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ADVANCED REVIEW

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A tetrahedral model of autobiographical memory research design

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Abstract

The field of autobiographical memory can do more to be representative of global populations experiencing and recollecting diverse events across the lifespan. To inspire such work, I present a general model for designing autobiographical memory studies. The tetrahedral model (based on Jenkins, 1979) has at its vertices *context* (e.g., the situated environment, activated schema, or functional goal), *outcomes* (e.g., the content and phenomenology of remembering), *participants* (e.g., the demographic characteristics and traits of the individual), and *events* (e.g., the lived experiences that comprise an individual's autobiography). Further, the area of the base of the pyramid can represent the time frame under investigation (e.g., the wider the distance, the greater the delay between an experience and its retrieval) and the height of the pyramid can represent the sample size (e.g., nearly flat for a case study, increasingly taller for larger groups) being studied. After applying the model to describe how typical autobiographical memory research is conducted (and briefly identifying the limitations therein), representative models of particularly promising areas of research are highlighted.

This article is categorized under:
Psychology > Memory

KEYWORDS

autobiographical memory, generalizability, research design, validity

1 | INTRODUCTION

The roots of autobiographical memory research are in a generalizability critique of traditional laboratory studies of remembering (Rubin, 1986). However, there is still more we can do as a field to be representative of global populations experiencing and recollecting diverse events across the lifespan (see Ledgerwood et al. (2022) for a similar argument levied at psychological science broadly). To justify this claim, I will present a general model for designing autobiographical memory studies as well as identify representative models of research that can inspire future work.

This paper takes as its primary inspiration Jenkin's (1979) tetrahedral model of studying memory. Jenkins (1979) described the minimal four variables that need to be assessed in any given research study: the orienting task (e.g., instructions, activities, and/or apparatus present during encoding), the criterial task (e.g., recall vs. recognition or performance assessed during retrieval), subjects (e.g., the knowledge or abilities of the individual being tested), and materials (e.g., modality, structure, and/or sequence of the to-be-remembered content). When each variable is

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connected as a pyramid, each edge connecting two variables represents a two-way interaction; each plane represents a three-way interaction; and the entire figure represents the four-way interaction among all variables.

Here, I am proposing that autobiographical memory investigators conceive of their designs in terms of context (e.g., the situated environment, activated schema, or functional goal), outcomes (e.g., the descriptive details and phenomenological features of remembering being studied), participants (e.g., the demographic characteristics and traits of the individuals in the sample), and events (e.g., the lived experiences thought to comprise an individual's autobiography). Further, I argue that the area of the pyramid can represent the time frame under investigation (e.g., the wider the distance, the greater the delay between an experience and its retrieval) and that the height of the pyramid can represent the sample size (e.g., nearly flat for a case study, increasingly taller for larger groups of individuals) being studied (Figure 1).

The premise of my argument is that the majority of autobiographical memory research examines a limited array of the variables available at each vertex and frequently fails to specify all of the interaction effects. To be precise, we tend to examine the content and phenomenology of relatively recent everyday experiences in sane, sober undergraduate students from safe, stable environments. I am certainly not immune from this critique: take Talarico et al. (2009) as one representative example. That study asked 170 Duke University undergraduate students to describe specific events during which they felt eight particular emotions. Participants were asked to briefly describe each event, to rate those recalled details as to whether they were "central" or "peripheral" to the experience, and to rate their phenomenological experience of emotional affect and intensity, their belief in the accuracy of their memory, their visual perspective while remembering, their sense of reliving the past in the present, the vividness of the memory, and the significance of the event on seven-point rating scales. From these data in this sample, we concluded that positive emotional affect was associated with recall of peripheral details of an experience and that focusing on central details was more associated with memories of anger than of fear. We also found that specific emotions influenced the relationships among emotionality and phenomenology. Although I continue to believe these are relevant data to questions of how the emotional character of events influence people's later recollections of those events, whether they truly generalize to all events for all people in all contexts, I am less certain.

Taking each component of the tetrahedral model in turn, I will describe how each variable is typically examined within autobiographical memory research and briefly identify the limitations of doing so. Then, when turning to interaction effects, I will highlight one promising area of research that exemplifies how to deepen our understanding of these constructs and/or elucidate important constraints on them. By intentionally examining our methods, we can enrich our comprehension of the phenomenon that is autobiographical remembering.

2 | VERTICES OF THE PYRAMID

2.1 | Events

Most autobiographical memory research focuses on singular, specific events, typically lasting a few minutes to a few hours and constrained so as not extending beyond a single day.[1] But, autobiographical memory is also commonly understood to

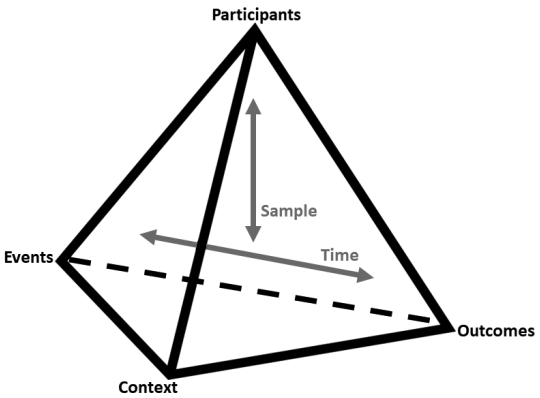

FIGURE 1 Tetrahedral model of autobiographical memory research

contain memories for extended events (e.g., a one-week vacation to a beach resort) and schematic memories that represent the merging of several similar repeated events (e.g., a visit to the beach generally). Forecasting future events is also thought to rely on similar processes and structures as recollecting past events (Schacter et al., 2008) as is the ability to reason about counterfactual events that did not, but could have, occurred (Özbek et al., 2017). Most events, in part due to the samples being investigated, are ordinary occurrences or, at most, are selected due to their emotional nature (including traumatic events). Only some theoretical models of autobiographical memory, notably the basic systems model (Rubin, 2006), capture this breadth of remembering and empirical tests of these event types are limited.

2.2 | Outcomes

Narrative reports of past experience and self-report ratings form the bulk of autobiographical memory data. Though narratives vary in length from brief titles (e.g., just a few words) to longer descriptions (e.g., paragraphs/pages of text describing events in as much detail as possible), they are typically verbal. However, one notable recent exception found that drawing rather than writing in a daily diary enhanced recall of event details (Tran et al., 2022). Other nonverbal memory reports include those from SenseCam, a wearable camera that automatically captures images which can be reviewed later, and similar technologies that have been successfully implemented with healthy adults (e.g., St. Jacques et al., 2011) and those with cognitive impairment (e.g., Berry et al., 2007). There is widespread acknowledgment that memory reports are distinct from memories themselves, but the narrative conventions that shape these reports are rarely explicitly addressed nor are the ways in which specific linguistic features may bias recall (see Wooffitt, 2005 for a discussion of this issue with regard to flashbulb memories). Similarly, the phenomenological features characteristic of autobiographical memory recall are broadly agreed upon, yet, paradoxically, this is most evident when examining the overlap among the many different rating scales which have been independently developed (e.g., Memory Characteristics Questionnaire (MCQ): Johnson et al., 1988; Autobiographical Memory Questionnaire (AMQ): Rubin et al., 2003; Memory Experiences Questionnaire (MEQ): Luchetti & Sutin, 2015; and Autobiographical Memory Characteristics Questionnaire (AMBQ): Boyacioglu & Akfirat, 2015). Each of these scales attempt to capture metacognitive constructs and qualia associated with recollective experience. Yet, despite consensus in the constructs of interest, there is still remarkable disagreement on some core concepts. For example, is vividness associated with the quantity of details recalled (also known as elaboration), specially recalling the sensory and perceptual details of an event (vs. more semantic or procedural details), and/or the clarity of the details recalled? Most investigators agree that vividness is distinct from the confidence with which the individual believes their memory captures the experience as it occurred, but whether that distinction is as natural or as obvious to participants is unclear.

2.3 | Participants

Research on human behavior and cognition, autobiographical memory included, has been rightfully criticized for focusing on WEIRD individuals (Henrich et al., 2010), that is, people from Western, Educated, Industrialized, Rich, Democratic countries—those places which have the economic and ideological luxury of supporting scientific research. Related critiques have emphasized the overrepresentation of White people even within diverse Western populations (Remedios, 2022), the lasting legacy of imperial colonialism. Both in terms of wealth available to invest in research among former colonial powers and the legacies of institutional structures that may support research more readily accepted as "academic" among formerly colonized locations (Silan et al., 2021), and the exclusionary dominance of English as the preferred language of scientific communication (IJzerman et al., 2021). As IJzerman et al. (2021) note, these factors have dramatically limited the places from which most research is conducted (i.e., primarily North America, Europe, and Oceana—and mostly UK, USA, and Australia therein) and therefore the local "convenience" populations most accessible to those investigators. Although there is a wealth of research in developmental psychology looking at young children's acquisition of autobiographical memory abilities (see Courage & Howe, 2022 for a review) and at how older adults' autobiographical memories are maintained and changed (e.g., Frankenberg et al., 2022); However, most autobiographical memory in "adulthood" is really in the emerging adulthood period of 18–22 years old, those most commonly enrolled in Introductory Psychology subject pools. It is true that the increase in online participant pools has mitigated this concern to some extent, as has social media promotion of research opportunities (e.g., advertising on Reddit or Twitter), but there is still less data on the representativeness of these samples outside the United States than within (Burnham et al., 2018; Michel et al., 2018), suggesting skepticism is still warranted.

Less attention has been paid to biases toward "healthy" samples (e.g., excluding dementia in older samples, mental health disorders in younger sample, and the physically disabled in all samples). Class issues have been practically ignored, despite being a central focus of Bartlett's (1932) foundational text and more recent calls to attend to the possible influence of socioeconomic status and memory performance (Herrmann & Guadagno, 1997). Both economic and social class have been shown to influence perception of and reaction to interpersonal events (e.g., Watts et al., 2018) so clearly there are implications for recollection of such events.

2.4 | Context

In part because of the identity and situational features of investigators and participants, autobiographical memory is assumed to include events that occur within stable and safe environments consisting of healthy, functional relationships. Traumatic memories (e.g., events involving abuse of a child by a parent or of domestic violence between intimate partners) are treated as if they are anomalous and rare; sadly, this assumption is unfounded for (at least) some populations. Related, in many false memory studies, verification of whether an event actually occurred to the participant in their childhood is dependent upon parents—therein assuming stable familial relationships, if not explicitly sober parents, in a nuclear family, who are assumed to have accurate memories of their children's lives due to their persistent attention and involvement; Again, this is sadly not a universally shared experience. Maintaining the focus on familial relations, there is a universal experience of each individual maintaining a multiplicity of social roles, but this is surprisingly ignored in favor of theorizing a singular autobiographical memory that defines an individual's experience. There may be some allusions to accessibility differences, but the systematic influence of these social roles in shaping the encoding and retrieval of lived experience has yet to be thoroughly explored.

Now that I've outlined how the points of the tetrahedral model are typically specified, let us turn now to some positive examples of research at the intersections of these points that broaden our conception of autobiographical memory. These are meant to be more illustrative than inclusive—a comprehensive review of methodological successes and failures is well beyond the scope of this argument.[2]

3 | EDGES OF THE PYRAMID

3.1 | Events–outcomes

Just as examining encoding-retrieval interactions has been a productive area of research for episodic memory broadly, the same is true within autobiographical memory specifically. As just one example, there is a growing body of work examining how individuals segment continuous ongoing experience into discrete events for later recollection (see Zacks, 2020 for a review). Collectively, these studies have demonstrated that the temporal and spatial features of events seem to shape segmentation, but do so flexibly and dynamically (Clewett et al., 2019).

3.2 | Events–participants

Berntsen's (2009) model of flashbulb memory formation highlighted the role of social group membership in leading to the emotional appraisal and rehearsal factors thought to predict durable, vivid, confidently-held personal memories of learning the news of a public event. One example of empirical work inspired by this model is that of Talarico et al. (2019) who found that differential public policy positions with regard to nuclear power were associated with different likelihoods of maintaining a flashbulb memory of the Fukushima nuclear disaster among otherwise geopolitically similar samples. The extension of similar work to personal autobiographical memories would be fruitful.

3.3 | Events–context

Work on cultural life scripts (Berntsen & Rubin, 2004) represent a terrific model of holistically evaluating individual events embedded within an entire autobiography as well as the contextualization of that life story within the cultural

expectations (and deviations) of that person. Bohn and Bundgaard-Nielsen (2021) compellingly demonstrated that the lifespan distribution of culturally important transitions similarly shaped the distribution of self-rated important autobiographical memories among individuals who do not share the dominant Western trajectory of a singular "bump" of significant events in late adolescence and early adulthood.

3.4 | Outcomes–participants

Here, there is remarkable work being done to expand models of autobiographical memory to include neurodivergent individuals and those with mental health conditions. Disruptions to autobiographical memory in mild cognitive impairment (Tramoni et al., 2012) and Alzheimer's disease (El Haj et al., 2015) relative to healthy aging have been well described. There is a long history of studying how depression disrupts autobiographical memory (Barry et al., 2018; Williams et al., 2007) as well as the memory-related symptoms of post-traumatic stress disorder (McNally et al., 1995; Thome et al., 2020) as well as more recent work extending to alexithymia (e.g., Camia et al., 2020), personality disorders (e.g., Lind, Thomsen, et al., 2019), schizophrenia (Berna et al., 2016), and many populations (e.g., see Brien et al., 2021 for a review of autobiographical memory disruptions in autistic children, deaf, or hard of hearing children, children with attention deficit hyperactivity disorder, and children with a history of trauma). Successful interventions have been developed to reduce symptoms in clinical populations (e.g., Lind, Jørgensen, et al., 2019; Moradi et al., 2021) but more integration of findings from clinical samples to "traditional" autobiographical memory work would be beneficial as well (see Kredlow et al., 2022).

3.5 | Outcomes–context

Explicitly examining the functions of autobiographical memory recall has been a productive line of inquiry (Alea & Bluck, 2003) even if disagreement still remains as to how best categorize the ways in which autobiographical memories are used in everyday life (Rasmussen & Habermas, 2011). Caci et al. (2020) adapted the Thinking About Life Experiences (TALE) Questionnaire not just to an Italian sample but also within the environment of Facebook. By doing so, they were able to replicate the tripartite structure of self-continuity, directive-behavior, and social-bonding functions. Further, they demonstrated that, within some domains such as vacations, the former two functions were as evident in a "social" media situation as was the last.

3.6 | Participants–context

The complex interpersonal dynamics that influence belief in the accuracy of one's own autobiographical memory when confronted with new or contradictory information are well articulated in contemporary models (Scoboria & Henkel, 2020) but empirical tests among survivors of domestic abuse (to assess interpersonal dissonance factors) or among transgender individuals who have undergone social, legal, or medical transitioning (to assess intrapersonal dissonance factors) would be informative. Turning from phenomenology to content, the work of Štěpánková et al. (2020) showed how political transformations can influence cultural and social conventions which, in turn, influence personal memories.

4 | SIDE PLANES OF THE PYRAMID

4.1 | Events–outcomes–participants

Although most autobiographical memory research is focused on specific, one-time-only events, more investigators are widening their lens to determine how memories for unique events differ from memories of repeated events, in terms of content and phenomenology, across the lifespan (e.g., Waters et al., 2014). One such found that young adults' memories of unique events from childhood did not differ from repeated events in personal significance, but that the former were more vivid than the latter (Peterson et al., 2016).

4.2 | Events–outcomes–context

Early studies of sequential bilinguals (i.e., individuals who first learned one language and subsequently acquired a second language, typically via e/immigration resulting in a shift from first-language dominance to second-language dominance across time) demonstrated that accessibility of memories increased when the language used at retrieval was consistent with that present during encoding (Marian & Neisser, 2000). Simultaneous bilinguals (i.e., those individuals who acquired both languages at the same time, typically by being raised in multilingual homes and cultures) have similarly shown language-dependent recall (Altman, 2015). Related work has shown that emotional intensity is similarly modulated by language-dependent processing (Marian & Kaushanskaya, 2004; Schrauf & Rubin, 2004). Further study of multigenerational bicultural families would provide rich data on how transfer-appropriate processing effects present in autobiographical remembering situations.

4.3 | Events–participants–context

An individuals' intersectional identities of age, race, gender, religion, social role, and other factors influence the content and accessibility of autobiographical memories. For example, Zaragoza Scherman et al. (2015) found cross-cultural differences in the temporal distribution of emotionally valenced events. Further, successful retrieval of autobiographical memories can prime particular self-concepts (Charlesworth et al., 2016). However, spontaneous narratives do not always references to these characteristics, even when potentially salient and materially influential (e.g., Murphy, 2005). But, when cued to recall events particularly relevant to a given role (e.g., religious belief: Tungjitcharoen & Berntsen, 2021), participants are readily able to do so. These findings are consistent with models of autobiographical memory structure that emphasize the "self" as the organizing principle such as that of Conway et al., 2004 where a given "working self" is active during effortful search and retrieval of task-relevant autobiographical memories.

4.4 | Outcomes–participants–context

The effect of the aspects of identity discussed above can be reassessed by manipulating the situational context of recall in ways that are relevant to culturally-bound social roles. For example, Nakash and Brody (2007) showed how both power imbalances and the agentic versus communal emphasis associated with male and female genders, respectively, in the United States influence the autobiographical memories of prior leadership experiences of both men and women. Even in the absence of significant effects, designing a study attentive to the possibility of an interaction effect can be quite informative. For example, Rubin et al. (2016) found that participants' self-ratings, observers' ratings, and computer-based ratings of narrative coherence do not differ from one another nor does coherence as a construct differ among traumatic memories, very important memories, or highly positive memories whether compared within or between individuals with post-traumatic stress disorder and those without post-traumatic stress disorder (PTSD).

5 | THE ENTIRE PYRAMID

5.1 | Events–outcomes–participants–context

Perhaps not surprisingly, there are few studies ambitious enough to tackle the entire pyramid—but one bold example is the work of Wasti et al. (2021) investigating the functions of domain-specific memories that vary in emotional valence cross-culturally. Their results showed that positive work-related memories of Turkish participants were most likely to be associated with the self-continuity function of autobiographical memory. For the social function of autobiographical memory, there were main effects of valence and culture; Moreover, cultural differences distinct from those seen for the social function were observed for the directive function.

5.2 | Volume of the pyramid

The width of the pyramid base can represent the time frame of investigation. The time frame of typical autobiographical memory studies is months to years. For example, in diary studies, participants may be asked to recall events from the

same day or within the past week; In word cued studies, participants may be instructed to specifically exclude memories from the past year to reduce recency effects. But there is certainly exemplary research at longer and shorter intervals. In the more than 20 years since the distribution of autobiographical memories across the lifespan were first plotted (Rubin & Schulkind, 1997) hundreds of studies have further refined our understanding of childhood amnesia, the reminiscence bump, the power function of forgetting, and related phenomena. We have also seen recent work trying to adapt test–retest designs to extended time frames beyond the typical weeks or months that are most feasible, with the work of Hirst et al. (2015) to assess the consistency of flashbulb memories for the September 11th attacks being a prime example. The temporal window has also been extended beyond a single lifetime by those investigating the intergenerational transmission of autobiographical memories (e.g., Gu et al., 2020) or the phenomenon of vicarious memories more generally (Pillemer et al., 2015).

Smaller time frames have also assessed within autobiographical memory research. There is Brewer's (1988a, 1988b) foundational work randomly sampling ongoing experience of a small group of participants over the course of 2 weeks and then assessing their recollection of those events three and 6 weeks later. He demonstrated that infrequent locations (and infrequent events) were more likely to be recalled accurately than were common occurrences. More recent work by Laliberte et al. (2021) examining the reliability of autobiographical memory for spatial location by comparing retrospective memory reports to auto-captured data of global positioning system (GPS) location was able to similarly demonstrate that individuals confused days across weeks (e.g., this Tuesday for last Tuesday) and events at the same time across days (e.g., lunch Monday for lunch Tuesday) An elegant example of studying the four-way interaction at this smaller time scale is the work of Jaffe et al. (2019) using twice-daily diary recordings to demonstrate that intrusive memories of an assault show state-dependency effects due to intoxication at the time of the initial trauma.

The typical height of the pyramid is a medium-to-large sample of individuals (e.g., dozens to hundreds of participants). The characteristics of the populations to which these samples are meant to generalize are captured by the "participants" vertex—here I am focusing on the sample size more precisely. Here, too, there are creative examples of work being done at smaller and larger scales than that which is typically examined. For example, there have been a number of case studies of autobiographical memory meant to illustrate particular phenomena within an individual. Initial descriptions of highly superior autobiographical memory (Parker et al., 2006), severely deficient autobiographical memory (Palombo et al., 2015), and visual memory deficit amnesia (Greenberg et al., 2005) would all be examples of this. I also recently completed a study with myself as the sole participant (Talarico, 2021), adapting prior self-study research in autobiographical memory to a contemporary context.

At the larger scale, machine learning techniques have been applied to publicly available recordings of personal experience (i.e., blog posts) to assess the similarities and differences between retrospective and prospective episodic representations (Thorstad & Wolff, 2019). Other "big data" techniques seem ripe with opportunities for fruitful application to autobiographical memory research, especially within the context of social media applications designed to capture and report everyday experiences.

Finally, it would behoove us psychologists to seek the expertise of others in allied fields to fully realize the strengths of the tetrahedral model. Events associated with consumer behavior, for example, would benefit from collaboration with economists. The study of outcomes could be informed by practitioners within those modalities, like linguists or artists. Participant characteristics could be expanded by anthropological constructs and diversity of participant pools could be enhanced by partnership with community groups. Sociologists and social workers could similarly broaden our conception of context. The time frame of investigation could be lengthened and shortened by the tools of media studies and computer science and the techniques of data science and neuroscience can analogously expand and narrow the analytical lens.

Hopefully, this highly selective review has lead you to examples of innovative autobiographical memory research and this tetrahedral model of autobiographical memory research helps to invigorate your own research program.

AUTHOR CONTRIBUTIONS

Jennifer M. Talarico: Conceptualization (lead); writing – original draft (lead); writing – review and editing (lead).

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CONFLICT OF INTEREST

The author has declared no conflict of interest for this article.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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ENDNOTES

[1] Notably, discussion of autobiographical facts (i.e., self-related semantic information such as the date and location of one's birth) is excluded here, but the model could be readily extended to that construct.

[2] For example, research on the consequences of inhibition (i.e., intentional prevention of memory retrieval), denial (i.e., deliberate omission of an event [or detail thereof] during retrieval), deception (i.e., conscious construction of false events or introduction of incorrect details in event recall), confabulation (i.e., unconscious fabrication or distortion of events), and other biases in autobiographical remembering are not discussed despite each of these topics being the subject of extensive and expansive investigation.

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