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Review

Flashbulb memories

Olivier Luminet[1,2] and Aline Cordonnier[1]

This paper reviews the intriguing category of flashbulb memories (FBMs), which are detailed memories of the reception context. After examining the different measures and operationalizations of the construct, we present the arguments in favor and against labeling FBM as a special category of memory. Explanatory models underscore a) the complementary role of cognitive, emotional, and social factors, b) the development of direct versus indirect pathways and c) a temporal distinction between immediate and long-term responses. The paper examines brain underpinnings, applications to clinical groups, and individual differences in age and culture. The links with the collective memory and its interdisciplinary relevance are then developed.

Addresses
[1] Psychological Science Research Institute, UCLouvain, Louvain-la-Neuve, Belgium
[2] Fund for Scientific Research (FRS-FNRS), Brussels, Belgium

Corresponding author: Luminet, Olivier, Psychological Science Research Institute, UCLouvain, Louvain-la-Neuve, Belgium. (olivier.luminet@uclouvain.be)

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Flashbulb memories (FBMs) are detailed memories of the reception context where one learns about a surprising and consequential event [1]. While they can concern personal events, most research has focused on public occurrences (e.g., disasters, attacks, events involving public figures or sports). FBMs are believed to be consistent, vivid, and long-lasting, and people tend to be highly confident about the accuracy of their memory [2,3]. These distinctive features set FBMs apart from more conventional autobiographical memories and have driven research into their unique characteristics and mechanisms. FBMs, although being highly idiosyncratic with the type of reception event depending on each individual history, have a strong link with collective memory because they happen in a group context, ranging from the family to the world level (see section Links with Collective Memory).

Methods

Despite general agreement on the definition of FBMs, there is no consensus on the exact criteria required to classify a memory as such. Brown and Kulik's [4] foundational study relied on participants' self-reports of remembering the reception context. Today, researchers employ diverse methods to operationalize FBM formation and recall [for a review, see 5; see Fig. 1]. Measures of FBM **content** generally assess canonical categories (place, activity, informant, aftermath, own affect, others' affect) [6], using either lists of details, free recall narratives, or a combination. Although more demanding to analyze, free recall captures idiosyncratic details and reduces biases from inferential processing — the tendency to infer rather than remember [7].

Consistency over time is the most common operationalization of FBMs. It is typically measured using an index that sums the consistency scores across canonical variables [8], though some studies apply weights based on relevance or combine these with free recall [5]. **Vividness** and **confidence** are also frequently measured, yet only 20 % of studies assess all three dimensions. This represents a limitation, as confidence is only weakly correlated with consistency and vividness, suggesting the need for a multi-dimensional approach [9].

Regarding methodological aspects, most FBM studies rely on a single group of participants, with relatively few comparing groups that differ in involvement (e.g., nationality, religion, fandom). The main objective is generally to examine how FBMs change over time, though most studies include only one retest, limiting insight into long-term change. To increase validity and reduce consolidation effects, initial reports (Time 1) are collected shortly after the event (Time 1), sometimes even on the same day [9]. Follow-ups (Times 2, 3, …), usually spaced one to two years apart, are compared and evaluated by judges to Time 1 to assess consistency. Although consistency generally declines over time, longer follow-ups suggest that memories may stabilize. For instance, Hirst et al. [10] found almost no change in 9/11 FBMs between three and ten years post-event in a U.S.

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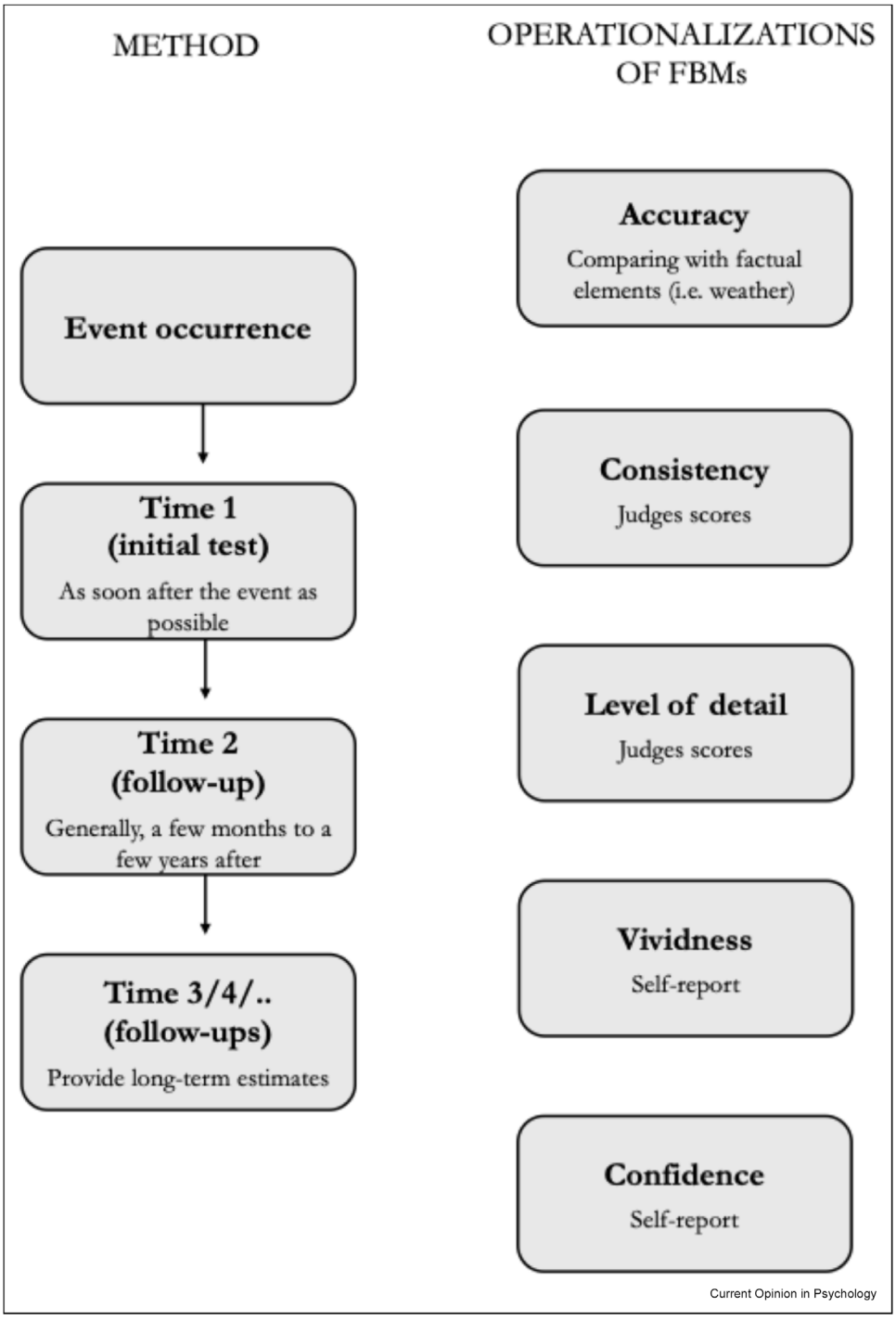
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Figure 1



Representations of the method and the various operationalizations of flashbulb memories. Note. FBM = Flashbulb memory.

sample. This suggests that reconstruction mainly occur shortly after the event, followed by a convergence towards a shared representation shaped by social identity. However, more studies are needed to generalize these findings.

A special status of memory?

In the first decades of research on FBMs, there were intense debates about the status of FBMs. Brown and Kulik's [4] foundational paper used the photographic metaphor to argue that FBMs form a special class of

memories, highly persistent and consistent over time. In contrast, other studies concluded that FBMs are neither immune to forgetting nor unusually consistent (e.g., Refs. [11,12]).

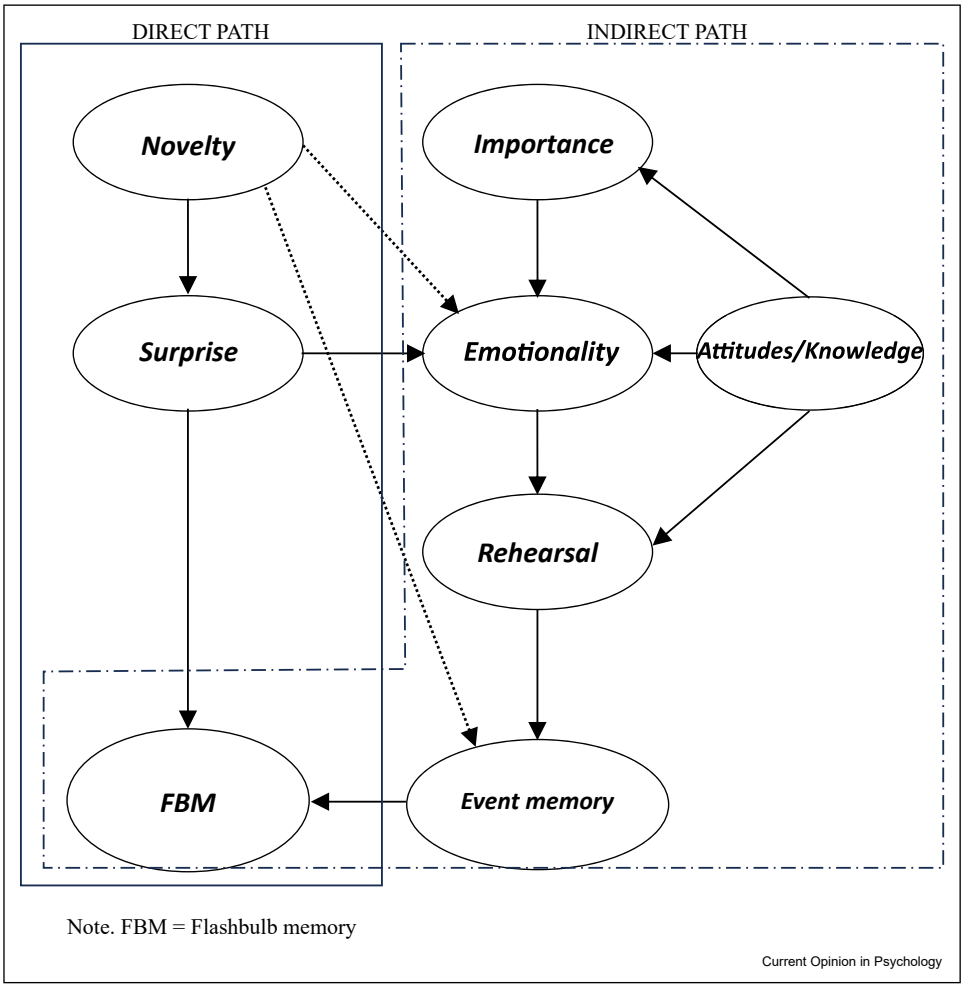
Assigning a label of "special memories" to FBMs depends first on their operationalization. When using vividness or confidence as criteria, FBMs clearly stand out, with people maintaining high levels even decades after the event [3,13]. Another explanation for these inconsistencies is the possibility of two stages in memory consistency: an initial decline followed by long-term stability [10,14], consistent with the notion of permastore — stable retention after an initial decline [15].

Future research should examine multiple operationalizations of FBMs to identify possible dissociations and evaluate how they evolve over time. In the short term, consistency may decline while vividness and confidence remain high. People may feel their memories are accurate because they remain highly vivid, even as details shift — often unknowingly — through discussions and media exposure (e.g., Refs. [16,17]). Over time, a shared understanding of the event and its meaning tends to emerge, shaping FBMs through social consensus (see Fig. 2 and section Explanatory models).

Explanatory models

Theoretical models explaining FBM formation emphasize a) the complementary role of cognitive, emotional, and social factors; b) the development of direct and indirect pathways; and c) a temporal distinction between immediate and long-term responses [8,17,18]. Much of the emotion and memory literature tends to reduce the role of emotions to valence alone [19]. FBM research is distinctive in incorporating psychological approaches to emotion, including appraisals and the social communication of emotions.

Figure 2



Model for the formation of Flashbulb memories [from 18]. Note. FBM = Flashbulb memory. Full lines represent pathways tested by the initial model [8], dotted lines represent pathways found in later versions of the model [18].

Various models have been tested. Structural Equation Modelling (SEM) — which compares theoretically derived models with empirical data to assess model fit has — applied to FBM have clarified which factors are involved and how they interact. SEM approach is designed to compare a theoretically established model with empirical evidence to assess the degree to which data do fit the theory [17]. The results of a SEM approach cannot be considered as the main support for advocating the superiority of a model over another one. Conclusions about preferable models accounting for the formation of FBMs can only be drawn from simultaneously considering theoretical accounts and statistical information [17]. The most predictive model is the emotional-integrative model, initially developed by Finkenauer et al. [8] and then adapted by Luminet and Curci [18]. The direct pathway begins with novelty appraisal, triggering an emotional state of surprise, which directly leads to stronger FBMs. The indirect pathway starts with appraisals of importance, both personal and collective, which trigger higher emotionality. These stronger emotional reactions activate rehearsal processes, including social sharing, internal thoughts, and media engagement. Finally, rehearsal indirectly affects FBM through memory of the event. An additional latent variable — attitudes and knowledge — influences importance, emotionality, and rehearsal. Later tests of the model (e.g., Ref. [18]) have identified additional path, such as from novelty to emotionality and event memory (see Fig. 2).

Social psychology also contributes by underscoring the role of social identity — how people define through group membership (e.g., Ref. [20]). Being part of a group threatened (physically or morally) by an event strengthens FBMs components [21], but only levels of social identifications directly relevant to the event can enhance FBMs indicators [9]. This highlights the need to consider a wide range of potential groups and strength of social identification. Temporary surges in social identity during key events can foster cultural cohesion and shared collective memory [22,23]. Some events even have the capacity to guide social categorization and reinforce social group membership. A recent study showed that people may identify as American partly because they possess a FBM of 9/11, and those lacking a detailed 9/11 FBM may feel less American [24].

Neuroimaging and clinical studies

Neuroimaging and clinical studies further highlight the role of emotion in FBMs. While brain activation related to autobiographical memory has been widely studied, only two neuroimaging studies have focused on FBMs in healthy individuals. Sharot et al. [25] compared 9/11 memories to summer autobiographical memories using fMRI, finding greater left amygdala activation (a region associated with emotional processing) during 9/11 recall—particularly in those near the World Trade Center. However, they did not explicitly target FBMs. More recently, Metternich et al. [26] directly contrasted event and FBM recall, showing that FBMs activated typical autobiographical memory regions, with emotional intensity associated with more bilateral activation, including the right amygdala and hippocampus.

Clinical studies complement this limited neuroimaging evidence and reinforce the amygdala's crucial role. Patients with temporal lobe epilepsy showed impaired FBM recall, especially those with amygdalar damage affecting the non-language dominant hemisphere [27]. Similarly, Alzheimer's patients—often showing amygdala atrophy—forget the details of new FBMs more rapidly [28]. While access to older FBMs is also impaired, patients can still recall core details at levels comparable to healthy controls for FBMs from the reminiscence bump period [29]. Conversely, the relative spared amygdala in Korsakoff's syndrome may explain retained emotional memory in these individuals [30,31].

Individual differences

Although FBMs are a widespread response to certain key triggers, their amplitude can vary with different individual differences such as age or culture. Like other types of memory, **age** influences FBMs formation and retention. A meta-analysis found that older adults reported fewer details and had less consistency over time than younger adults [32]. Researchers found no age-related differences in factors like investment, importance, surprise, emotionality, and overt rehearsal, suggesting the memory differences are not due to differential encoding processes.

Wang and colleagues (e.g., Ref. [33]) developed a culturally embedded model of FBM, emphasizing that **cultural** variables shape how we perceive, feel and remember events. The cultural context influences which events are perceived as salient, important, and significant, thereby affecting attention to certain types of events and their reception contexts. For instance, collectivistic cultures, which prioritize group affiliation over individual response, may attribute less personal importance to public events than individualistic cultures, while it is less likely that national importance would differ. Similarly, emotion may also have a reduced impact on memory in collectivistic cultures where emotion is less encouraged [34]. Furthermore, collectivistic cultures are less likely to promote sharing of important and emotional events, which can directly impact FBM. For instance, Stone et al. [35] found that rehearsal was independently associated with greater FBM confidence and event memory accuracy in Australians but not in Japanese participants when recalling their Prime Minister's resignation. Other individual differences are worth examining such as subjective

severity (for an application to the Covid-19 context, see Ref. [36]).

Links with collective memory

Historical factors can influence how individuals use FBMs and public event memories to construct personal and generational identities. Flashbulb memories act as a bridge between individual experience and collective memory, which are individual memories that bear on collective identity [37]. While rooted in autobiographical memory, FBMs connect individuals to events of shared significance, aligning private moments with collectively meaningful narratives [38,39]. A mundane experience like watching television at home becomes part of a shared story that reinforces group identity and social belonging [24,40]. Furthermore, these personal memories are often associated with event memories — memories of the details surrounding the event. While event memories generally focus on objective elements, they may also become embedded in collective representations that reflect the event's meaning for the broader community. As Hirst and Meksin [39] note, these collective memories evolve over time, based on their function for the community, while FBMs provide a personal anchor that fosters resonance and connection among community members.

Interdisciplinary relevance

Implications of FBM research extend beyond psychology. For instance, the study of FBMs is a privileged domain of collaboration between psychology and the humanities, such as history and cultural studies [38]. Psychologists, by using historical sources, can investigate FBM related to distant events. Conversely, historians can better understand how individuals remember public events, and the meaning they attach to these memories. For psychologists, examining historical archives offers methodological advantages. They grant access to spontaneous FBMs accounts, reducing experimental demand that could influence or bias memory retrieval. Additionally, these events may retain verifiable details that can be tested for the most demanding criteria: accuracy. Weather reports are a unique way to examine the contextual memories associated with distant public [41]. For instance, many Belgians accurately remembered the unusually sunny weather on the 1918 Armistice, aligning with official meteorological reports [13]. These results support the notion that vivid, accurate memories can persist over the long-term, especially when tied to distinctive contextual features.

FBMs studies can also be of relevance in legal contexts. When no factual evidence is available to the court, memory reports become critical, and triers of facts generally assess witness credibility based on detail, consistency and confidence. However, the literature on FBMs can increase legal system workers' awareness of the naïve misconception that memory functions as an accurate and permanent storage system [42]. Memory researchers should warn jurors and legal professionals about the persuasive effects of highly confident witnesses while demonstrating how reconstructive processes shape the formation of narratives concerning vivid and detailed memories. The goal is to help legal actors develop a more critical assessment of witness evidence.

Conclusions

The field of flashbulb memories reflects the intriguing observation that we sometimes have extremely detailed and vivid memories of the reception context surrounding significant events. However, because FBM research is highly dependent of the occurrence of public news events that are both surprising and consequential, the field remains limited, despite nearly 50 years of research. Current findings highlight the need to consider cognitive, emotional, and social factors together, employing a multi-dimensional assessment that includes several dimensions such as consistency, level of detail, vividness, and confidence. Greater collaboration with social sciences and humanities is encouraged to better understand the circumstances under which FBM emerge, to benefit from complementary methodological approaches, and to expand the range of applications.

Author statement

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Declaration of competing interest

The authors declare no conflict of interest.

Data availability

No data was used for the research described in the article.

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- • of special interest
- •• of outstanding interest

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Further information on references of particular interest

5. •• This review provides an in-depth analysis of the different methods and measures that have been used up until now, reflecting on best-practices for the future.

9. This paper is unique in having the first data collection on the day the
•• event happened, thus limiting reconstruction biases. It also involves a multi-measure assessment of FBMs (consistency, vividness, and confidence) and of social identity (local, national, supra-national).

19. This papers emphasizes the need for memory research to
• consider more elaborated approaches of emotion that includes for instance appraisals together with a multi-component approach of autobiographical memory measurement.

21. While this paper does not solely focus on FBM, it highlights the
• important role of social identity as well as media rehearsal on memory of consequential events. More importantly, the paper also shows a link between FBM and future thinking.

24. This paper demonstrates that people expect certain events to be
• remembered as flashbulb memories by members of their social group. Thus, it highlights the social role played by FBMs.

29. This paper reviews the literature on FBM in Alzheimer's disease
• and shows that individuals with AD can retain quite detailed episodic memories over long temporal delays when cued for FBM from their younger life periods.

38. This opinion paper explores the benefits of interdisciplinary
• perspective – particularly cultural studies and psychology – to shed new lights on the phenomenon that is FBM.