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Commentary

The Individual Mind in the Active Construction of its Digital Niche

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In the target article (Marsh & Rajaram, 2019), Elizabeth Marsh and Suparna Rajaram masterfully weave together the specific characteristics of the online information flow and the specific characteristics of human information processing to shed light on the question of how the Internet changes cognition. They make acute observations of ten important properties of the Internet concerning how and what information is dispersed, properties that may not be unique to the Internet but are amplified in the digital age. Then, taking the perspective of cognitive sciences and consulting research findings from the laboratory, Marsh and Rajaram provide insights into how these properties may have consequences for human memory and cognition. Given the prevalence of the Internet in everyone's everyday life in contemporary societies, it would be shortsighted for any student of mind and memory to ignore the pervasive impact of Internet usage. Marsh and Rajaram's article is therefore a must-read for memory and cognitive researchers who plan to venture into the digital world.

The target article focuses primarily on searching and processing public information online, and briefly touches upon autobiographical memory, namely, memory for information concerning the self and personal experiences (Marsh & Rajaram, 2019). Importantly, the type of information (public vs. personal) and the role individuals play (producer vs. consumer) in information processing may result in different cognitive and mnemonic consequences when individuals engage with the Internet. For interested readers, these issues are discussed in depth in Stone and Wang (2018) through the lens of induced forgetting and false memories, and in Wang and Aydin (2018) in the context of examining the influence of social media as a cultural force on personal and collective remembering. In addition, Wang (2013) made an extensive analysis of the impact of social media (including blogging and microblogging) on the construction of autobiographical memory and the autobiographical self in the digital age. Given the limited space for a commentary, I will not reiterate the points made in those works. Instead, I will focus on the active role of the individual in navigating in and negotiating with the cyberspace.

The role of the individual is alluded to in Marsh and Rajaram's (2019) discussion of some of the properties of the Internet, such as that search is required to find information, anyone can be an author to contribute information, and it is easy to share and receive information with others online. I would like to extend this further and emphasize that the interaction between individuals and the Internet is a dynamic process that entails not just what individuals *need* to do and *can* do, but also what they *want* to do, or their personal agency. I argue that in the face of the overwhelming sea of information online—much of which may be false (Lazer, Baum, Benkler, et al., 2018)—individuals are not completely passive, helpless, and powerless beings waiting to be absorbed. To a considerable extent, individuals can make their own choices in every aspect of their online behavior.

What to Search

As Marsh and Rajaram (2019) point out, consumers of information need to enter search terms and click on links in order to find information they need. The search terms individuals

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choose to use and the links in the search output they choose to click on, however, are not random but often reflect individuals' personal preferences, prior knowledge, and purpose of search. More important, such personal choices and preferences in online search create a user's unique search history, which then leads to a customization of search engine results, namely, *personalized search*. In other words, search results are customized based on individuals' choices and search history. Google, for instance, takes into account a user's search history in the past 180 days to customize search results. This gives rise to an information loop between a user's interests and preferences and the search results that feed on those interests and preferences. As a result, personalized search creates a digital niche unique to each individual. Personal choices and preferences thus greatly reduce the amount and scope of information that individuals are exposed to.

Who to Trust

The seemingly indefinite information online and the anonymity of many of the information sources intensify the uncertainty about the truthfulness of the information. As a result, individuals often tune into sources that are familiar to them and sources that tell them what they want to hear (Lazer et al., 2018). They frequent Internet sites that meet their personal interests and align with their ideologies (Posta, Shi, & Macy, 2015). In the process of information dissemination in our digital age, the power of selectivity is no longer only in the hand of the information producer; much of it rests in the personal choice of the information consumer. This, in turn, has important consequences for memory and cognition. For instance, in a study by Wang and colleagues (Wang et al., 2009), middle-aged adults from the U.S., England, Germany, Turkey, and China were asked to recall public news events that took place in any period of their lives. The memories participants recalled did not correspond with the news coverage in their countries. For example, "disaster" accounts for 2.3% of global news coverage (1.4% U.S., 4.7% Germany, 1.0% China; Shoemaker & Cohen, 2006). Yet it was the most frequent memory topic in the study, accounting for 16.3% of memories across the sample (10.9% U.S., 15.0% Germany, 29.3% China). Foreign events recalled by non-U.S. participants were disproportionately about the U.S. (UK: 54.8%, Germany: 61.4%, Turkey: 53.2%, China: 75.2%), which greatly exceeded the percentage of U.S.-related media coverage in these countries (approximately 17.7%; Wu, 2000). These results suggest that, rather than media coverage alone, individuals' selective information processing—what news information they frequently tune in, ponder on, and share with others—is critical in determining memory (Wang & Aydin, 2018).

What to Believe

Individuals can choose not only which information source or news media to attend to, but also what information to believe. The common existence of *my-side bias*, in which people process information in ways that are partial to their prior beliefs and attitudes (Stanovich, West, & Toplak, 2013; Taber & Lodge, 2006), is amplified in the digital age. With the vast availability of news media on the Internet, individuals have the freedom to seek out information to defend their positions and find excuses to refute information they disagree with (Lazer et al., 2018). Ideological beliefs and attitudes further influence how individuals perceive and interpret information. For instance, people's beliefs about global warming shape their perceptions of temperatures (Howe & Leiserowitz, 2013). When asked about the summer of 2010, global warming skeptics were significantly less likely than believers to consider the unusually hot summer as abnormal, even when controlling for demographics and local climate conditions. Thus, information processing entails not just a cognitive process but also a motivated one. Under the spell of motivational and cognitive biases, individuals digest online information in line with their prior beliefs, which can further lead to attitude polarization (Taber & Lodge, 2006).

Whether to Share

Individuals can decide whether and how much they want to produce or share information on the Internet. For instance, more than half of Twitter users never post a message, whereas the top 10% most active users contribute to over 90% of all content (Kaplan & Haenlein, 2011). Similarly, at the largest Chinese microblogging site Weibo, 4.8% users contribute more than 80% of the original posts (Fu & Chau, 2013). Individuals as information consumers can further decide whether to comment on or repost others' messages, and reposting appears to be a cognitively costly activity that undermines the reposter's own comprehension of the posted information and even negatively affects subsequent offline cognitive performance (Jiang, Hou, & Wang, 2016). There are also vast individual differences in the inclination to share personal information online—reflecting variation in personality and motivations for disclosure, and in the form in which personal information is shared—ranging from detailed documentation of one's life stories in "macroblogging" to moment-to-moment status updates in "microblogging" (Wang, 2013). Whether to share personal experiences online further has consequences for memory. For instance, in a study by Wang, Lee, and Hou (2017), participants were asked to keep a diary for a week, recording at the end of each day all the events that happened to them during that day and whether they posted any of the events online. Surprise memory tests at the completion of the diary recording and then a week later both showed that participants were more likely to remember the events that had been shared online than those not shared, even when controlling for the characteristics of the events. It appears that, different from sharing public information (Jiang et al., 2016), sharing personal experiences online may facilitate rehearsal and meaning making and thus benefit long-term memory retention.

What to Share

Individuals are highly selective in deciding what information to share on the Internet. In the study by Wang et al. (2017), out of the total 1614 events (24.45 per participant) that participants initially recoded in their diaries across 7 days, only 98 (6%) were posted online (1.48 per participant). Events posted online further differed in quality from those not posted online, being

more emotionally intense and personally important according to the participants' ratings. In other words, individuals selectively share personal experiences online that are important and meaningful to them. In addition, experiences selectively shared online are predominately positive (Wang et al., 2017), consistent with the notion that the Internet serves as a performance stage for individuals to communicate their ideal self (Lee, Im, & Taylor, 2008; Wang, 2013). When posting or reposting non-personal information such as news or commentaries on the Internet, needless to say individuals often express their personal interests, views, and ideologies by selectively disseminating and promoting confirmatory information and condemning contrary information (Hou, Jiang, & Wang, 2017). Such selectivity not only has implications for memory and cognition but also may have detrimental personal and social consequences (Ronson, 2016; Wall & Williams, 2007).

How to Share it

Sharing personal information online to a large audience entails unique motives for self-expression and social connection as well as the intension of soliciting feedback and "likes" from others (e.g., Sherman, Payton, Hernandez, Greenfield, & Dapretto, 2016). As a result, "online" memories may deviate from private recall such as in the traditional pen-and-paper diaries and exhibit unique characteristics that allow the memories to better serve both self and social functions (Wang, 2013). This hypothesis was tested in a study by Wang and colleagues (Wang, Blenis, Ng, & Gonzalez, 2015). Participants were asked to recall autobiographical memories by imagining themselves write in either their online blogs accessible to the general public or their private diaries accessible only to themselves. Participants also completed a series of personality measures. It was found that memories written in blogs were more elaborate, more expressive, more self-revealing, and more positive, and they exhibited a greater dialogical intension and a greater focus on here-and-now, when compared with memories written in diaries. Furthermore, personality traits played a role: extraverts recalled more detailed blog memories than did introverts, and people who scored higher on disclosiveness were more expressive and self-revealing in their blog memories than were those who scored lower. Thus, individuals choose how to share their personal information on the Internet in line with their motives for sharing and their personal characteristics.

How Frequently to Surf Online

Great variations further exist in how frequently individuals use the Internet to receive and disseminate information. In extreme cases, individuals develop Internet Addiction Disorder (IAD), an impulse control disorder in which individuals exhibit a compulsion to use the Internet to excess, so much so that it interferes with other aspects of daily life. Similar to other addictions, IAD causes long-term emotional, social, health, and performance problems and is a growing social issue worldwide, afflicting approximately 6% to 18.5% of the population (Hou, Xiong, Jiang, Song, & Wang, 2019; Young & Nabuco de Abreu, 2011). Within the normal range, Internet usage is associated with demographic factors such as age and gender, as well as individual factors such as personality and self-esteem. Even within an individual, variation in Internet usage can exist on a day-to-day basis. The degree of engagement with the Internet is further reflected in brain structure. For instance, a study by Loh and Kanai (2012) found that people with a general preference for online social interactions showed decreased volumes of grey matter in regions that are involved in facial and speech processing. Thus, individuals' personal preferences and characteristics influence the frequency at which they use the Internet, which can, in turn, moderate the extent to which the Internet shapes their memory and cognition.

Conclusion

There are many ways in which individuals exercise their personal agency when interacting with the Internet. To understand how the Internet changes memory and cognition, it is not enough to just ask how and what information is dispersed on the Internet. It is critical to also ask why and how individuals use the Internet, what personal characteristics and beliefs that individuals bring into the information processing, and what social dynamics (e.g., "cyber celebrities" vs. followers) affect online information production and consumption. To answer these questions, cognitive psychologists must work closely with researchers in social and personality psychology, communication, political science, data science, and so on. Interdisciplinary approaches are required in order to truly understand the impact of the Internet on memory and cognition and the active role of the individual mind in the construction of its digital niche. To borrow Tulving's (1983, p. 146) words, "Rememberers do not leave their brains and minds behind, or switch them off" when they *surf online.*

Conflicts of interest

The authors declared no conflicts of interest.

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