On retrieving information from external knowledge stores: Feeling-of-findability, feeling-of-knowing and Internet search

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ABSTRACT

The ease with which individuals can access information has changed drastically with the advent of the Internet. Understanding how this change in our information landscape influences thinking represents an important question for psychological science. Research has demonstrated that we have a fairly accurate sense of the relative availability of internal information − a feeling-of-knowing. Here we examine the extent to which individuals have developed a sense of the relative availability of information stored on the Internet (i.e., externally) − a feeling-of-findability. Results demonstrate that when individuals do not know the answer to a question their feeling-of-findability accurately predicts the amount of time it takes them to locate the answer on the Internet. Furthermore, this feeling-of-findability, when individuals do not know the answer to a question, is unrelated to individuals' feeling-of-knowing, despite the fact that the latter is also demonstrated to predict search times. Instead, feeling-of-findability appears to be predicted by intuitions about how difficult it will be to generate a successful search query and the popularity of the type of information sought.

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1. Introduction

The Internet has profoundly altered our ability to access information. Understanding how this access might influence our thinking and how we think with this external knowledge represent important questions for psychological scientists and society more generally (e.g., Carr, 2011; Ferguson, McLean, & Risko, 2015; Fisher, Goddu, & Keil, 2015; Sparrow, Liu, & Wegner, 2011; Ward, 2013; Wegner & Ward, 2013). One means of thinking about the interaction between humans and the Internet is to view them as forming a kind of transactive memory system (Ferguson et al., 2015; Fisher et al., 2015; Sparrow et al., 2011; Ward, 2013; Wegner & Ward, 2013). Traditionally, a transactive memory system represents a memory system composed of two or more individuals that collectively encode, store, and retrieve knowledge, analogous to what we might form with a long-term partner, small team, or within an organization (e.g., Hollingshead, 1998; Hollingshead & Brandon, 2003; Peltokorpi, 2008; Wegner, 1986, 1995). In extending the concept of a transactive memory system to aid in understanding the informational relationship between humans and the Internet, the latter takes the place of another individual (or group of individuals). In a transactive memory system the cognitive burden associated with the encoding, storage and retrieval of information is distributed as opposed to being carried by a single person. This necessitates the development of knowledge that supports access to the externally located information within that system (e.g., individuals learn "who knows what"). In the present investigation we examine the nature of an analogous form of knowledge in the context of individuals' interaction with the Internet, specifically, knowing how accessible a given piece of information is externally.

1.1. A feeling-of-findability?

One type of knowledge (or feeling) that could emerge from and be useful within a human-Internet transactive memory system is a sense of the relative accessibility of information located on the Internet − a feeling-of-findability.[1] For example, when an individual lacks some relevant information, knowledge about how easily that information can be obtained from the transactive memory

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[1] In the context of Web Search, the term "findability" refers to the quality of being locatable or navigable (Morville, 2005).

partner (i.e., the Internet) might inform decisions about whether or how to engage in an external search. A similar phenomenon exists in the form of metacognitions (i.e., our thinking about our own thinking) about our internal states of knowing. It has long been known that individuals have a relatively accurate feeling-of-knowing (Hart, 1965; Koriat & Levy-Sadot, 2001; Koriat, 1993; Nelson & Narens, 1990; Reder, 1987). For example, when individuals respond that they "don't know" an answer to a question and are then asked to rate their feeling-of-knowing (e.g., how likely do you think that you will be able to remember the answer at a later point in time?), that rating predicts the likelihood that they are able to retrieve that information at a later point in time (Hart, 1965; Nelson & Narens, 1990). Thus, we have a sense of the relative accessibility of information located in our internal/biological memory. Here we examine whether we have an accurate sense of the relative availability of information located on the Internet (i.e., a feeling-of-findability).

1.2. Previous research

A related line of inquiry has examined the perception of search task difficulty (Kim, 2006; Liu, 2015; Liu, Kim, & Creel, 2015). To date much of this work has focused on properties of a given task that lead to different perceptions of difficulty. For example, Liu et al. (2015) identified a number of reasons (self-reported by participants) that influenced ratings of search task difficulty including the specificity of the required information and uncertainty about the information needed amongst other reasons (see also Kim, 2006). The focus on different search tasks has led to research that has investigated a small number of instances (typically 1) across a broad range of different tasks (e.g., graduate school information, creation of a Wikipedia entry; Liu et al. 2015; finding the name of a restaurant, finding information about lead paint and housing; Kim, 2006). The feeling-of-findability, as construed here, refers instead to an individuals' perception of how accessible (or difficult to find) a specific piece of information might be. Thus, the "task" (i.e., fact-retrieval) remains constant and what we are interested in is how participants' feeling-of-findability varies across numerous instances of this task (i.e., different pieces of information) and how these ratings are related to other measures of interest (e.g., actual search time). In this sense, an accurate feeling-of-findability refers to an accurate sense of the accessibility of a given piece of information (e.g., "In what park is 'old faithful' located?" vs. "What is the last name of the author who wrote 'The Old Man and the Sea'?"), rather than an accurate sense of how difficult a given search task will be relative to other tasks (e.g., fact retrieval vs. open ended information search).

1.3. Present investigation

In the reported studies we adapted a standard paradigm for investigating feeling-of-knowing (Koriat & Goldsmith, 1996; Nelson & Narens, 1980) in order to examine the feeling-of-findability. Individuals answered general knowledge questions that had one-word answers (e.g., "What is the capital of France?"). If participants knew the answer to the question, then they provided it and if not, then they responded, "don't know." In Study 1a and 1b, after providing their know/don't know response, individuals estimated how quickly they could retrieve the answer using the Internet (i.e., make a feeling-of-findability judgement). Individuals later searched the Internet for the answers to the previously seen questions. If individuals have an accurate sense of the relative availability of information stored on the Internet, then their feeling-of-findability judgements following a "don't know" response should predict the time it takes them to locate that information

online. The results of Study 1 provide strong evidence for the existence of an accurate feeling-of-findability. In Study 2 we sought converging evidence for the results of Study 1 using a more conservative between-item design (see Singer & Tiede, 2008). Furthermore, we tested the hypothesis that when individuals' don't know the answer to a question their feeling-of-findability is derived, at least in part, from individuals' internal feeling-of-knowing. Finally, in Experiment 3 we examined a number of other potential predictors of an individual's feeling-of-findability related to intuitions regarding the relation between the information sought and the Internet (e.g., how difficult it would be to form a search query for that information, how many other individuals look up similar information).

2. Study 1a and 1b

2.1. Materials and method

Study 1a and 1b are largely identical barring some minor methodological changes and different samples (i.e., in-lab vs. online). We report both to demonstrate that the main results are replicable.

2.1.1. Participants

Thirty undergraduates from the University of Waterloo ($N = 30$) were recruited for Study 1a. The goal was to collect approximately 32 participants before our data collection period ended based on achieving approximately 0.80 power to detect a medium sized effect (g*power; Erdfelder, Faul, & Buchner, 1996). Forty-eight adults were recruited for Study 1b from Amazon's Mechanical Turk ($N = 48$).

2.1.2. Stimuli

General knowledge questions were drawn from Tauber, Dunlosky, Rawson, Rhodes, and Sitzman (2013) and ranged in normed probability of recall (i.e., the overall likelihood that participants correctly answered the question from Tauber et al., 2013). Specifically, the Tauber et al. (2013) sample was split into thirds based on probability of recall, then 15 questions were randomly drawn from each third to make two lists of 45 questions. All were fact based and required single word answers. All of the correct answers to the questions were available online. Using data from previous research with these lists, we selected the 60 questions that received the most "don't know" responses for use in Study 1a and 1b. Examples of questions include: "In what park is 'old faithful' located?" and "What is the last name of the author who wrote 'The Old Man and the Sea'?"

2.1.3. Procedure

Study 1a consisted of two parts. In the first part of the study participants were presented with a general knowledge question and asked to respond with "I know" or "I don't know." Following this response, participants made a feeling-of-findability judgment on a 9-point likert scale that required them to estimate how quickly they could retrieve the answer to the question using the Internet (1 = I would find it almost instantly; 9 = I would find it in a few minutes). Then, if they indicated that they knew the answer, they immediately entered it on the test computer. If they responded with "I don't know", they entered "NA" instead. In the second phase, participants were randomly presented with the same set of questions. Upon reading a question, participants pressed a "start search" button on the test computer to mark the beginning of their search. They then used a different computer to search the Internet for the answer (browser history on the search computer was cleared before each session). Once they found the answer online,