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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.

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

Palabras clave:
Memorias vívidas
Memoria autobiográfica
Trauma
Terrorismo
Testimonio
Visualización hiperdimensional

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

different levels of religious involvement (practicing Catholics, non-practicing Catholics and Evangelists) and concluded that there was a significant difference in the processes that are activated when a person is asked to remember the original news or the context in which he/she received the news.

Phenomenal Qualities of Self-reported Memories

Memory of a complex event is affected by many variables. These variables can be grouped on the basis of their influence on information encoding, retention, and recovery. Two important aspects of autobiographical memory are the qualitative (or phenomenal) aspects of memory and the subjective point of view that leads to remembering (Argembeau, Comblain, & Van der Linden, 2003; Larsen, 1998). The phenomenal characteristics (amount of sensory detail or clarity of location, for example) give the individual the feeling that a particular mental representation is a memory of a real event, as opposed to an imagined event or any other kind of mental representation (Johnson, Hashtroudi, & Lindsay, 1993). In addition, the viewpoint of recall (Crawley & French, 2005; Robinson & Swanson, 1993) is one of the characteristics that indicate the degree of involvement of the subject in the event, as well as the deterioration of the quality of the memory: greater involvement and time delay tend to produce memories from an observer perspective rather than from a field perspective.

To examine the phenomenal characteristics of emotional memories, several studies have used an array of questionnaires that enable specific memory features to be explored (for a review of these studies, see Manzanero & Recio, 2012). One of the earliest studies looked that has at the phenomenal characteristics of memories of negative events (Tromp, Koss, Figueredo, & Tharan, 1995) concluded that, compared to other types of memory, these memories were less clear and vivid, less well remembered, thought about and talked about more, and had less visual detail. In contrast, another study (Byrne, Hyman, & Scott, 2001) found that memories of negative events differed only in the sense that they were reported as having less sensory information.

In any case, the characteristics of memories of traumatic events may depend on cultural and/or resilience factors, as shown in a recent study assessing positive and negative memories amongst the people of the Gaza Strip (Manzanero, López, Aróztegui, & El-Astal, 2015). Thus, the same negative event could be remembered in a vivid and consistent manner or, conversely, in a fragmented manner or perhaps not at all.

Age Influence on Memory

Only a few studies have examined the phenomenology of negative memories in children and adolescents. The few existing related to phenomenal qualities and ageing have resulted in mixed findings: some of them have found age-related effects in the vividness or specificity of the details remembered (Denver, Lane, & Cherry, 2010; Kensinger, Krendl, & Corkin, 2006) and others have not found any age-related differences (Conway et al., 2009; Kvavilashvili et al., 2010).

In a study of the developmental aspects of FBMs, Winograd and Killinger (1983) asked 338 high school and college students to state their personal memories surrounding 7 major events. These subjects were 1-7 years old at the time of the event and, for the most well-known events, recall was shown to improve steadily with increasing age. Winograd and Killinger argued that the differences found between the college students and the high school students could be attributed to their neurological immaturity or their inability either to perceive the importance of the event or to be surprised by it.

Warren and Swartwood (1992) found that, among children who were in kindergarten through eighth grade at the time of the space shuttle Challenger explosion, only those who reported a high emotional response to that event could remember a lot about it two years later. Using data gathered at two weeks, two months, and two years and taking all the children into account, with the varied intensity of their emotional responses, they found that a great deal had been forgotten or distorted over time.

On the other hand, there is some variability in the phenomenology of children's memories of negative events, as shown in some studies of sexually abused children (Burgess, Hartman, & Baker, 1995) and of young children who had experienced an earthquake (Azarian, Lipsitt, Miller, & Skriptchenko-Gregorian, 1999). Kensinger, O'Brien, Swanberg, Garoff-Eaton, and Schacter (2007) suggested that there is reason to believe that young adults retain more vivid and detailed memories of a negative experience than of a positive experience. Other studies have found that older adults tend to process information with a particular focus on their affective response to the information (Comblain, D'Argembeau, & Van der Linden, 2005), which could favor the preservation of memory with emotional relevance, specifically.

Cohen, Conway, and Maylor (1994) and Kensinger et al. (2006) found significant age effects for memories of the resignation of Margaret Thatcher and of the space shuttle Columbia explosion, respectively.

The present work was designed with the objective of exploring age-related effects on the phenomenal characteristics of long-term memories. It was hypothesized that people who at the time of occurrence of the events were of an age that did not allow them to consider the transcendence of the event would generate a memory of that event that would not comply with the characteristics of a FBM.

Method

Participants

One hundred and ninety-six people participated in this cross-sectional study, all of whom were living in Madrid at the time of the events, were aware about the attacks, and were over 8 years old in 2004. In order to select the sample, students from the first two years of the Psychology Faculty of the Universidad Complutense de Madrid and their relatives (parents, uncles, etc.) were asked to participate voluntarily in the study. In this way, we would control the effect of factors beyond the study object, maximizing the homogeneity of the samples, since each younger participant would have an older relative of their own environment. Their participation was not paid in any way.

Subsequently, the participants included 92 students (68 women), who were at the time of the event 9.60 years old on average ($SD = 2.44$), and 104 relatives of these students (65 women), who were at the time of the event 39.41 years old on average ($SD = 9.46$).

In general, participants with neurological treatment due to pathologies that affect their cognitive abilities were excluded (it was informed in the instructions that persons with this characteristic could not participate in the study, because their memory of the facts could be affected).

Procedure

The event examined was the terrorist attacks that took place in Madrid (Spain) on March 11, 2004. These attacks affected four trains, with ten simultaneous explosions in which 191 people died and 1,858 people were injured.

Participants were asked to recall the event twelve years after the attacks, and then complete a questionnaire to indicate how they remembered the attacks. They were informed that the experiment sought to study the characteristics of memories regarding personal experiences. It was not necessary to provide the narratives either verbally or in writing. The questionnaires were filled in anonymously, requesting only the necessary data to characterize the sample (age and gender).

The Phenomenological Questionnaire for Autobiographical Memory (Manzanero & López, 2007) was used for data collection (see Appendix A). The psychometric properties of this questionnaire in the present sample, considering the 32 items that were included, were the following: the Cronbach's alpha was .901; inter-item correlation was .220; corrected item-total correlation found exceeded .35 value in all of the items except for Implication (.27), Valence (-.24), Color (.17), Haptic Information (.30), Taste (.23), Problems to Talk about the Event (.15), Previous Events (.32) and Recall Perspective (.23), although in none of them the reliability was modified if those items were removed.

Results

Table 1 shows mean scores for each memory variable as a function of age. A *t*-test (2-tailed) was conducted to assess the effects of age on each memory characteristic. This analysis revealed a number of significant differences in the dependent variables analyzed, for many of which the scores obtained by the adult group were higher than the scores obtained by the young group. These findings are consistent with the idea that there is a relationship between an individual's memory of an event and his/her age when the event took place. The results show that the characteristics of memories for flashbulb events vary depending on the individual's age at the time of the event.

The variables that appeared to be affected were the following:

Memory quality: definition, vividness, detail, sensory and contextual information, fragmentation, comprehension, complexity, doubts, and recall perspective were evaluated in studying this variable. Results show that young memories of the attacks had less definition, less vividness, fewer details, less fragmentation, less visual, auditory and odor information, and were less complex and understandable. They also reported a shorter duration for the event and had worse memory of the place where the event happened and the exact year and hour when it occurred. When shift in perspective is considered, adults tend to remember the event in an observed perspective more than younger people. No effects on sensorial characteristics about color, haptic, and taste were found because of floor effects. The only variable in which the young group has obtained a higher score is in doubts about their own memory.

Associated emotion: in evaluating associated emotions, the variables taken into account were implications, valence, intensity of feelings, relevance, feelings during the event and now, and thoughts at the time of the event. The young group gave the same implications to the event as the adults but had less negative valence, intense feelings, and less relevance associated with the event. Compared to the adult group, they also tended to have less memory of their thoughts and feelings at the moment the event took place, as well as at the present time.

Accessibility: data showed that the young group would tended to talk and think about the event on fewer occasions and made less effort at retrieval. Also, young people remembered worse the related events that took place before and after the attacks. No differences were found between the two groups regarding problems to talk about the event.

Table 1
Sample Size, Mean, Standard Deviation, and t-test Values for each Dependent Variable.

		Young			Adult						
		n	*M*	*SD*	*n*	*M*	*SD*	*t*	*df*	*p*	*d'*
Quality	Definition*	92	3.94	1.71	104	5.64	1.27	-7.76	166	.000	1.11
	Vividness*	92	3.86	1.65	104	5.36	1.41	-6.81	194	.000	0.97
	Detail*	92	3.41	1.59	104	4.81	1.48	-6.40	194	.000	0.92
	Fragmentation*	91	3.00	1.43	104	4.58	1.63	-7.16	193	.000	1.02
	Comprehension*	92	3.79	1.66	104	4.52	1.94	-2.87	194	.005	0.41
	Complexity*	92	3.91	1.65	104	4.77	1.72	-3.54	193	.000	0.51
	Doubts*	92	4.03	1.68	104	2.87	1.64	4.87	194	.000	0.70
	Recall Perspective*	92	3.78	2.24	104	4.45	1.91	-2.26	194	.025	0.32
	Color	92	4.98	1.74	104	5.07	1.88	-0.34	194	.737	0.05
	Visual Info*	91	4.62	1.72	104	5.81	1.43	-5.21	175	.000	0.75
	Sound*	92	3.37	1.85	104	4.35	2.10	-3.47	194	.001	0.50
	Odor*	92	1.37	0.92	104	1.78	1.56	-2.29	170	.023	0.33
	Haptic Info	92	1.35	0.73	104	1.51	1.25	-1.12	167	.263	0.16
	Taste	92	1.14	0.52	104	1.37	1.07	-1.97	154	.051	0.28
	Where*	92	5.43	2.00	104	6.34	1.23	-3.80	148	.000	0.54
	Duration*	91	3.93	1.75	104	5.32	1.86	-5.35	193	.000	0.77
	Year*	92	4.70	2.31	104	5.57	1.80	-2.91	171	.004	0.42
	Hour*	92	4.12	2.12	104	5.57	1.65	-5.28	172	.000	0.76
Associated Emotions	Implications	92	5.75	1.78	104	6.14	1.56	-1.65	194	.101	0.24
	Valence*	92	2.01	1.20	104	1.60	1.37	2.17	193	.031	0.31
	Intensity of feelings*	92	4.64	1.42	104	6.24	1.26	-8.28	183	.000	1.18
	Relevance*	91	4.52	1.51	104	5.93	1.23	-7.06	174	.000	1.01
	Feelings during event*	92	4.23	1.88	104	5.99	1.28	-7.70	194	.000	1.10
	Feelings now*	92	4.02	1.56	104	5.27	1.41	-5.90	193	.000	0.84
	Thoughts during event*	91	3.55	1.89	104	5.49	1.65	-7.68	194	.000	1.10
Accessibility	Effort to recall*	92	4.44	1.84	104	5.82	1.24	-6.07	157	.000	0.87
	Problems to talk about	92	3.10	1.76	104	3.26	1.90	-0.58	194	.565	0.08
	Previous events*	92	3.60	2.11	104	4.28	2.08	-2.24	192	.026	0.32
	Post-events*	92	4.04	2.02	104	5.03	1.84	-3.55	185	.000	0.51
	Multiple retrieval*	92	3.87	1.55	104	4.44	1.43	-2.64	193	.009	0.38
	Talking about*	92	4.44	1.63	104	5.21	1.54	-3.39	194	.001	0.48

Note. *t*-tests statistics and degrees of freedom were adjusted according to Levene's test results with $p < .05$.

* $p < .05$.

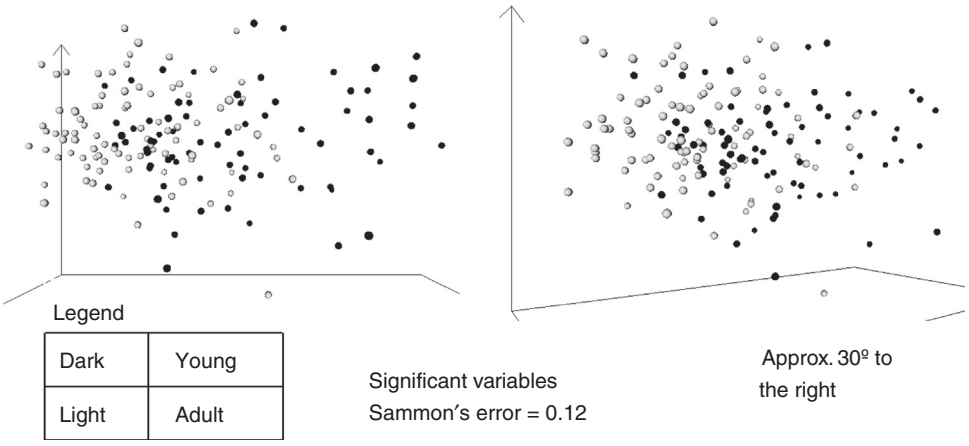

Figure 1. HDV graph of variables showing significant statistical differences.

HDV Graphs

HDV graphs facilitate the visualization of complex data. This technique displays all the data at once, enabling researchers to graphically explore in search of data distribution patterns (Manzanero, El-Astal, & Aróztegui, 2009; Manzanero, López, & Aróztegui, 2016). The graphs are similar to scatter plots. The different variables corresponding to a subject's responses on questionnaire items are represented as a point in a high-dimensional space. When there are more than three variables, as in this study, mathematical dimensionality reduction techniques are used to build a 3D graph (Buja et al., 2008; Cox & Cox, 2001). Each point in the hyperspace has a distance to each of the other points. Multidimensional scaling will search 3D points, preserving the distances between points as much as possible (Barton & Valdés, 2008). Sammon's error (Barton & Valdés, 2008) is used to calculate the 3D transformation error.

3D points are represented using Virtual Reality Modeling Language (VRML). VRML files allow graphical rotation and exploration to facilitate graphical data analysis. 3D graphs permit visual exploration of the data in search of its distribution patterns.

Figure 1 shows two different views of the graph obtained using the 3D points, which were made from points for the 24 dimensions (in the mathematical sense) corresponding to those variables measured where significant differences were shown. The complete graph shows 3,749 data points in compressed form. Sammon's error was 0.12, suggesting that it should be interpreted with caution.

Upon exploration of the graph, the following may be observed:

1. There is considerable overlap of the data for the two groups.
2. Data for the adult group is displaced to the right of data for the young group.
3. The two groups show a similar data distribution (cone-shaped with apex pointing to the right).
4. Data for the young group shows higher dispersion than data for the adult group.

The data overlap (observation 1) is consistent with theories presenting FBM development as a process that is continuous and similar between young people and older adults. The displacement to the right of data for the adult group (observation 2) is consistent with theories of FBM development as changing gradually with age. The similarity of data distribution (observation 3) is also consistent with theories presenting FBM development as a process that is continuous and similar between young and adults.

The variability of the data is observed and used to describe and test hypotheses (see Appendix B). The reduction in data variability with increasing age (observation 4) could be due to a more reliable memory process in older adults. This is consistent with a theory of FBM development in which young adults gain in reliability, accuracy, and stability of recall as they grow toward adulthood. The ratio of variability obtained for variables in which significant differences were shown was rv = .0969. Expressed as a percentage, this means that, in comparison to the young adults, older adult performances were 9.69% less variable. The older adults appeared to be more reliable. On the other hand, the improvement in reliability, as seen through variability reduction, is significant but not extreme.

Discussion

The purpose 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.

Differences between the two groups (adults and youths) were found in terms of memory quality, emotions associated with the event, and accessibility of the information remembered. The adults group obtained higher scores than the younger group on the following variables: definition, vividness, amount of detail remembered, fragmentation of the retrieval event, comprehension, complexity, viewpoint of recall, visual information, sound, odor, where and when the event took place, duration, year and hour when event happened, valence, intensity of feelings, relevance, feelings during the event and now, associated thoughts, effort to recall, remembering related events that took place before and after the attacks, multiple retrieval, and problems to talk about the event. On the other hand, the young group obtained a higher score only in one variable: doubts about their memories of the event. As the HDV graphs show, there was less quantitative variability within the adult group (differences).

Many empirical studies have demonstrated the existing relationship between the amount of retrieval of a FBM and the capacity to provide a detailed and confident report, after a long time period (Bohn & Bernsten, 2007; Conway et al., 1994; Curci & Luminet, 2006, 2009; Finkenauer et al., 1998; Talarico & Rubin, 2003, 2007; Tinti et al., 2014). For this reason, the great importance that retrieval has in maintaining this type of memories becomes obvious.

In a review by Gordon, Baker-Word, and Ornstein (2001) regarding past experiences in children, results showed that simple exposure to an event is not enough to give rise to a FBM. As age increases, some cognitive functions experiment changes that affects the acquisition and maintenance of the information in memory systems. That is to say that what we already know can determine what we can remember or not. According to these authors, it seems that there are some factors that influence the representation strength in the memory: a person's involved level of

active participation, age or level of development and time of exposure to the event. An individual's previous knowledge and nature of the event itself would therefore influence details of the event codification and inclusion in long term memory system. This would explain results found in the present study.

On the other hand, some studies have found that the way older adults tend to process information with a particularly focusing on their affective response to the information (Comblain, D'Argembeau, & Van der Linden, 2005), specifically favors, the preservation of memory with emotional relevance. The emotional-integrative model of FBMs also suggests that the emotional impact and personal importance of the event are factors crucial to the encoding and retention of FBMs (Luminet & Curci, 2009). The individual's emotional reaction encourages post-event elaboration and rehearsal, both of which serve to enhance recollection, vividness, and confidence in memory accuracy (Finkenauer et al., 1998). According to the importance-driven model, proposed by Er (2003), personal consequences will determine the intensity of the emotional reaction. The emotional arousal will be different depending on the consequences the person thinks the event could have. The greater the degree of importance and the greater the emotional reaction, the more detailed and accurate the memory. The study conducted by Kensinger et al. (2006) found that, in some instances, emotional content may benefit the memories of older adults more than those of young adults. Emotional responses may make older adults more likely to rehearse the central information of the event (event-related details), as well as the personal details of emotional events. An event's emotional salience appears to enhance older adults' memories. In another study conducted by Tekcan and Peynircioğlu (2002) analyzing possible age-related effects in FBMs formation, these authors found a positive correlation between retrieved information about an event that took place long time ago and older persons: the older they were at the moment the event took place, the more information they provided. This difference could be due, as we pointed out in a previous paragraph, to the existing difference in the ability to measure consequences of the events between both age groups and the greater ignorance of the real importance of the event by the younger participants (Winograd & Killinger, 1983).

Given that the extent of consequences could be the key determinant of the intensity of an individual's emotional reaction (the emotional arousal), in our opinion, it is more difficult to younger people to identify the significance of an event (an event of this complexity, at least), for they probably do not attribute the same personal relevance to it as adults do. The fact that the emotional content of an event enhances the strength of the memory formed may be the most likely reason why the children's group obtained lower scores for relevance, comprehension, vividness, and intensity of feelings. Future studies should address this by comparing events that evoke emotions of similar intensity in both children and adults.

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Conflict of Interest

The authors of this article declare no conflict of interest.

Appendix A.

Phenomenological Questionnaire on Autobiographical Memory (translated from the original version in Spanish).

							Age:	Gender:
Type of event: THE 11 MARCH ATTACKS								
Please, consider the following characteristics regarding the 11 M terrorist attacks. Circle the most appropriate answer.								
Type of event								
1.	In this event I was:							
	Witness							
	Participant							
	Victim							
2.	The duration of the event was:							
	1	2	3	4	5	6	7	
	short						long	
3.	The place where the event took place was:							
	1	2	3	4	5	6	7	
	unknown						familiar	
4.	This event had serious implications:							
	1	2	3	4	5	6	7	
	not at all						definitely	
5.	My feelings were:							
	1	2	3	4	5	6	7	
	Negative						positive	
6.	My feelings were:							
	1	2	3	4	5	6	7	
	not at all intense						very intense	
7.	For me, this memory means:							
	1	2	3	4	5	6	7	
	nothing						a lot	
8.	Was anyone you're close to affected by the attacks?							
	Yes						No	
	Memory characteristics							
9.	My memory of this event is:							
	1	2	3	4	5	6	7	
	vague						sharp/clear	
10.	My memory of this event is:							
	1	2	3	4	5	6	7	
	in black and white						in color	

(*Continued*)

							Age:	Gender:
11.	My memory of this event involves visual detail:							
	1	2	3	4	5	6	7	
	not at all						definitely	
12.	My memory of this event involves sound:							
	1	2	3	4	5	6	7	
	not at all						definitely	
13.	My memory of this event involves smell:							
	1	2	3	4	5	6	7	
	not at all						definitely	
14.	My memory of this event involves touch [or tactile] sensations:							
	1	2	3	4	5	6	7	
	not at all						definitely	
15.	My memory of this event involves taste:							
	1	2	3	4	5	6	7	
	not at all						definitely	
16.	Overall vividness is:							
	1	2	3	4	5	6	7	
	vague						very vivid	
17.	My memory of this event is:							
	1	2	3	4	5	6	7	
	sketchy						very detailed	
18.	My memory of this event is:							
	1	2	3	4	5	6	7	
	fragmented						complete	
19.	The storyline of the event is:							
	1	2	3	4	5	6	7	
	confusing						understandable	
20.	The storyline is:							
	1	2	3	4	5	6	7	
	simple						complex	
21.	My memory about where the event took place is:							
	1	2	3	4	5	6	7	
	vague						clear/distinct	
22.	About the year:							
	1	2	3	4	5	6	7	
	vague						clear/distinct	
23.	About the day of the week:							
	1	2	3	4	5	6	7	
	vague						clear/distinct	
24.	About the hour:							
	1	2	3	4	5	6	7	
	vague						clear/distinct	
25.	I remember how I felt at the time the event took place:							
	1	2	3	4	5	6	7	
	not at all						definitely	
26.	As I remember it now, my feelings were:							
	1	2	3	4	5	6	7	
	not at all intense						very intense	
27.	I remember what I thought when it was happening:							
	1	2	3	4	5	6	7	
	not at all						clearly	
28.	In general, I remember this event:							
	1	2	3	4	5	6	7	
	with difficulty						easily	
29.	It is difficult for me to put into words what happened:							
	1	2	3	4	5	6	7	
	not at all						definitely	
30.	I remember other events that preceded and were related to this event:							
	1	2	3	4	5	6	7	
	not at all						yes, clearly	
31.	I remember other events that followed and were related to this event:							
	1	2	3	4	5	6	7	
	not at all						yes, clearly	
32.	Do you have any doubts about the accuracy of your memory of this event?							
	1	2	3	4	5	6	7	
	not at all						definitely	
33.	Since it happened, I have thought about this event:							
	1	2	3	4	5	6	7	
	not at all						often	
34.	When I remember this event I see myself from outside, as if I'm watching a movie.							
	1	2	3	4	5	6	7	
	not at all						definitely	
35.	I have talked about this event:							
	1	2	3	4	5	6	7	
	not at all						often	

Appendix B.

The following procedure will be used to compare variability between groups of data and get a more accurate and complementary value for variability. An n-dimensional point—a specific set of data for multiple variables for a single subject—can be formally represented as:

$$P_i^l = (x_1^l, \ldots, x_i^l, \ldots, x_m^l)$$

The centroid (Protter & Morrey, 1970) of a set of n-dimensional points can be calculated and expressed as follows:

$$C_n = (\bar{x}_1^n, \ldots, \bar{x}_i^n, \ldots, \bar{x}_m^n)$$

Group centroids are used to measure group variability. Variability is calculated as the average distance of group points to group centroid. The point-centroid distance (Bourbaki, 1987) can be calculated as:

$$d_{in} = \sqrt{\sum_{k=1}^{m} (x_k^i - \bar{x}_k^n)^2}$$

In measuring the ratio of variability between the two groups, the proportion between the smaller and the larger provides a value for the degree of variance difference:

$$rv = \frac{(\sum_j d_{jm} - \sum_i d_{in}}{\sum_j d_{jm}}$$

Where:

$$\sum_i d_{in} < \sum_j d_{jm}$$

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