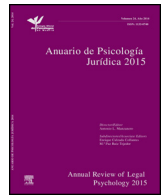




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## Age-related differences in the phenomenal characteristics of long-term memories of March 11, 2004 terrorist attack

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### ABSTRACT

The objective of this study was to explore age-related differences in the phenomenal characteristics of long-term memories of the terrorist attacks that took place in Madrid (Spain) on March 11, 2004. One hundred and ninety-six individuals participated in this experiment: 92 were 9.60 years old on average and 104 were 39.41 years old on average at the time of the event. To evaluate their real memories of the event twelve years later, the Phenomenological Questionnaire on Autobiographical Memory was used. Differences were shown between the two groups in terms of memory quality, emotions associated with the event, and accessibility of the information remembered. Results were also represented using high-dimensional visualization (HDV) graphs, supporting the assertion that long-term event memories have different characteristics depending on the age of the individual at the time the event took place. Memories in adult people meet the criteria to be considered flashbulb memories, while in the case of the younger people this kind of memory does not seem to emerge. Young people are probably less capable of evaluating the consequences of an event which results in reduced emotional arousal and a different elaboration of the event memory in comparison to older adults.

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## Diferencias según la edad en las características fenomenológicas de los recuerdos a largo plazo del atentado del 11 de marzo de 2004

### RESUMEN

El objetivo del presente estudio fue analizar las diferencias, relacionadas con la edad, en las características fenomenológicas del recuerdo a largo plazo de los atentados que tuvieron lugar en Madrid (España) el 11 de marzo de 2004. Participaron 196 personas: 92 con una media de 9.60 años y 104 con una media de 39.41 años en el momento del suceso. Para evaluar su recuerdo real del suceso doce años después, se utilizó el Cuestionario sobre Características Fenomenológicas de Recuerdos Autobiográficos (CCFRA). Se encontraron diferencias significativas entre ambos grupos respecto a la calidad del recuerdo, su accesibilidad y las emociones asociadas al suceso. Los resultados fueron también representados utilizando gráficos de visualización hiperdimensional, apoyando la idea de que el recuerdo de hechos a largo plazo tiene patrones distintos dependiendo de la edad de la persona en el momento del suceso. Solo el recuerdo de las personas de mayor edad cumpliría criterios suficientes para generar recuerdos vívidos, mientras que en el caso de los más jóvenes no parece generarse este tipo de memoria. Las personas más jóvenes son probablemente menos capaces de evaluar las consecuencias de un suceso, lo que provocará una menor activación emocional y una forma distinta de elaborar la información del suceso, en comparación con personas de mayor edad.

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Over the last decade, several European capital cities have suffered attacks that have severely affected their populations. Istanbul and Nice were recently attacked. Brussels, Paris, London, and Madrid were attacked before. The study of how people (especially the most vulnerable) remember these events over time can be useful to prevent the psychological damage associated with victimization (Muñoz, 2013). Memories of traumatic events are the main symptom of diseases such as post-traumatic stress disorder. Often these memories are presented as especially vivid resulting in what is known as flashbulb memory (FBM).

FBMs are detailed and vivid memories that are stored on a single occasion, usually associated with a significant event, and retained for a lifetime (a type of autobiographical memory). The event does not necessarily need to be a major disaster; FBMs can also arise from events of personal importance (hearing of a family member's death or witnessing an unusual event) that exceed critical levels of surprise and consequences (Brown & Kulik, 1977; McCloskey, Wible, & Cohen, 1988), in other words, emotionally arousing events. To generate a FBM, the event must be new and unexpected and must elicit surprise. The emotional content of the event will enhance the strength of the memory formed. FBMs are deeply determined by the reconstructive processes of memory and are prone to decay, like any other type of memory. It is possible for both positive and negative events to produce FBMs. Brewer (1986) argued that FBMs are a "special" form of personal memory. According to him, the high level of recall associated with FBMs may be understood as the joint product of factors such as emotion, rehearsal, and distinctiveness.

Brown and Kulik (1977) argued the existence of a "special" memory mechanism that creates a permanent record of the details and circumstances surrounding an event. They proposed a theoretical model for FBM formation and maintenance. As stated above, to trigger FBM formation, an event must be new and unexpected and must elicit surprise. No attention is paid to common, routine events, nor do they lead to surprise; thus, it is the novelty of the event that determines the level of surprise. The event is then evaluated in terms of personal consequences or importance which, from Brown and Kulik's perspective, equates to emotional arousal. Both surprise and consequences are considered necessary for FBM formation.

Not all researchers have the same view of the nature of FBMs (see Wright, 2009; Wright and Gaskell, 1995). Some authors even argue that these memories are just a type of traumatic or super-episodic memory, others point out that these memories are a potent type of autobiographical memory and that they are formed after a non-ordinary event, are more vivid, include more contextual details, and are remembered with more confidence than other types of autobiographical memories (Talarico & Rubin, 2003).

Flashbulb memories are a type of memory characterized by high accessibility and confidence in the accuracy of what is remembered, "as if it had just happened," long after the events occurred. In the formation and maintenance of this type of memory, the consequences derived from the event play a fundamental role (Curci, Lanciano, Maddalena, Mastandrea, & Sartori, 2015). For methodological reasons, studies are usually made from public events, common for many individuals, but this is not a characteristic that the event must necessarily have (Talarico & Rubin, 2007). These memories can occur both after positive and negative events, because the emotional intensity of the event is a better predictor of the formation of flashbulb memories than its valence, according to these authors.

The terrorist attacks that took place in New York on September 11, 2001 satisfy, beyond question, the event criteria for FBM production. Many people are able to recall in detail when and how they heard the news, what they were doing, events that happened the day before or after, the conversation they had, the weather outside, the music on the radio, and so on. For this reason, several

studies analyzed characteristics of the memories of this event (Conway, Skitka, Hemmerich, & Kershaw, 2009; Hirst et al., 2015; Kvavilashvili, Mirani, Schlagman, Erskine, & Kornbrot, 2010; Lee & Brown, 2003; Luminet et al., 2004; Pezdek, 2003; Schmidt, 2004; Talarico & Rubin, 2003, 2007; Tekcan, Ece, Gülgöz, & Er, 2003; Wolters y Goudsmit, 2005) and we have also chosen a similar event in the present study (11 M attacks that took place in Madrid in 2004).

Most studies confirmed the characteristic features of FBMs. For example, Schmidt (2004) found that central facts are remembered with more consistency than peripheral facts, whereas memories of this event contain many errors owing to the improper reconstruction of events. Those participants who had been most emotionally affected showed worse memory and more inconsistencies in peripheral details than those who were less emotionally affected.

In a longitudinal examining FBM and event memory retention after a lengthy delay, Hirst et al. (2015) demonstrated that confidence remained high throughout a 10-year period, even with marked levels of forgetting. Of the 5 factors examined in their study (attention to media, amount of discussion, residency, personal loss and/or inconvenience, and emotional intensity), none had any influence on FBM consistency. They observed that, in terms of function, external influences served to correct memories rather than distort them. These authors distinguished between FBM that would refer fundamentally to the memory of the circumstances in which the news about the facts was received, and memory for flashbulb events which refers to the memory of events that give rise to a FBM. In any case, not all memories of events of great social or emotional transcendence would give rise to the formation of FBMs. Thus, some authors speak generically of event memories (Hirst et al., 2015).

### Is There a Special Mechanism for FBMs?

There is a great debate about whether the formation of FBMs follows different processes than the formation of other types of memories. Tinti, Schmidt, Testa, and Levine (2014) conducted a study to try to delve into this topic. They proposed to test two hypotheses: a) that event memory and FBM have different determinants and b) that event memory is not necessarily a direct causal determinant of FBM. For this matter, they took as reference the memory of an important and positive event, the Italian victory in the 2006 World Cup Football Championship. The results showed significant differences in both types of memory, so they concluded that each type of memory is originated following different processes. This finding also suggests that the processes involved in maintaining memory also differ: event memory was maintained by mere exposure to the media, whereas FBMs could only be maintained after thinking and discussing with others about the event experienced. Therefore, these authors showed that both types of memory did not have to be related. Furthermore, according to their model, the only direct determinant in maintaining FBMs was the recovery of the personal circumstances surrounding the event, while maintaining the event memory depended on prior knowledge and exposure to the media.

In contrast, Kraha, Talarico, and Boals (2014), taking as reference a positive event for the Americans (the murder of Osama Bin Laden), carried out a study whose results showed that the memory of a positive event is not so vivid, nor is it remembered with as much confidence as a negative event. According to these authors, these results provide further evidence against the existence of a special memory mechanism involved in the formation of FBMs.

Also, Curci et al. (2015), taking as reference the resignation of Pope Benedict XVI, analyzed the memory of three groups with

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