is easier to Google a piece of information than to recall it from one's organic memory, the E-Memory will be favored. E-Memory can be used to support O-Memory by ensuring complete and accurate recall. The second factor is practical cognitive incorporability. If the technology is easily called into action, if one uses E-Memory without considering it as a tool, and if the interface is transparent, the technology may become an integral component of memory. Third, is the factor of autonomy. In order for E-Memory to be as valuable as O-Memory, it must be able to manipulate stored memories. It is not enough to simply recall information at the right time, memory also needs to be able to restructure memory to adapt to novel requirements, and it needs to be able to do this independently and complementary to O-Memory. Interestingly enough, autonomy and totality seem to suffer some conflict with each other's principles. The fourth factor is entanglement. This factor addresses the fact that memories are not created in isolation, but rather through the interactions of individuals and groups. Memories formed within a group will be stored in many forms, creating many memory traces that will potentially be used for a variety of purposes. Social media is an example of this occurring presently. Clowes posits that if these factors are fulfilled, and if the form is complementary to O-Memory, E-Memory will come to be utilized more and more. The fear is that electronic memory is coming to replace organic memory, thus reducing the capacity of the human mind. However, it could just as easily be that E-Memory is not going to replace O-Memory, but augment, extend, and complement it. Perhaps relegating simple storage and recall tasks to an external store, opens the mind for more advanced cognitive processes; and will see humanity leap forward, not back.

The publication, *Strategic Direction*, discusses how Google, in recent years, has become the go-to search engine globally (2014). Traditionally, Google's role was simply to respond to a query with a list of possible links to access to find the desired information. That was before the Google Knowledge Graph was rolled out in 2012. The addition of this feature means that Google now provides answers directly on the search results page, making further searching unnecessary. This presents a couple of concerns. First, it puts Google in control of the knowledge disseminated as the subjective editor of that knowledge, and second, it stymies critical thinking by feeding information to the user, rather than guiding the user towards the sought after information. Vang (2013) also points to these concerns. Google is very trusted, but why? It is a commercial, American based company. Not only does Google decide what we see, it also decides what we do

not see. It is of the utmost importance that critical thinking is taught and utilized in using Google. If Google is to play the role of E-Memory, users need to be able to assess the reliability and validity of the information provided. This will need to be explicitly taught in schools in order to avoid a blinded “Google” generation.

Larry Sanger (2010) moves away from direct issues with the Internet itself, and towards what the changes brought about by the Internet mean for traditional education. He illustrates three bodies of concerns. First, is unnecessary memorization. With the ease of access to information, less emphasis is put on the importance of memorizing information, but one cannot be said to know something if it is not remembered. Googling does not replace critical inquiry; from developing core knowledge, to knowing where to go next. Second, is outmoded individual learning. The internet is used to promote collaboration, but at the cost of individual learning. Individual and social learning each have their place in education. One writes a paper independently, then turns it over for peer editing. One reads and considers a selection independently, then discusses it collaboratively. Which leads to the third concern; the loss of “boring old books”. Sanger argues that tidbits online cannot replace what it is to read deep and meaningful texts by a single author. He suggests that deep-readers are deep-thinkers and that if that practice is allowed to fall away, it will be at the cost of deep-thinking adults.

IV. Discussion

The arrival of the Internet has been a catalyst of change in the way human memory operates and in how we interact with technology. The addition of mobile technology amplifies this effect. There are four criteria necessary for external extension of the mind (Clowes, R.W., 2013); constancy, facility, trust, and prior endorsement. Constancy and facility require that the tool and information can be accessed with great ease and great speed. Constancy also considers the frequency of consulting the device important; the agent does not often act without consulting the device. Trust and prior endorsement mean that not only is the information provided by the device trusted as reliable and valid by the user, but the fact that it has been trusted in the past means it will be trusted again in the future. Mobile technology, especially smart phones, are meeting this criteria already, or very nearly so. How can the relationship between how access to the internet affects learning and memory be reconciled with the idea that technology will ultimately become part of the extended mind?

By revisiting the main points of Section II, it is possible to examine the relationship. Point a) focus and attention have shifted away from the ability to read long texts; in order to avoid the loss of these long, deep texts, personal technology needs to be added into the equation. For example, an e-text version of a book, that is voiced to the user and complemented by various links in the document. The user can navigate the text and the links to construct that deep meaning traditionally formed through engagement with text alone. Point b) people turn to the internet readily to find out unknown information; in this case, it is important that users are critical thinkers. People need to know that Google isn’t necessarily a trustworthy source. It is also critical that core knowledge in subject areas is still taught. What good are factoids if the user cannot connect them in some meaningful way? Point c) access to the Internet makes people believe they are smarter and more capable of providing information; allow this to be the case. If we have constancy, facility, trust, and prior

endorsement with mobile technology, allow it to provide the benefit of boosting the user's confidence. Point d) information is less likely to be stored if it is believed that later access will be available; again, if technology is to be recognized as an extension of the mind, allow it to be a vast store. As Clowes (2013) suggests, perhaps utilizing external storage can open up space for higher level cognitive processes. Point e) people tend to remember the location of information, rather than the information itself; this shift will need to be addressed in pedagogy. For example, learners will need to create cognitive maps, allowing various access points to locate the desired information. And point f) people are more willing to answer knowledge questions in the absence of the Internet; this is an indication of the newness of this technology. Critical thinking will help to supplant the need to look up every piece of information, as will encouraging deeper processing to ensure information accessed is meaningful and does not exist in isolation.

V. Conclusions and Implications

Technology is here to stay. We will see technology becoming more prevalent, more discreet, more easily accessed, and more easily trusted in the very near future. Education and pedagogy will need to reflect this reality very soon, as this reality is already here. This means acknowledging the fact that our society is currently undergoing a shift in the way people remember and learn. Old techniques will have to be adapted into technologically favorable ones; such as revamping the way information is presented in textbooks and the formatting of novels. In order to maintain the cognitive growth that comes with engaging with deep texts, the texts themselves will have to be modified to reflect the new ways of thinking, learning, and remembering. Perhaps texts and books will be provided in an interactive e-format, or perhaps technology will be incorporated into the more traditional book layout.

A second consideration, and we already see this being emphasized in education today, is critical thinking. Children need to learn from a young age not to automatically trust the validity and reliability of information accessed on the Internet. The process of evaluating the credibility of information needs to be pressed to the point of automaticity. Especially where trust and prior endorsement tend to reinforce each other, one needs to be certain that trust and prior endorsement are legitimate, and not blind. The readily accessible nature of information does not supplant the ability to critically think

In addition, students will need support in creating functional "mind maps" to address the idea that location is better recalled than information. If this is the case, students still need to be able to access information locations based on a wide variety of stimuli. Multiple access points need to be mapped to be able to recall information readily and efficiently. This might look something like the distributed memory theory of information processing, but for location rather than information.

Finally, it needs to be acknowledged that the Internet is a tool, a complement to human cognition and memory, not a replacement for it. Technology of this pervasive nature needs to be embraced to ensure appropriate use to the benefit of human beings. Technology, including the Internet and smart phones, only exist because humans desired it. Now, this desire has been fulfilled, but with this fulfillment comes the responsibility to teach our youth how to utilize this tool to advance their own cognition, heighten their understanding, and enhance their experience within society.

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