

Remembering Digitally: Unpacking the Impact of Technology on Autobiographical Memory

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Commentary on Hutmacher, Appel, and Schwan's "Understanding Autobiographical Memory in the Digital Age" for *Psychological Inquiry*

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Hutmacher, Appel, and Schwan (2024) make the compelling argument that our current digital age requires a new framework for understanding autobiographical memory because of the increasing density of how we create digital records and the frequency with which we are interacting with such materials. Many decades of research have established that memory is not like a video recorder, and instead is a constructive process that we piece together. Yet, the idea that we can somehow preserve a digital record of our memories continues to appeal to society, with recent technology like Apple Vision Pro suggesting that capturing 3D videos and photos will enable us to “relive a memory as if you’re right back in the exact moment” (Apple, 2023). The Autobiographical Memory in the Digital Age (AMEDIA) model presents an alternative idea by proposing that information stored in external records interacts with information stored in the mind to support the constructive nature of autobiographical memories. In this way, digital records are not preserving memories but rather “working in concert with” how autobiographical memory operates in the mind. This is a timely and valuable idea, though considering how the digital database of our experiences supports autobiographical memories raises many questions. In the current commentary, we present additional ideas and avenues for future research that may direct some of these questions. We discuss the importance of exploring episodic and semantic aspects as well as phenomenological aspects of autobiographical memory. We also explore issues involved in sharing and reminiscing about autobiographical memories and factors that might impact accuracy and belief in these memories when using external resources for remembering, and we discuss the concepts of cognitive offloading and cueing in the AMEDIA model.

Episodic and Semantic Aspects of Autobiographical Memory

Hutmacher, Appel, and Schwan (2024) recognize that internal autobiographical memory has both episodic as well as semantic elements and discuss this point very briefly. This is an important point that is essential for a full understanding of autobiographical memory (Levine et al., 2002; Renoult et al., 2019; Tulving, 2002). When people remember their personal life experiences, their recollective

experience can involve episodic elements, ranging from a vivid sense of reliving the experience, replete with rich sensory-perceptual and contextual detail and accompanying emotional responses and other thoughts, to a recollection with much less detail and much less vividness. Confidence in the veracity of the details and in the very occurrence of the memory can vary as well (e.g., Rubin et al., 2003). People's recollection can also involve semantic elements, consisting, for example, of facts and knowledge about their personal experiences without any sense of reliving the event or the kind of recollective details that accompany episodic autobiographical recollection. For example, you might recall with great detail and vividness your trip to the Eiffel tower when you were 10 years old, feeling the awe as you craned your neck to look and the delicious taste of the pastry you were chewing. You might remember the red beret your sister insisted on wearing and the annoying way she tried saying words in French on that sunny, warm spring day. Or you might be very confident but have fewer details in your recollection, remembering the sights you saw but less about the pastry you ate or about your sister. But you might instead just *know* that you went with your family to the Eiffel Tower when you were 10 but you do not have any accompanying recollective details; you know about this experience in the way that you know that Paris is the capital of France or that you know you were born in 1986.

To what extent might the interplay between internal autobiographical memories and external resources for autobiographical memories such as photos or online posts accentuate episodic recollective experience, or instead bring about a greater volume of semantic elements in people's autobiographical memories? Does looking at personal photos, for example, create a sense of Remembering an experience or just Knowing that it occurred with little if any recollective experience? Indeed, prior research has shown that digital photographs from everyday life elicit a greater sense of familiarity than recollection (Milton et al., 2011; Rissman et al., 2016). For example, Milton et al. (2011) asked participants to record photographs of their everyday life with a wearable camera. Participants who were asked to view photographs, taken from cameras 36 hours later, reported Know responses for 52% of memories but

Remember responses for only 27% of the images. What factors might influence the likelihood of autobiographical remembering being relatively more episodically rich and detailed when people's internal memories interact with external resources? Likely candidates include how long ago the depicted event was as well as the age of the rememberer, how often one has thought about and/or discussed the event since its occurrence, and the emotionality or importance of the event along with its current centrality in one's self-identity (e.g., Campbell et al., 2011; Nadel et al., 2007; Prebble, Addis, & Tippett, 2013; St. Jacques & Levine, 2007). With the increased density of recorded life events afforded by digital technology that Hutmacher et al. (2024) describe throughout their paper comes increased sources of those recorded events. So it might also matter whether the externally recorded information originated from you – your Instagram posts or photo archive – or from someone else – a news story you are featured in, a distant relative's photos from a long forgotten family reunion.

Furthermore, it is not unusual for recollective experiences that once were episodic in nature to shift to being more semantic, for instance, as more time has passed, with the age of the rememberer, or as repeated rehearsal and elaboration or embellishment occurs when thinking about or talking about the event increases (e.g., Bartlett, 1932; Levine et al., 2002). Such findings highlight that human memory storage is also more akin to "curating," such that it involves a dynamic process of stabilizing and restructuring memories via consolidation (e.g., Moscovitch et al., 2006). Some theories of memory further propose that consolidation changes the representational format of memories traces from episodic to more semantic or abstract in nature (Winocur & Moscovitch, 2011). These processes can occur during sleep or periods of awake rest (Wamsley, 2022), but also actively when memories are reactivated (Hardt et al., 2010). The role that external resources for autobiographical remembering might play in contributing to changes in the episodic nature of autobiographical remembering is important to consider, and this is an area that could benefit from further research.

One of the powerful aspects of human memory is that we can abstract the commonalities from many similar episodes (e.g., how I spend my summer vacation). For example, Neisser (1981) examined how testimony provided by John Dean regarding his conversations with President Richard Nixon to the Watergate committee matched an audio recording of the same conversations that was later reported. Dean's memory was generally accurate when considering the main theme across several conversations, but not when considering verbatim and gist details associated with recalling a single conversation. Similarly, the complementary learning systems framework highlights how the neural architecture of memory reflects the interplay of both a rapid system of learning detailed representations of unique episodes via the hippocampus and a slow system that generalizes across many instances within neocortical areas (McClelland et al., 1995). The abstract summary of multiple episodes or schema is thought to contribute to our life story, which integrates our sense of self with autobiographical memories (Bluck & Habermas, 2000). Such research highlights how digital records that correspond to a single episode may be useful in some contexts (e.g., recalling one specific event), but not others (e.g., summarizing a theme across many repeated events). Hutmacher et al. (2024) discuss the role of algorithms that can automatically curate patterns of data and anticipated future directions in artificial intelligence (AI) in capturing the personal past, but many questions remain about the nature of how such external resources will interact at the level of discrete episodes from our personal past to more abstract aspects of autobiographical memory such as our life story. How does curation of digital records based on algorithms and/or AI align with how humans develop and create a life story? What is the best way to use external resources to support how we summarize and extract patterns in our autobiographical memories? Understanding the multiple ways that such external resources may interact with not only discrete episodes from the personal past, but also how we create a life story will be fruitful directions for future research.

Phenomenological Aspects of Autobiographical Memory

Deeper consideration and research into the various phenomenological features of autobiographical memories is also needed in the context of the AMEDIA model. The authors mention *reflection* in a brief paragraph on page *29 but not with the clarity or depth that such an important topic merits. They state that “recollection denotes remembering past events in detail,” a relatively simplified view that does not tap into the deep research literature on the phenomenology of autobiographical remembering that exists. As autobiographical remembering in the digital age relies on both internal autobiographical memory and on external resources for autobiographical remembering, how are the subjective qualities of people’s internal autobiographical memories impacted? Theories of autobiographical memory emphasize that remembering these experiences involves multiple component processes including phenomenological characteristics such as emotion, visuospatial imagery, self-reflection, and personal significance (e.g., Rubin, 2006; Svoboda et al., 2006). Johnson’s seminal work in which she and colleagues developed the Memory Characteristics Questionnaire explored a wide range of features that might vary among memories derived from different sources, such as clarity, perceptual detail (sight, sound, smell, taste, touch), contextual detail (time, location, setting), vividness, complexity, realism, feelings and emotions, intensity, and certainty (Johnson, Foley, Suengas, & Raye, 1988). Since then, other measures have been developed, many with overlap but each with their own unique elements such as visual perspective and sense of reliving (e.g., the Autobiographical Memory Questionnaire [Rubin, Schrauf, & Greenberg, 2003], the Memory Experiences Questionnaire [Luchetti & Sutin, 2016; Sutin & Robins, 2007], and the Autobiographical Memory Characteristics Questionnaire [Boyacioglu & Akfirat, 2015]).

Digital resources may go beyond merely “working in concert” with autobiographical memories, to actively reshape the phenomenology of memories. A prominent example of this is that photographs depict a particular visual perspective or viewpoint of an event. Photographs can capture some aspects of our perception, such as representing how the event appeared to us from our first-person perspective as

the photographer taking the images. Yet, they are just as likely to represent the world differently than they were experienced, such as when we adopt a selfie portraying our body in the event. A growing number of studies have shown that photographic viewpoint can influence the way that people remember events (King et al., 2023; Marcotti & St. Jacques, 2018, 2021). For example, King et al. (2023) found that when people reported having photographs of events that they are pictured in (i.e., they could see themselves in the photograph), they were more likely to remember these events from a third-person than a first-person viewpoint (i.e., seeing themselves in the memory rather than retrieving it from their own eyes or how the event was originally perceived). Other research has also demonstrated that when people review photographs of events that depict third-person viewpoints, they are more likely to later recall memories of these events from a viewpoint that matches the photograph. Similarly, creating records of memories through the act of drawing has also been shown to shift the viewpoint that people adopt during memory retrieval (Tran et al., 2023). Changes in viewpoint can also influence other phenomenological properties of remembering such as emotion and vividness (for review see Küçüktaş & St. Jacques, 2022; St. Jacques, 2019) and episodic nature of memories (e.g., Wardell et al., 2023). In this way, the format of digital records goes beyond a simple interaction with internal records to actively reshaping the re-experiential aspect associated with remembering.

Exploration of the phenomenology of the *content* of autobiographical remembering in the digital age is valuable, but so too is exploration of the phenomenology of autobiographical *retrieval* (see Moulin, Carreras, & Barzykowski, 2022). Hutmacher, Appel, and Schwan (2024) discuss several different modes of remembering: intentional, incidental, and triggered. Whereas numerous studies have addressed differences between intentional and incidental retrieval of autobiographical memories, it is a strength of the authors' approach that they have considered and defined *triggered memories*, which are elicited by algorithms used by social media and photo storage sites, for instance. As the authors point out, these triggers are not incidental because they are designed to induce remembering, nor are they

intentional because they are not initiated by the individual rememberer. The authors offer a brief but thoughtful discussion of some issues in the employment of memory-triggering algorithms, including the ways they may shape peoples' life narratives and may lead to negative rather than positive emotions (e.g., when an unpleasant past event is highlighted).

Additional consideration of how each of these different modes of remembering might impact the content of what is remembered as well as the subjective experience and phenomenological features of the recollective experience is warranted. Are triggered memories, for example, as detailed and rich in sensory-perceptual detail for the rememberer as intentionally or incidentally retrieved autobiographical memories? Is visual perspective impacted? Emotionality? Sense of familiarity? Do the rememberers tend to stick more to the content from the trigger, or evoke cascades of other related memories, thoughts, and emotions, as may occur when intentional or incidental memories arise?

Furthermore, might there be different styles, patterns, and even functions of reminiscence served by the different modes of remembering? Sometimes people intentionally seek out their prior social media posts or digitally archived photos to regulate their emotions, looking back on happier days to cheer themselves up, for instance, whereas sometimes that same looking back can evoke feelings of embarrassment at their oversharing, their clothing choices, or general demeanor (Jungselius & Weilenmann, 2023). Additional research is needed to determine whether incidental and triggered memories arising from interaction with external resources show similar patterns.

Sharing and Reminiscing About Autobiographical Memories

It is already well established that people's memories are shaped by whether they discuss their experiences with other people or not (Harris, Barnier, Sutton, & Keil, 2014). The content of and the manner in which people share with others may differ when done on the internet or through other digital media than when done in person, which Hutmacher et al. note is "largely uncharted territory" (p. *31).

The authors offer a brief section discussing reminiscence and the idea that engaging with externally recorded information may serve different purposes with regards to autobiographical remembering. It is worthwhile to draw upon the existing rich literature using the Reminiscence Functions Scale (RFS; Webster 1993, 1997) to examine how functions may differ with digitally assisted remembering. For instance, some functions of reminiscence such as Identity (maintaining and enhancing one's sense of self and their personal identity), Conversation (facilitating social interaction, communication, and connection with others), and Boredom Reduction (thinking about or talking about one's past to alleviate boredom and help pass the time) may be especially prominent when people draw on external records for autobiographical memories. Hutmacher, Appel, and Schwan suggest that life review and meaning making styles of reminiscence may be enhanced because of the richness of external records, which maps onto the RFS's Death Preparation factor (engaging in life review to find coherence and meaning as one prepares for death). Autobiographical remembering in the digital age can best help achieve people's goals and purposes by actually understanding what those goals and purposes are (see, e.g., Finley, Naaz, & Goh, 2018; Soares & Storm, 2022).

Exploring digitally enhanced reminiscence across different age groups and across different life circumstances is also of value. For example, the functions and values of reminisce differ for healthy community dwelling older adults compared to older adults with cognitive decline living in care facilities (Henkel, Kris, Birney, & Krauss, 2017; Henkel & Kris, 2018).

Accuracy and Belief in Autobiographical Memories

The authors stress throughout the paper a critical point: Internal autobiographical memories are constructed and reconstructed -- they are malleable. The malleability of memory is well established through more than half a century of research, and although surveys sometimes show that the general public holds some erroneous and naïve beliefs about memory (e.g., Simons & Chabris, 2011, 2012),

awareness that memories are malleable appears to be growing (Wake, Green, & Zajac, 2020; see also Finley, Naaz, & Goh, 2018).

Less is known about the general public's beliefs about the veracity of external records of autobiographical memories. Hutmacher, Appel, and Schwan (2024) discuss what they term "the optimistic view" – the idea that the increased density of recorded life experiences afforded by the digital age would provide "a stable and accurate representation of past events that can be accessed to verify and – if needed – correct our subjective perceptions" (p. *4). They note that a more balanced perspective is needed, and they address head on the idea that external records stored on digital media are curated; they are selective and not necessarily veridical. This too is a critical point, and indeed the authors drive the point home by deliberately opting for terminology about the *curation* of external resources in their AMEDIA model, rather than the widely used term *storage*. They state explicitly and emphatically that they use the terminology of *curation* rather than *storage* to "emphasize that storing externally recorded information is not necessarily passive but can be deeply reconstructive as well."

We cannot amplify this important point enough, especially because we suspect that a common sentiment in the general public is that people can turn to photos and videos as proof of what really happened, that photos and videos are reliable, objective, and veridical evidence of reality. That is not to say that people are not aware of the existence of doctored photos and deepfakes that others have created. But people might be surprised to learn their self-initiated edits to their photos – applying a filter to alter the colors, editing out an unsightly blemish, cropping out someone or something -- is not necessarily well remembered. For example, a few days after cropping out specific objects from their photos, people's memory for what they cropped out was relatively impoverished, and their overall ability to remember what kinds of edits they made was not that impressive (Henkel & Milliken, 2020). It also is the case that digital records are missing much of the experiential aspects associated with the internal thoughts and emotions we felt during these events, which may lead to retrospective biases in recalling

these experiences later, such as the tendency to recall the past as involving less negative affect than was felt at the time the event occurred (Walker et al., 2003).

But in truth, any given photo or video – even ones that are not explicitly doctored -- represents an interpretation of its content and the person’s experience through things such as the lighting, the angle, and what is included in the shot and what is excluded. A photo or video is capturing a blinkered moment in time and space from a given perspective, not necessarily the Whole Truth or even The Truth. You take a photo of your delicious appetizer but leave out the breadbasket in front of the dish. The body worn camera on a police officer captures images of what is in front of the lens, though the officer may have their head turned and be seeing something not represented in the video. The suspect charging at them may appear larger or shorter, depending on how tall the officer is and where his or her camera is attached. The seemingly simple solution of creating a video record of criminal interrogations so the truth would be documented and knowable was not so simple after all: The camera’s perspective matters. When the camera focused exclusively on the suspect, viewers formed different judgements about coercion and guilt than when the camera included the suspect and the interrogator in the shot (Lassiter, 2010). While it is probably not surprising to many people that an individual’s handwritten diary entry or written social media post is subjective and therefore may be biased, incomplete, and selective, people may have a higher default belief in the veracity of photos and videos.

Hutmacher, Appel, and Schwan make strong and explicit statements about curation in the AMEDIA model and make clear that external records can be subjective, biased, and incomplete, and can be further changed and altered over time. Here too we point out that digital records are not always “live recordings” or records created in situ, but can include diary entries, scrapbooking, social media posts, etc., which occur after the fact. This may not be enough to counter people’s beliefs about the veracity of such records. Indeed, the language that the authors use elsewhere throughout the paper (and that we ourselves and so many others use) may be unintentionally reinforcing the notion of external resources as

more truthful and fixed than they are. Phrases and terms such as “creating a record,” “digital records,” and “digital data” perhaps connote a degree of objectivity and veracity that is not necessarily the case, and the earlier part of the paper frequently discusses the *storage* of information rather than the curation of it. This shows up, for example, in the section called “Model Overview” and in the diagram of their AMEDIA model, where they use the shortened phrase “externally recorded info,” rather than the header in the text where they refer to “external resources for autobiographical remembering.” This is not a limitation of the model or even a rebuke of the authors; it is an issue with the language that we all use that may be inadvertently creating a sense of truth that is not necessarily the case. These digital records are *versions* of our experiences, they are *interpretations*. More research is needed to better understand people’s beliefs about external resources for autobiographical remembering (see Finley, Naaz, & Goh, 2018).

Consideration of the presumed veracity of the external resources for autobiographical remembering gives rise to another important topic that may have unique nuances in the digital world or that may instead parallel what occurs in nondigital everyday life when people’s memories are challenged in some way. The authors mention that sometimes people might access an external record that does not trigger an internal feeling of remembering (p. *35). If people take as truth the external record, they are presented with evidence for something that is in conflict with their own internal autobiographical memories. They can disregard the external record and go on believing the event never happened (or did not happen that way it is depicted). Or they might come to accept that the event happened even though they do not remember it, just as you accept the fact that you were born even though you have no recollection of it. If they accept it as true, the person might thereafter *know* that the depicted event happened -- so has a belief in its occurrence -- but might not have any recollective detail accompanying their autobiographical remembering. A person's belief in the occurrence of something they remember can be undermined by other people challenging their memory or by other forms of evidence, such as

photos or videos, leading the individual to reduce or even relinquish their belief in the event's occurrence (Scoboria, Boucher, & Mazzoni, 2015). Scoboria and colleagues introduced the term *nonbelieved memories* to refer to memories that people no longer believe occurred that way but for which they still retain recollective details for that “feel” like a memory. Their work highlighted the importance of separately examining both a person’s belief in occurrence and sense of recollection (Scoboria, Jackson, Talarico, Hanczakowski, Wysman, & Mazzoni, 2014). The SCOboria social-cognitive dissonance model examines the factors that determine whether an individual will relinquish belief in a challenged memory or not (Scoboria & Henkel, 2020). This model should prove useful in exploring what happens when external resources for autobiographical remembering pose such challenges and in determining whether the frequency of nonbelieved memories might increase as people interact with the increased density of recorded life experiences that Hutmacher, Appel, and Schwan (2024) shine a light on.

Cognitive Offloading and Cueing

When the concept of cognitive offloading is discussed by Hutmacher et al. (2024), it comes across as if digital resources are treated by people as an external hard drive to store information so that one’s “internal hard drive” of the brain and one’s cognitive resources are completely relieved of their memory duties and therefore disengaged. Many memory researchers such as ourselves do not take such an extreme view when it comes to autobiographical memory and external resources. Taking a photo of one’s spot in a parking garage so that one can find their car later is different in many important aspects from taking a photo of a meaningful event so that one can later look at it and aid their memory. Indeed, people do in fact strategically use internal memory and external resources for remembering in different ways for episodic, semantic, procedural, and prospective memory purposes (Finley & Naaz, 2023). Might cognitive offloading not be an all-or-nothing thing and instead have elements of memory augmentation inherent in it when it comes to autobiographical remembering? A recent study showed

people preferred to use photos as an external resource for remembering primarily as a way to enhance and enrich internal memory rather than as a way to replace it (Soares, Finley, & Roberts, 2023).

Along similar lines, the authors purport in several places in the paper that externally recorded information is not merely a cue for autobiographical remembering. For instance, they state that “the host of empirical studies on autobiographical memory published in recent years arguably still views externally available information as nothing but a cue that individuals respond to, misrepresenting the dynamic and iterative nature of human remembering” (p. *37). If they are using a definition of “cue” from the early behaviorist and verbal learning days where there is Cue A and it activates Response B, then their point may stand, but when it comes to the rich body of research on autobiographical memory it does not seem to us that researchers are actually carrying forward the term “memory cue” in such a narrow sense – Cue A activates a cascade of associated thoughts, ideas, memories, emotions, etc. “The dynamic and iterative nature of human memory” that their model embraces is not a wholly novel notion. It is an important notion, and they do an excellent job of articulating it clearly and highlighting it, but they may be slightly overselling the degree of novelty.

By shying away from the notion of external resources as “cues,” Hutmacher et al. (2024) also miss some important aspects of the interactive aspect between external resources and internal representations of memory. Autobiographical memory retrieval is a spatiotemporal dynamic process, such that different characteristics of memories are more or less important earlier and later during retrieval. For example, prior research has shown that emotional aspects of memory occur earlier than visuospatial aspects (Daselaar et al., 2008). Still other research has emphasized how spatial and scene-based aspects of memory provide a “scaffold” from which to populate memories with additional content (e.g., Robin, 2018; Rubin & Umanath, 2015). For example, Robin et al. (2015) found that familiar spatial locations were more effective cues for memory than non-spatial cues. In addition to better understanding how the modality and format of external resources interacts with memories, it would be

of interest to understand how different types of external resources may be effective at different timepoints during autobiographical retrieval to support this dynamic process of remembering. For example, spatial and location based external resources (e.g., photograph of the location, map of the area, etc.) may interact more effectively with internal aspects of memories when they are presented earlier than later during retrieval. Advances in digital recording techniques may also change the nature of remembering in ways that are currently not understood. For example, it is unknown how the sense of depth and immersion associated with digital records (e.g., Apple, 2023) will influence autobiographical memories.

Final Thoughts

Hutmacher et al. (2024) present both optimistic and pessimistic views of how digital records may interact with autobiographical memory. In presenting the optimistic view, they state that supplementing autobiographical memories with digital records could “*compensate the weaknesses of human memory* by reducing biases and memory distortions” (p. *4). Rather than viewing such errors in human memory as a weakness, many memory researchers have argued that they reflect adaptive aspects of how our memory operates (e.g., Nairne et al., 2008; Schacter et al., 2011). For example, the reconstructive nature of our memory that can lead to distortions can also enable us to flexibly update our memories with new information (St. Jacques et al., 2013) and to imagine novel ways that the past could have occurred (De Brigard et al., 2018). Looking forward we propose that another important avenue of considering autobiographical memories in the digital age is considering how we will use such records not only to remember the past but also to simulate and plan future events.

It is also important to consider some limitations of the model. Not all memories are recorded. For example, a large majority of autobiographical memories are mundane experiences that occur every day, and many important and significant events that occur in our lives are less likely to have digital

records (e.g., it would be inappropriate in many cultures to take photographs at a funeral). Thus, a large part of our personal past may be impenetrable to the types of interactions with external resources suggested by the AMEDIA model.

Additionally, of the memories that are recorded in some manner, the sheer volume of the resulting rich database of external records of our life experiences afforded by the ease and availability of digital media provides a virtual mountain of information for people to search through. Just as too many options when making decisions may result in decision paralysis, autobiographical remembering in the digital age may suffer because having too many external resources may instead discourage people from making use of them in ways that do indeed benefit their autobiographical remembering.

Ultimately, digital and external resources will continue to shape how we remember. The AMEDIA model brings together many key features of digital remembering, and we hope that this commentary helps to address other considerations that contribute to this discussion.

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