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How did you hear the news? The role of traditional media, social media, and personal communication in flashbulb memory

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Abstract

Flashbulb memories are at the intersection of public and private event memory. We investigated whether the source of news (traditional media, social media, or another person) shaped how people remembered learning of an event. Individuals were asked how they learned of Osama bin Laden's assassination immediately after the event and 7, 42, 224, or 365 days later. Initial memory reports from those who learned from traditional media showed enhanced phenomenological features (i.e., a sense of recollection and vividness) relative to those who learned from social media or from another person. Both phenomenological and metacognitive (i.e., belief in the memory's accuracy) features of memory reports decreased over time; however, there were no differences as a function of source. Consistency of the memory reports did not differ as a function of time or source. Although sources differed as a function of social group salience, these differences did not seem to influence memory.

Keywords

autobiographical memory, flashbulb memory, media studies, memory consistency, social media sites

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Flashbulb memories are vivid, confidently held, and long-lasting memories of how one learned of significant events. Typical examples of flashbulb memory–producing events include the assassination of US President John F. Kennedy (Brown and Kulik, 1977), the Marmara earthquake in Turkey (Er, 2003), and the terrorist attacks of 11 September 2001 (Talarico and Rubin, 2003). Long-lasting, vivid, confidently held memories of directly experienced, emotional, and oft-rehearsed events are not unexpected. These are all well-established cognitive mechanisms of learning. But the idea that simply receiving news about a socially, culturally, and/or politically important event can change a mundane individual experience into a noteworthy memory remains surprising. Early in the study of flashbulb memories, Neisser (1982) suggested that "we remember the details of a flashbulb occasion because those details are the links between our own histories and 'History'" (p. 48). In some ways, he was arguing that collective memory for important, public events is to be expected. The desire for an individual connection to that common experience is what leads to a greater emphasis on the reception context relative to the factual details of the event. Therefore, a heightened personal memory of learning about a public event underscores the interaction between individual and collective remembering, between private and public identity, and between event features and memory characteristics.

Inaccuracies in flashbulb memories

Initially, Brown and Kulik (1977) proposed that flashbulb memories were highly accurate over time, much like a photograph, and there has been some research to support this assertion (Bohannon, 1988; Bohannon and Symons, 1992). However, many researchers have found inconsistencies in flashbulb memories after time delays (Hirst et al., 2009; Neisser and Harsch, 1992; Talarico and Rubin, 2003). Therefore, in addition to examining the reliable phenomenological and metacognitive enhancements seen in flashbulb memories relative to ordinary autobiographical memories, the emphasis of research in this area has shifted to examining the types of inconsistencies that are likely to arise and the mechanisms that might explain these particular instances.

One common inconsistency is that participants tend to misremember hearing news from the media instead of from an individual (Neisser and Harsch, 1992). In their sample, 12 participants shifted from not learning via television initially to claiming to have first learned from television approximately 2.5 years later, whereas only one participant shifted from television to another source in the same time frame. Similarly, in a study with a similar delay interval, 14 participants shifted from an in-person source to television as the source and only 2 participants shifted from the television to a person as the source (Schmolck et al., 2000). Overall, Schmolck and colleagues found that individuals who learned of a flashbulb event via a traditional media source (i.e., television and radio) were more consistent in remembering the event than those who learned the news from another person. Although not exclusively responsible for this difference, the reduced likelihood of shifting away from television as the initial source of information is certainly contributing to this enhanced consistency.

One mechanism to explain the "TV priority" in remembering (Neisser et al., 1996) is the increased salience of vivid images displayed during news broadcasts. Schaefer et al. (2011) compared individuals who saw images as they learned the news, those who saw images immediately after learning the news, and those who waited at least an hour before viewing images on various measures of flashbulb memory. They found that although the delayed viewing group did not differ from the simultaneous or immediate viewing groups in the number of canonical details reported (i.e., "time; location; ongoing activity; informant; presence of others; clothes worn by the participant; first thought; feelings; [and] subsequent activity," pp. 254–255), the number of words included in narrative reports, or in the consistency of flashbulb memories, the delayed viewing group did report less elaborated memories over time. Furthermore, how recently the images were

viewed was associated with the overall frequency of viewing images in their study; this was consistent with the idea that image salience may be conceptually driving the memory enhancement. Additionally, the salience of an image can distort memory by shaping the memory of the narrative to be more consistent with what was presented in the image. For example, Garry et al. (2007) found that participants who saw "after" photographs of a hurricane-damaged village were more likely to falsely recall having read details of deaths and injuries (that were not, in fact, presented) than were those who saw "before" pictures of the same village while reading the same story. More broadly, David (1998) showed that mere inclusion of an image with a news story enhanced recall of the news item.

How we learn news of flashbulb-associated events

Thus, previous research suggests we ought to be attentive to how individuals receive and remember news. Furthermore, although television and radio are still relevant, with expanding technology, the ways in which we learn news have increased. Purcell et al. (2010) reported that approximately 59% of Americans seek news in a typical day from either offline or online sources. For 14- to 17-year-olds, approximately 62% report getting news about current events online and 68% visit online news sites (Lenhart et al., 2010). In a recent study of the top 25 Internet news sites identified by Nielsen, 17 were associated with traditional media sources (e.g., newspapers or television stations; Olmstead et al., 2011). Therefore, both web-based and offline news outlets retain utility for modern news consumers.

In addition to authoritative news outlets, many people rely on other individuals around them to keep them informed. Social interaction has always been involved in the dissemination of news. However, the ways in which that social interaction occurs are different now than they were even a few years ago, including both interpersonal interaction and digital communication. For example, of the 71% of adults who get news online in Purcell et al.'s (2010) sample, 75% said they get information forwarded to them via email or via posts on social media sites. Of online news consumers who were also social media users, 51% said that they received news from other people via social media in a typical day (Purcell et al., 2010). More than one-third of social media users report using those sites to "like" or promote political or social news, to repost content related to political or social news, or to post their own thoughts and feelings about political and social news (Rainie et al., 2012). Active participation in social media sites can also influence offline behavior. Tufekci and Wilson (2012) reported that individuals who used social media were more likely to attend Tahrir Square protests that led to the collapse of Egypt's authoritarian regime, and almost half of their sample used social media sites to share pictures and/or videos from the protest as "citizen journalists."

Overall use of social media sites is particularly popular among college-aged individuals. Lenhart et al. (2010) reported that 72% of 18- to 29-year-olds who are online use social media sites. Furthermore, studies have shown that over 91% of college students use Facebook (Wiley and Sisson, 2006), spending an average of 10–30 minutes on that specific social media site per day (Ellison et al., 2007). Of those surveyed by Hermida et al. (2012), 43% used social media sites for news and information on a daily basis and 51% of their Canadian college student sample use social media sites for news filtered by their social group. Similarly, 71% said that keeping up with the news was a "main reason" for visiting/participating in social media sites (Hermida et al., 2012: 5).

Influence of how we learn on what we remember

This study proposes that the source of how one learns of important public events may influence both the content and the phenomenology of the flashbulb memory for that event. Flashbulb

memories are at the intersection of personal, autobiographical memory (i.e., remembering one's personal context of receiving news) and social, collective memory (i.e., public event understanding) and could therefore be influenced by the nature of the initial connection between those two: more public (traditional media), more personal (individual communication), or somewhere between the two (social media). Flashbulb memories typically address the "commandment questions of news" (Zelizer, 2008: 82) by including information about how and when the participant learned the news, where the participant was, who was with them at the time, and what they were doing both at the time and immediately after learning the news. However, flashbulb memories also include cognitive and affective components (i.e., what the participant thought or felt as they learned the news) and other distinctly personal details that are typically omitted from traditional news reports. In an earlier study comparing individuals who learned of important public events from traditional media to those who learned from another person, Bohannon et al. (2007) found that the media-informed group recalled more factual details, whereas the person-informed group reported more details of their own personal circumstances.

Berntsen's (2009) model of flashbulb memory formation suggested that an event which activates one's social identity would lead to heightened personal significance attributed to the event, an emotional reaction to the event, and rehearsal of that event (and how one learned of the event) within social groups. This model expanded on the social aspects of Brown and Kulik's (1977) original flashbulb memory model and further clarified why the memory-enhancing features of emotion and rehearsal are more likely to be present for some public events than for others. Furthermore, she formally described a feedback loop wherein having a flashbulb memory for a given event signifies one's membership in the larger social group and further supports the persistence of the memory. Berntsen's (2009) model would predict that flashbulb memory phenomenology is likely to be greatest when membership in a social group is important to the individual and when that membership is publicly displayed. Given this mechanism, one would expect contexts where social group affiliation is broadcast more widely (such as within social media sites) would enhance phenomenological features of the memory such as vividness and confidence in its accuracy.

Also consistent with Berntsen's (2009) feedback loop in creating and maintaining flashbulb memories is Larsen's (1992) concept of "rehearsal displacement," wherein the event itself is not the central focus of rehearsal; instead, it is the personal circumstances of learning about the event that is rehearsed and the public news event becomes merely a cue to that personal memory. Telling one's personal story of learning about a shared event serves narrative conventions to introduce novel details to a conversation and serves larger social functions by building group cohesion. Both individuals and groups have an expectation of remembering and of having a story to share. Presumably, one's failure to remember a given event would allow group members to infer that an individual failed to understand or appreciate the significance of the event and therefore result in a negative impression of the individual and a loss of status for the individual within the group. For example, Conway (1997) reported anecdotal evidence of flashbulb memories among astronomers for the discovery of Supernova 1987A. Therefore, the role of one's social group in marking an event as important and therefore worthy of remembering seems clear. What is less clear is how online social networks serve this function.

Given the explicit reminders of connectedness within social networks provided by social media sites, we may expect this source to enhance flashbulb memory phenomena. Furthermore, the ease of sharing news within social networks via social media sites (e.g., the "share" and "retweet" buttons available on Facebook posts and tweets within Twitter, respectively) may increase rehearsal and therefore further enhance flashbulb memory phenomena. Social media sites allow users to quickly share and discuss current events—even within minutes of the event occurring. Szabo and Huberman

(2010) noted that whereas traditional media's news content is determined by editors, the active members of social media sites are themselves generating and sharing news. Although the volume of traditional media coverage reflects large-scale social importance of an event and fosters collective sharing of information (Hirst and Meksin, 2009), the feeling that an event is significant to one's personal social network and the ability to immediately participate in commenting on and sharing information, as permitted by social media sites, may enhance flashbulb memory characteristics.

In many ways, social media sites present a hybrid between traditional mass media and personal communication. Van Dijk (2007) has suggested that media representations of autobiographical memories are mutually shaped by and shape autobiographical memories. In this context, social media sites serve as a connective link between personal/private media (e.g., photographs and home movies) and mass/public media (e.g., television and newspapers). Social media is similar to traditional media in that it is broadly communicated, passively received, and frequently produced close in time to the event itself. Like individual communication, social media is personalized, dynamically generated, and the timeliness of the message is determined by the receiver. Although traditional media has greater presumed accuracy than do personal communications, again social media presents a middle case in that the specific source and/or the accumulation of sources affects how accurate that information appears to be.

Current study

This article uses data from a more traditional flashbulb memory study to investigate how different news sources influence recall of the learning about an important and emotional news event over time. In this study, memory is conceived of from a psychological perspective that includes information retained by an individual over extended periods of time. However, we believe the cognitive representation of an event to be only one component of a dynamic, iterative mnemonic process that involves social, cultural, and historical components as well. We will return to this in the "Discussion" section. The primary study examined the assassination of Osama bin Laden as this was a significant and unexpected event with international implications. While the national reaction to the news was not uniform, many in north Texas celebrated the news. Some reported hanging the American flag proudly in their windows, while others took to the streets and set off fireworks to celebrate (Lewis, 2011). Importantly, for the purposes of this study, there are no concerns regarding the unfolding nature of news reports frequently seen in flashbulb memory–producing events. The assassination announcement was a singular, finalized event at the time of occurrence. Furthermore, the news report itself was a presidential press conference. There are no official photographic images of the corpse and/or of the burial at sea that have been made public. Portraits of the living Osama bin Laden were certainly available as was the photograph of President Obama and his national security team in the White House Situation Room during the raid taken by Pete Souza, but these images are very different from the footage typical of the death of a political figure (or of other, common flashbulb memory–producing events like terrorist attacks, natural disasters, and even space shuttle explosions); the imagery is neither perceptually salient nor viscerally evocative. Any fictional portrayals of the events (e.g., the film *Zero Dark Thirty*) that included these features were available only after we completed data collection. This allows for us to indirectly test the "TV priority" as all sources in this study were equally lacking in graphic visual imagery. In the absence of this difference, we can focus on the social components that may shape flashbulb memory phenomena. Specifically, we will explore whether hearing the news through social media, through traditional media, or through a personal communication influences phenomenological, metacognitive, and objective aspects of the memory. Within hours of the event, participants' recollective experience of the event, vividness of the memory, and belief in the accuracy of the memory were

assessed as a function of how one initially learned the news. Those characteristics and the consistency of the memory reports over the course of 1 year were also assessed by source (traditional media, social media, or personal communication).

Our dependent measures structure our hypotheses. First, for recollection and vividness, we expect that those who learned the news via social media sites will show enhancements relative to the other two sources. Although previous research might predict an enhancement for traditional media, the lack of salient visual imagery in this case reduces that probability, and instead, we expect the greater salience of social/personal significance to enhance flashbulb memory phenomenology. Second, we expect that those who learned the news via traditional media and via social media will show greater belief in their memory's accuracy than those who learned from an individual, personal source. The greater perceived accuracy for traditional media outlets is likely to be balanced by the collective trustworthiness of "reporters" in a participant's social network. Finally, given the media bias seen in the previous literature (i.e., that changes to media sources are less common than changes away from media as the source of news), we predict that those who learned the news from traditional media and social media may be more consistent in their memory reports than those who learned from another person.

Method

To summarize, participants were contacted immediately after the announcement of the assassination of Osama bin Laden on 2 May 2011 and then once more over the next year. Participants were grouped according to how they learned of the news (by social media, traditional media, or personal communication) and by the specific follow-up session in which they participated (none or 7, 42, 224, or 365 days later). The investigation of this event as it pertains to broader issues in the flashbulb memory literature is the topic of another paper (Kraha et al., 2014).

Participants

A total of 329 individuals, with the majority being students from a large state-funded public university in the Southwest, were tested in-person within 2 days of the assassination announcement in exchange for extra-credit in a psychology course. Following the procedure of Talarico and Rubin (2003), participants were randomly assigned to independent groups who were tested again at varied delay intervals. At each follow-up interval, participants were given 48 hours to complete an online questionnaire and were compensated US$5 (or US$10 for the 1-year interval).

The resulting data set includes three independent samples of individuals (i.e., those who completed the initial instrument only, those who completed the initial instrument and one-and-only-one follow-up session of 7, 42, 224, or 365 days later, and those who completed the initial instrument, the 1-year follow-up, and one-and-only one intervening session (the 7, 42, or 224 delay session).[1]

Two independent raters determined from open-ended responses (described below) how each participant heard the news of the assassination. These were grouped into three source categories: personal communication (which included hearing from friends, families, and acquaintances in-person, via telephone, via text message, or via email), social media (which included Facebook, Twitter, and other social media sites), and traditional media (including radio, television, and newspapers, as well as the Internet sites of traditional media outlets such as cnn.com and nytimes.com).[2]

Because we are interested in how news source immediately influences flashbulb memory phenomena, we started with the total sample of individuals who completed the initial instrument, regardless of how many follow-up sessions in which they participated (0, 1, or 2). We excluded four participants for whom we could not determine how they learned the news of Osama bin Laden's assassination. We also excluded two participants who were younger than 18 and nine who were over

Table 1. Demographic characteristics for both samples.

	Initial instrument sample	Initial and one follow-up session sample
Gender		
Male	110	40
Female	191	71
Missing	13	5
Ethnicity		
Hispanic	35	11
Non-Hispanic	264	98
Missing	15	7
Race		
White/Caucasian	219	85
Black/African American	34	14
Asian	14	4
Native Hawaiian/Pacific Islander	1	0
American Indian/Alaska Native	1	0
Multiracial	18	3
Missing	27	10
Total	*314*	*116*

Table 2. Distribution of participants who completed the initial instrument and one-and-only one follow-up session by source and delay interval.

Delay source	7 days	42 days	224 days	365 days	*Total*
Traditional media	10	12	10	7	*39*
Social media	9	13	4	9	*35*
Personal communication	16	7	8	11	*42*
Total	*35*	*32*	*22*	*27*	*116*

40, leaving 314 participants ($M = 22.88$ years old, standard error of the mean (SEM) = .22 years) with 32 who did not disclose their age (see Table 1 for the demographic characteristics of the sample). The sample was roughly evenly distributed among the three possible sources of learning the news: 41% ($n = 128$) heard the news from another person, 30% ($n = 95$) heard from traditional media, and 29% ($n = 91$) heard from social media. Neither age ($F(2, 279) = 2.34$, $p = .098$) nor any other demographic characteristic varied as a function of source, largest $\chi^2 = 1.97$, all ps > .10.

As we are also interested in how source might influence flashbulb memory phenomena over time, we also examined the group of participants who completed the initial session and one-and-only-one follow-up session, 7, 42, 224, or 365 days later.[3] The resulting sample of 116 participants ($M = 23.09$ years old, $SEM = .36$) included six participants who did not disclose their age (see Table 1 for the demographic characteristics of the sample; see Table 2 for the distribution of participants by source and delay). A 3 (source: personal communication, social media, or traditional media) × 4 (time: 7, 42, 224, or 365 days later) between-subjects factorial analysis of variance (ANOVA) on age did show a significant main effect of source, $F(2, 98) = 4.00$, $p = .02$, with Tukey's honestly significant difference (HSD) post hoc analysis showing that the traditional media group ($M = 24.50$, standard deviation (SD) = 4.03) was significantly older than the

personal communication group ($M = 21.79$, $SD = 3.02$, $p < .01$), but that the social media group ($M = 23.13$, $SD = 4.00$) was not significantly different from either of those groups (both $p > .28$). The age of participants did not differ by delay, $F(3, 98) = 1.34$, $p = .27$, nor was there any interaction between source and delay, $F(6, 98) < 1$, $p = .90$. Although low cell frequencies made chi-square analysis unreliable, there appear to be no systematic differences in gender, race, or ethnicity among source or delay groups.

Materials and procedure

At each testing session, after obtaining informed consent, participants were asked a series of open-ended questions about how they learned about the assassination of Osama bin Laden. Specifically, we asked *when* participants first heard the news, *what* they were doing when they heard, *who* they were with, *where* they were, and what their dominant *emotion* was. We also asked whether there were any other *distinctive details* of the event. Following the procedure of Talarico and Rubin (2003), similar questions were asked of a self-nominated event from the preceding weekend (Friday–Sunday), but those data will not be discussed here (see Kraha et al.'s (2014) data for a comparison between the flashbulb event and the everyday event).

Two independent raters coded the open-ended questions for consistency following a method similar to Curci and Luminet (2006). Answers that were exactly similar received a score of 2, answers with a minor gain or loss of information received a score of 1, and answers with completely inconsistent information received a score of 0. For example, a minor gain of information would be if, during initial testing, someone said that they were at home when they heard the news, but at the follow-up they indicated that they were at home in their bedroom. Likewise, a minor loss of information would be when someone originally said they were in the living room but later reported that they had been at home. These scores were summed to provide a total consistency measure across all six questions, with higher values indicating greater consistency between memory reports.

In addition, participants were asked a series of rating-scale questions about the phenomenological and metacognitive aspects of remembering that were adopted from the Autobiographical Memory Questionnaire (Rubin et al., 2003). Here, we will focus on the key properties of autobiographical memory, the enhancement of which defines flashbulb memory: recollection, vividness, and belief in the accuracy of the memory. Recollection was assessed by collapsing responses to two questions: "I feel as though I am reliving" the experience (from 1, *not at all*, to 7, *as clearly as if it were happening now*) and "while remembering the event now, I feel that I travel back to the time it happened" (from 1, *not at all*, to 7, *completely*). Vividness was assessed by collapsing responses to ratings of how well participants could "see it in my mind," "hear it in my mind," and "know the setting where it occurred" (all three rated from 1, *not at all*, to 7, *as clearly as if it were happening now*). Belief in the accuracy of the memory was assessed by combining questions regarding whether the participants "believe the event in my memory really occurred in the way I remember it" (from 1, *100% imaginary*, to 7, *100% real*) and if they could "be persuaded that your memory of the event was wrong" (from 1, *not at all*, to 7, *completely*). Participants also completed items on remembering versus knowing that the event occurred, language and narrative properties of the memory, visual perspective in the memory, rehearsal, surprise and consequentiality, as well as emotional affect, intensity, and visceral reactions, but those items will not be discussed here (see Kraha et al. (2014) for more information about these characteristics). Similarly, questions regarding participants' interest in US anti-terrorism policy and their familiarity with the "flashbulb memory" concept will not be analyzed.

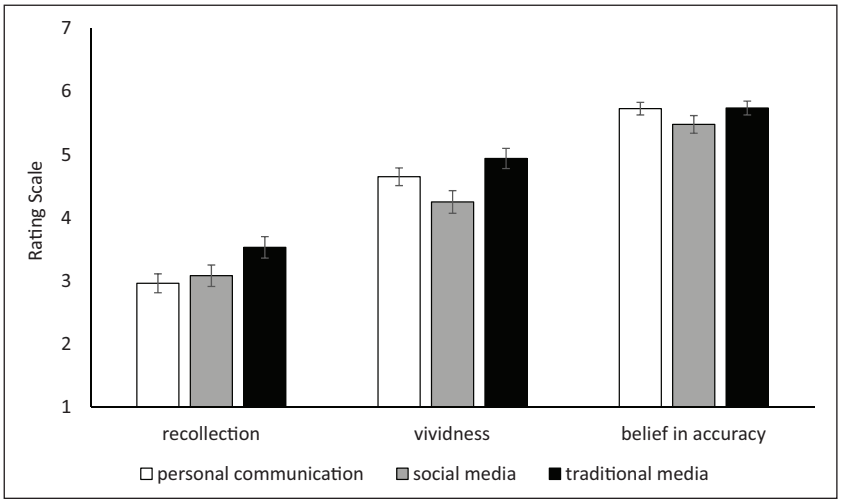

Figure 1. Initial mean ratings of phenomenological and metacognitive properties of flashbulb memories for learning the news that Osama bin Laden had been killed as a function of the source of that news (error bars represent standard error of the mean).

Results

Initial flashbulb memory reports

To see whether initial memory phenomenological and metacognitive characteristics were influenced by how one heard the news, we conducted a one-way between-subjects ANOVA on the sense of recollection, vividness, and belief in the memory's accuracy as rated only at the initial session by all 314 participants (see Figure 1). News source had a significant effect on initial ratings of recollection, $F(2, 302) = 3.45$, $p < .05$. According to Tukey's HSD post hoc tests, traditional media ($M = 3.53$, $SEM = .17$) was significantly different from personal communication ($M = 2.96$, $SEM = .15$), but social media sites ($M = 3.08$, $SEM = .17$) were not different from either. This suggests that traditional media reports engendered a greater sense of mentally traveling back to learning the news and reliving that experience in the present within a few days of the event than did learning the news from another person, whereas learning from social media resulted in an intermediate sense of recollection.

How one learned the news also had a significant effect on vividness of the memory initially, $F(2, 304) = 4.17$, $p < .05$. Tukey's HSD post hoc tests here showed that traditional media ($M = 4.94$, $SEM = .16$) was significantly different from social media ($M = 4.25$, $SEM = .18$), but personal communication ($M = 4.65$, $SEM = .14$) was not different from the other two. Enhanced vividness, like recollection, was seen among those who learned the news from traditional media sources. However, here, the least vivid memories were from those who learned via social media with personal communications resulting in memories of intermediate vividness.

Not surprisingly, given the very short delay interval between the event and the memory report, there was no effect of source on initial ratings of belief in the memory's accuracy, $F(2, 303) = 1.46$, $p > .05$. Most participants were near ceiling in this rating, with only 5.2% of participants rating their confidence as below a 4 on 7-point scale.

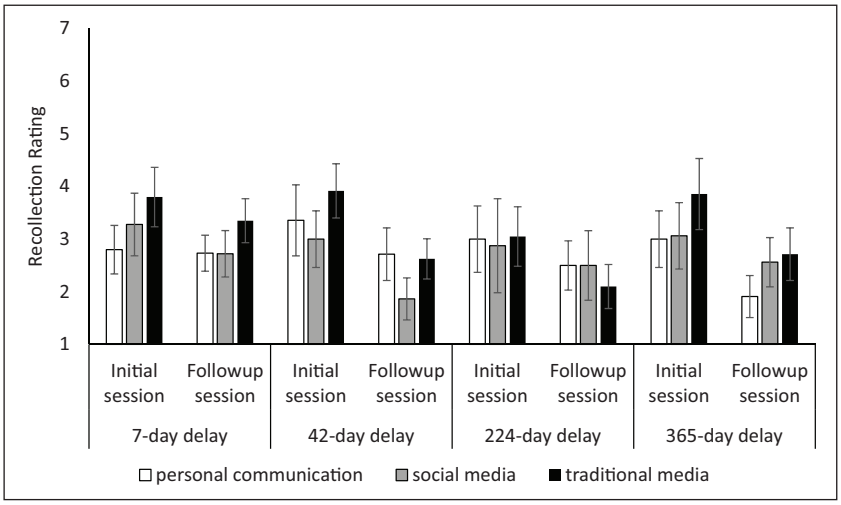

Figure 2. Mean ratings of recollection as a function of the source of that news and time (error bars represent standard error of the mean).

Flashbulb memory reports over time

To examine whether how one heard the news influenced memory properties over time, we conducted a 2 (session: initial vs. follow-up) × 4 (delay: 7, 42, 224, or 365 days later) × 3 (source: personal communication, social media, or traditional media) mixed factorial ANOVA on recollection, vividness, and belief in the memory's accuracy on the 116 participants who completed the initial instrument and then one-and-only one follow-up session.

As shown in Figure 2, there was a main effect of session for recollection, $F(1, 100) = 27.87$, $p < .01$, with ratings of recollection being higher initially ($M = 3.25$, $SEM = .18$) than at the follow-up session ($M = 2.53$, $SEM = .13$). There was, however, no main effect of delay, $F(3, 100) < 1$, $p > .10$, nor a main effect of source, $F(2, 100) < 1$, $p > .10$, nor were there any interactions among session, delay, and/or source, largest $F = 1.41$, all ps $> .10$.

For vividness, as shown in Figure 3, there was also a main effect of session, $F(1, 100) = 38.37$, $p < .01$, with memories being rated as more vivid initially ($M = 4.68$, $SEM = .17$) than at the follow-up session ($M = 3.67$, $SEM = .16$). There was also a session by delay interaction, $F(3, 100) = 5.47$, $p < .01$, such that there was no difference in vividness between the initial session and the 7-day delay group, $t(33) = .45$, $p > .10$, but there were significant differences at all other delay intervals, smallest $t(22) = 2.87$, $p < .01$. There was, however, no main effect of delay, $F(3, 100) < 1$, $p > .10$. There was also no main effect of source, $F(2, 100) < 1$, $p > .10$, nor were there any other interactions among session, delay, and/or source, largest $F = 1.22$, all ps $> .10$.

There was a similar pattern of belief in the memory's accuracy (see Figure 4). There was a session by delay interaction, $F(3, 99) = 4.00$, $p = .01$, demonstrating that the main effect of session, $F(1, 99) = 6.99$, $p = .01$, is primarily driven by a significant decrease in belief in the memory's accuracy from the initial session to the 224-day delay group, $t(20) = 5.25$, $p < .01$, since no other delay groups showed a significant difference between the initial session and the follow-up, largest $t(22) = 1.78$, $p = .08$. There was no main effect of delay, $F(3, 99) = 1.84$, $p > .10$. There was also no main effect of source, $F(2, 99) < 1$, $p > .10$, nor were there any other interactions among session, delay, and/or source, all Fs < 1.

Since consistency was calculated by comparing the initial session and follow-up session reports, a 4 (delay: 7, 42, 224, or 365 days later) × 3 (source: personal communication, social media, or

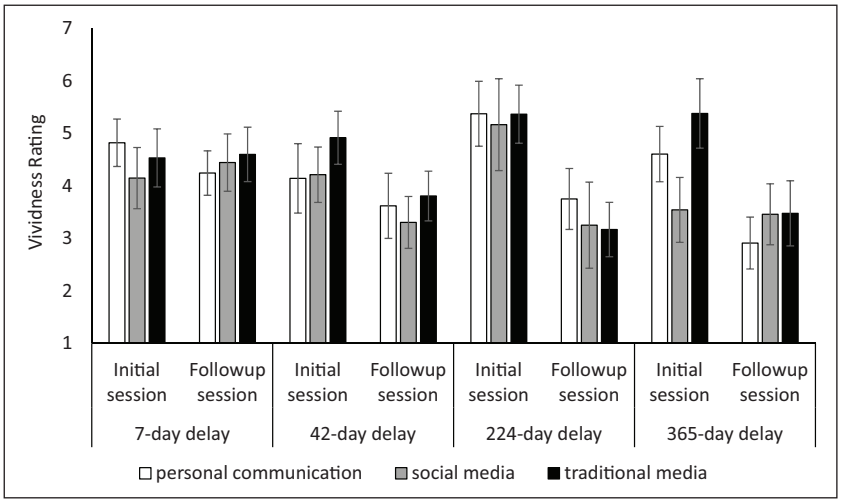

Figure 3. Mean ratings of vividness as a function of the source of that news and time (error bars represent standard error of the mean).

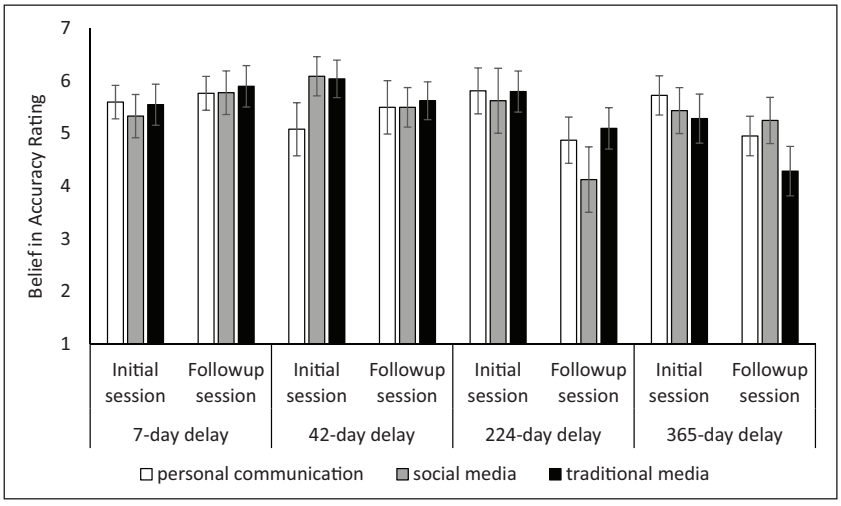

Figure 4. Mean ratings of belief in the memory's accuracy as a function of the source of that news and time (error bars represent standard error of the mean).

traditional media) between-subjects factorial ANOVA was computed. Unlike for the memory characteristics, there was no main effect of time, $F(3, 102) = 2.27$, $p > .05$. As before, we saw neither a main effect of source, $F(2, 102) < 1$, $p > .10$, nor any interaction between delay and source, $F(6, 102) < 1$, $p > .10$ (see Figure 5).

Discussion

How one learned the news of Osama bin Laden's death influenced flashbulb memory phenomenology initially; however, the differences by source were not seen when examining flashbulb memories

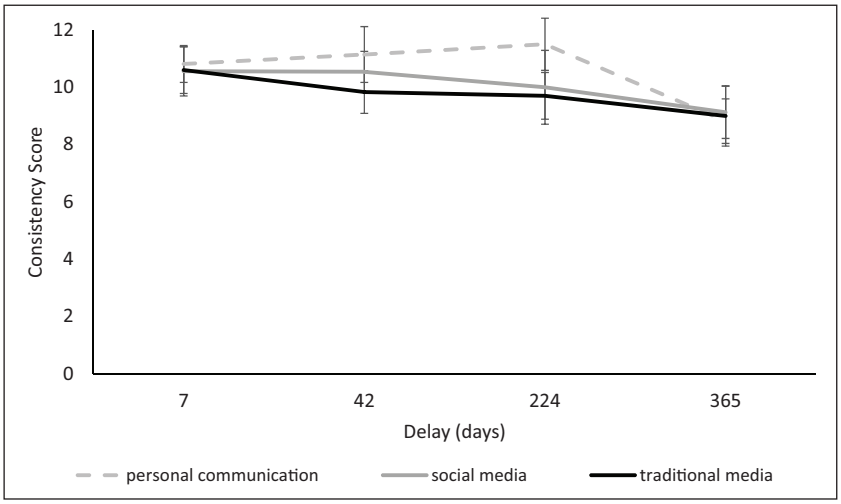

Figure 5. Mean consistency scores for memories of learning the news that Osama bin Laden had been killed as a function of the source of that news over time (error bars represent standard error of the mean).

across time. Initial ratings of recollection (i.e., mentally traveling back in time to relive the experience) and vividness (i.e., seeing and hearing the event as if it were happening now) of the memories were highest for those who learned the news via traditional media. Contrary to the original hypothesis, although learning via social media led to intermediary levels of recollection, it was associated with the lowest levels of vividness. The relationship among social media, traditional media, and interpersonal communication appears to be more complex than social media simply being a hybrid of the other two. Initial belief in the memory's accuracy was quite high for all participants and not influenced by source.

Whatever differences may have been present among the source groups initially were not persistent. When examining flashbulb memories over the course of 1 year, the most reliable differences we found were decreases in recollection, vividness, and belief in the memory's accuracy with time, but these changes were not influenced by source. Although this sample had fewer participants and therefore less overall power to detect differences among groups, the fact that we were able to see both main effects and interactions for the time dimension consistent with previous research suggests that low power alone is insufficient to explain the lack of main effects of and interactions with source.

Surprisingly, neither time nor source influenced memory consistency; flashbulb memory reports were relatively (although not perfectly) consistent over the course of 1 year. As Kraha et al. (2014) showed, consistency of the memory reports for learning the news of bin Laden's death was objectively low but did not change over time. Those data also showed no difference between flashbulb memories for this event and everyday memories from the same time period, a conceptual replication of Talarico and Rubin (2003) using a different consistency measure with memories for a different public event.

How remembering processes shape memories

Blank (2009), borrowing a concept from Tulving (1983), articulated a two-stage theory of remembering that emphasized processes that occur after an internal representation has been brought to

mind. At that point, "memory conversion" transforms the internal thought to external behavior. The first stage of conversion is validation—developing a belief about the past. This construct is closely tied to our measure of belief in the memory's accuracy. Given that external information (e.g., logical plausibility, consistency with the reports of others and with material evidence) is known to influence this stage of remembering, it is somewhat surprising that source here had no effect on one's confidence in their flashbulb memory. Instead, this outward-looking process may be more important to personal event memory and to collective memory, neither of which were assessed here.

Communication is Blank's (2009) second stage of memory conversion, and it includes both selection and modification components. Roughly speaking, these are analogous to errors of omission and commission, respectively, but with the notable difference being that individuals may be consciously aware of differences between their internal representation and external report in the former model and are typically thought to be unaware of these differences in discussion of memory errors. This processing stage is heavily influenced by interpersonal norms and contextual expectations. Our consistency measure relied on written responses to specific prompts, all while individuals were knowingly participating in a psychological research study. These demands are perhaps why we saw so few changes in participants' reports over time in the current study. Yet, one would still expect that changes to reporting demands would result in changes to the memory reports. Moreover, questions that emphasize the social significance of the event and/or that heightened the perception of one's social group as the audience for the report should bias participants' responses in ways consistent with Berntsen's (2009) model (e.g., including more details about one's emotional reaction to the event).

Event-specific flashbulb memory characteristics

Although media reports of Osama bin Laden's death did not include graphic visual imagery of the event, we still saw slightly higher initial vividness ratings from those who learned via traditional media coverage when compared to social media. Given that historical analogies provide context for events at the time (e.g., the *Challenger* disaster was frequently discussed in coverage of the *Columbia* disaster; Zelizer, 2008), it may be that any imagery from the September 11 attacks included in media discussions of bin Laden's death may explain the slight bias in phenomenology for those who learned via traditional media seen here. This media bias, however, was neither strong enough to distort later memory reports nor did the differences in vividness among sources last over time. Of interest is whether the subsequent release of constructed images associated with this event (e.g., the film *Zero Dark Thirty*) may influence recollections of the event as was seen when the release of the documentary film *Fahrenheit 911* increased people's knowledge of factual details about the September 11 terrorist attacks (Hirst et al., 2009). There is some evidence that factual event knowledge is more susceptible to media-based differences than are autobiographical memories. Hirst et al. (2015) found that increased attention to the media leads to increased accuracy in event memory, including the correction of previously reported errors; no similar effects were found for participants' flashbulb memories.

Role of social media in social remembering

One limitation of the current study is that multiple social media sites were collapsed, and the different types of sites may have varying effects on the quality of a memory based on the nature of the site. Boyd and Ellison (2008) articulated three key features of all social media sites: personal profile, relationships, and communication functions. Communication is the primary function of

messaging individuals (or groups) within the site, but can also include private messaging functions. The profile is an online representation of the self, important in the current context because it is deliberately public. Relationships include the identification of individuals within the site with whom the person is connected. These relationships themselves are typically (though not always) public as well. Relationships can be one-directional or bi-directional depending on the site constraints. For example, Facebook requires reciprocal relationships but Twitter does not; Kwak et al. (2010) found that 77.9% of Twitter users had one-sided relationships. The systematic investigation of sites that differ along these dimensions is likely to be informative, not just for flashbulb memory research but also for a number of social-cognitive phenomena. Similarly, there were some subcategories that might fit less well in some categories than others. For instance, the few participants who found out via text message ($n = 5$) were put in the personal communication category, and those who found out via Internet news ($n = 5$) were placed in the traditional news category. However, if these numbers could be increased, closer examination of differences by specific source might be possible. Although both of these ways of learning the information were digital, the more important difference (to us) was between personal communication and mass media. The effects of other forms of personal electronic media (e.g., email and instant message) were similarly not explored because there were too few participants who received the news this way; however, there might be important differences among these sources. More general information-seeking behaviors as well as social media site familiarity and frequency of social media site use may be additional moderating variables influencing flashbulb memory phenomena. Finally, a college student sample was ideal for this study due to their high rates of social media usage according to Raacke and Bonds-Raacke (2008); however, caution must be taken when generalizing these findings to other age groups.

Because the influence of source was not our primary question of interest when designing the study, we did not directly investigate the level of social presence the participants felt in their social media interactions. This construct discussed in Khalifa and Shen (2004) seems to influence how individuals learn and remember via virtual environments and should be included in future investigations. This would allow for a more direct test of Berntsen's (2009) social identification theory for flashbulb memory formation. Here, we suggested that social media might increase the salience of social significance and therefore increase the personal significance attributed to the event. However, where source differences were seen, it was still traditional media that lead to flashbulb memory enhancements.

Interactions between social groups and individual memories

Mass media reporting may be a proxy for intensity of the event within the relevant social group. In the foundational flashbulb memory study, Brown and Kulik (1977) showed strong evidence for differences in the prevalence of flashbulb memories for US civil rights–related events among White and Black Americans. Since then, many have shown cross-cultural differences in flashbulb memory prevalence for nationally relevant (but internationally limited) events (e.g. Kvavilashvili et al., 2003; Luminet et al., 2004). These studies examined memory from a psychological perspective in that the autobiographical recollections of personally learning of an internationally important and culturally shared event were the focus. The nature of the events that lead to these unexpectedly vivid, long-lasting, and confidently held memories indicates that they are necessarily influenced by larger social and cultural factors, though. The individuals in our study were Americans who predominately viewed the death of Osama bin Laden as a positive occurrence and, to some extent, as bringing about an end to an important chapter in the country's history; individuals with different cultural interpretations of this event might have a different mnemonic experience.

It may be that although participants originally heard through one, and only one, source, they are likely to have rehearsed that information via other forms of media. Some of our participants

explicitly said that after they heard or saw the news from someone via social media or in-person that they then went to the traditional media for more information. All participants are likely to have been exposed to traditional media accounts at some point and to have shared the news with others in person, over the telephone, or via social media. Therefore, the lack of differences among original sources may not be surprising. However, this is not to suggest that there are no differences in how each source may influence individuals' interactions with news and with others. Bohannon et al. (2007) reported that individuals who talked about important public events more often were also more likely to seek media coverage about those events. Lee and Ma (2011) found that social media sites serve both information-seeking and socializing goals, often in concert with one another. In their study, the intention to share news was influenced by both of those motivations as well as status-seeking. They suggest that sharing news via social media sites leads to "anticipatory socialization" and the desire to be seen as an "opinion leader" within one's social network (p. 337). With slightly younger participants than those studied here, Dunne et al. (2010) found that creation and maintenance of one's social media presence facilitated gaining and maintaining acceptance from peers. These positive social interactions, unfortunately, co-exist in an environment where negative behaviors are also prevalent, as is seen with cyberbullying (Kowalski et al., 2014). These findings are all consistent with the argument that social media sites are a fruitful context for testing Berntsen's (2009) model of flashbulb memory formation.

Future directions

Future research should investigate differences among those who share news versus those who do not. Purcell et al. (2010) reported that 37% of Internet users have contributed to the creation of news, commented on the news, or disseminated news via social media sites. Gopie and MacLeod (2009) showed that destination memory (i.e., remembering to whom you have provided information) was more fallible than was source memory (i.e., remembering from whom you learned information). In this context, one might examine how learning and sharing news (as both a receiver and a sender, respectively) via social media can shape memory for the news itself as well as from whom and to whom that news was communicated.

The Internet has forever changed the way that we communicate. Our data provide a small window to the changing media landscape. Only one participant explicitly mentioned the official Presidential announcement as their source (although more mentioned "breaking news" or an interruption of ongoing programming) and about as many people generically said they heard from "the news" (or "TV"/"radio") as mentioned a specific news outlet (e.g. "CNN," "Yahoo! News," and "The Today Show"). Social media sites are increasingly used as a method of maintaining social relationships and obtaining local, national, and international news. Despite the relative frequency of the Internet as a social and societal tool, little research has yet to thoroughly investigate the cognitive effects of these virtual environments. Our current research suggests that this ignorance may not have large costs, but perhaps it is premature to draw that conclusion just yet.

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Notes

1. This sample ($n = 58$) will not be discussed further.
2. Although some people saw a link to a traditional news article posted on social media, this did not appear to be common in our data. As an example, in the subset of participants who initially reported receiving the news from Facebook ($n = 70$), only one individual explicitly mentioned learning via the "recent news" feature; the majority specifically said something about a friends' "status" update ($n = 40$). Furthermore, differentiating between individuals who sought traditional media at the behest of a personal contact from those who saw or read the news spontaneously seems to be of potential mnemonic importance.
3. There were no systematic differences between those who completed one-and-only-one follow-up session and those who only completed the initial instrument on source ($\chi^2(2, N = 256) = 1.320$), gender ($\chi^2(1, N = 245) = 1.33$), ethnicity (Hispanic vs non-Hispanic, $\chi^2(1, N = 244) = 1.21$), or race (White vs non-White, $\chi^2(1, N = 256) = 2.74$), all $ps > .05$. Nor there were differences between the samples in age ($t(211.5) = 1.86$, $p > .05$, corrected for violating the homogeneity of variances assumption according to Levene's test, $F = 11.71$, $p = .001$).

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