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COMMENTARIES



On the Role of Metacognitive Beliefs and Experience With Internal and External Autobiographical Memory

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Our digital footprints capture so much of our lives that our data is routinely used to predict our personality traits, attributes, and behavior (Azucar et al., 2018; Kosinski et al., 2013). We often consult this data when remembering personal events, searching through photos, social media posts, location data, and a host of other information as we recall and reminisce. The AMEDIA Model argues, alongside others, (e.g., Fawns, 2019; Finley & Naaz, 2023; Heersmink, 2018) that in the digital age autobiographical remembering is a process negotiated by combining information stored in the world (*external memory*) and memories stored in the mind (*internal memory*) (Hutmacher et al., this issue). A critical claim of the AMEDIA model is that interactions between internal memory and external memory represent an iterative process which gives rise to autobiographical memory. Autobiographical remembering is therefore considered an emergent property of repeated interactions between internal and external information. In this way, neither external records nor internal memory alone fully capture what a person can remember about their life. External records alone cannot represent autobiographical memory because that information, however complete it may be, requires interpretation and the conscious experience of remembering. A person's ability to remember autobiographical experiences is likewise not fully captured when they cannot access the externally recorded information with which they routinely remember.

The AMEDIA model contradicts research that views digital devices largely as a site of memory offloading, but the model is not inconsistent with the framework from which that assumption is sometimes drawn. Much of this research draws upon transactive memory theory, which was initially developed to characterize how people remember together (Wegner, 1987; Wegner et al., 1985, 1991). Transactive memory systems are argued to exist across the minds of people who routinely interact with and rely on one another to remember. These memory systems contain information shared in common between members of the system (*integration*) and information that is held by some members of the system, but not others (*differentiation*) (Wegner, 1987). Modern work often draws upon transactive memory theory by viewing technologies like the internet or digital devices as transactive memory partners (Sparrow et al., 2011). These digital technologies are usually assumed to be a

largely differentiated transactive memory partner onto which information can be offloaded, holding that information so that it need not be stored in internal memory (for reviews, see Gilbert et al., 2023; Marsh & Rajaram, 2019; Storm & Soares, 2024).

It seems unlikely that most people want to cede the duty of remembering important life events to digital records (Eliseev & Marsh, 2021; Harvey et al., 2016). The relationship between autobiographical memory and digital technology could, however, be characterized by integration within the transactive memory framework. Integration describes not only shared memories between transactive memory partners, but also the potential of members within the system to collaboratively generate new knowledge or understanding (Wegner et al., 1985). Integration can also occur when members of a transactive memory system engage in *cross-cuing* when recalling information together. Cross-cuing describes when partners cue one another to retrieve information iteratively, allowing partners to retrieve more information together than they would have been able to remember independently (Harris et al., 2011).

We could consider engaging in autobiographical recollection alongside the various sources of digital data we have available to be a type of cross-cuing. An illustrative example is provided by Hutmacher et al. (this issue) of reviewing vacation photos to verify the stops on a trip, then being reminded of a band you saw playing in a café and digging up a digital note with the band's name. In this example, you engage in a type of cross-cuing with your own digital footprint. It is not uncommon, as in the example provided, to begin searching through digital records for a piece of information or with the intention of remembering a specific event, only to be spontaneously reminded of other events which then send us looking deeper through digital mementos. As such, Hutmacher et al. (this issue) argue that remembering with digital artifacts goes beyond simply responding to a cue. Rather, remembering in concert with digital records is more like having a conversation with those records. Taken further, remembering with digital records can also resemble a conversation with the past self who recorded that information. When we create digital records, we often do so with the prospective intention to create a memento for an imagined future self (Soares, 2023; Soares

& Storm, 2022). In later interactions with these mementos, we interface with that past self.

The AMEDIA model emphasizes that this dialog between internal and external memory is continuous and repeated, so prior experience encoding, curating, and retrieving autobiographical memories should influence later decisions related to each phase. The introduction of both new life events and new ways of recording and remembering those events cause consistent changes to the ecosystem of internal and external memory. Therefore, decisions about how and what information to record (or to allow to be tracked on your behalf), how information will be curated, and when and how to engage with digital data are likely influenced by past experiences with and beliefs about qualities of one's own memory, how digital records work, and how the two interact. Within this context, an important line of future inquiry will be to further develop our understanding of such beliefs and experiences, as they likely influence decision-making during encoding, curation, and retrieval of autobiographical memories.

Metacognitive Judgements of Internal Memory

Metacognitive judgements of internal memory are informed both by explicit beliefs about memory as well as by subjective experiences that occur during encoding or retrieval of those memories (e.g., Brown & Siegler, 1993; Kelley & Jacoby, 1996; Koriat, 1997). Prior and continued use of digital records can influence such beliefs and subjective experiences. Previous work investigating the effects of engaging in internet search has shown that using the internet, relative to memory alone, can inflate participants' expectations of their own internal knowledge (Eliseev & Marsh, 2023; Fisher et al., 2015, 2022; Pieschl, 2021; Ward, 2021). Such effects have been attributed both to mistaken beliefs about the location of searched-for information (e.g., Ward, 2021) and changes in subjective experience caused by searching (e.g., Eliseev & Marsh, 2023).

Using external digital records to support autobiographical recollection seems likely to influence metacognitive expectations of internal memory, be it by changing the subjective experience of remembering, by altering beliefs about memory, or both. There are good reasons to expect a substantially different relationship between internal and external memory for autobiographical recollection than has been observed between search engines and semantic memory. That said, a person could easily confuse information stored in their digital archives with information stored in internal memory. Given the personal nature of autobiographical memories, one might even expect a person to be *more* likely to make such conflation for autobiographical memories than semantic information, though this is an empirical question.

Recalling an event with external records can also change the subjective experience of how those memories are recalled (e.g., Congleton et al., 2021; Loveday & Conway, 2011; Talarico, 2022). Experience reviewing and remembering with external records can also build up over time. For example,

in studies in which participants reviewed some photos of an earlier museum visit, they later reported stronger feelings of reliving the events when cued by those same photos at a later time (St. Jacques et al., 2013, 2015; St. Jacques & Schacter, 2013). Qualities of recollection can also be influenced depending on features of an external record (Hou et al., 2022; Soares, 2023; Soares & Storm, 2022). For example, participants in one study were more likely to report an observer perspective when remembering photographed events if the photos showed the participant compared to photographed events in which the participant was not visible (King et al., 2024). The variety sensory modalities, and sometimes even internal states (Sas et al., 2013), that can be captured by a recording strategy also likely change the recollective experience.

Beliefs and Experience With External Sources

Decisions about what to record, curate, and how to retrieve autobiographical events are also likely to be influenced by prior experience interacting with sites of external memory. Some studies have shown that people have a sophisticated understanding, for example, of what information will be available through an internet search engine and how long that information will take to find (Risko et al., 2016). It is not clear whether people have similarly accurate and nuanced understandings of the externally recorded information they use to support autobiographical memory. For example, we do not know the extent to which people expect the use of smartphone cameras, social media posts, exercise tracking, or sleep data to influence qualities of how they recollect related autobiographical events. Likewise, little is known about which technologies people prefer to recollect, reminisce, or reflect with.

Experiences recording events could also influence the likelihood of recording using the same or another strategy in the future. Taking photos, at least under certain circumstances, can boost enjoyment of and engagement in an experience (Barasch et al., 2017, 2018; cf. Tamir et al., 2018), which could increase the likelihood of future photo-taking. Use of digital technology can also beget future use. In one study, participants assigned to use internet search to answer difficult trivia questions were substantially more likely to continue using internet search when it was no longer an efficient strategy compared to participants who initially answered from memory (Storm et al., 2017). Future work could examine whether similar effects occur for the various methods used to intentionally record personal events.

Beliefs About How Internal and External Memory Interact

Finally, people's beliefs and experiences with interactions between internal and external memory are likely to influence encoding, curation, and retrieval of autobiographical memory. Participants sometimes describe using external memory to compensate for internal memory in general, but examples of such compensation usually constitute documenting

semantic information like phone numbers and dates (Finley et al., 2018). There is some evidence to counter this compensatory relationship for autobiographical memories. In a recent study, participants were asked a hypothetical question about which year of their life they would most want to save photos from, assuming they had many photos from each year. Participants were substantially more likely to report a year they were likely to remember well (e.g., due to recency) compared to years they were unlikely to remember (due to childhood amnesia). Participants also qualitatively reported being substantially more likely to choose a year because they wanted to enhance recollection of events they already remembered well than they were to report choosing a year to compensate for memory failures (Soares et al., 2023).

Beliefs about the relative strengths and weaknesses of internal and external memory are also likely to influence decision-making. The memory symbiosis framework argues that people choose to remember using internal or external memory based on the strengths of each approach in the context of remembering (Finley et al., 2018). This framework argues that external memory is particularly strong, and therefore preferred, in tasks that draw on semantic memory, while internal memory is preferred for tasks that align more with episodic memory. Participants have reported using internal and external memory consistent with these patterns in survey studies (Finley et al., 2018; Finley & Naaz, 2023). The memory symbiosis framework might then predict that the strengths and weaknesses of how an external record represents and cues memory should determine how likely a person is to record a life event. If this is the case, people build up an understanding of the specific strengths and weaknesses of types of digital records through experience, and this experience is used to inform future decisions.

Conclusions and Future Directions

The AMEDIA model builds on extant approaches, like the transactive memory framework (Wegner, 1987; Wegner et al., 1985, 1991) and the distributed cognition approach (Heersmink, 2018), by discussing explicitly how digital records and internal autobiographical memory work in concert. The model stresses the iterative nature of autobiographical memory as a process existing between interactions with internal memory and externally recorded information. This argument highlights the need for more empirical work examining beliefs and experiences about internal and external memory and their interactions, particularly in the context of autobiographical memory. In addition, the model considers the specific structural components of digital records (e.g., the record's intended audience, the type of data) with some speculation about how these factors could influence autobiographical recollection. Many questions remain about how these structural components could influence qualities of autobiographical remembering.

An area for growth and future inquiry related to the AMEDIA model is to develop clear, testable, and theoretically informed predictions about how internal and external memory interact to form autobiographical memory. Our

understanding of autobiographical memory as a collaboration between internal and external digital memory is still nascent. A goal of future work should be to continue developing this understanding to such an extent that we can make clear predictions about the effects of remembering in different ways alongside digital devices on how we remember individual events as well as form larger narratives, and the cognitive mechanisms underlying such effects. Such work would not only inform approaches to developing new digital technologies intended to support autobiographical memory, but also our basic understanding of how autobiographical memory functions in the modern world.

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No potential conflict of interest was reported by the author(s).

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