Evaluating the Binding Hypothesis for Flashbulb Memories: The Effect of Recall Location on Memory for Emotional and Neutral Pictures

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I. Abstract

Previous research has shown some evidence for the *binding hypothesis,* which predicts that the recall of *flashbulb memories* (FBM's) is bound to their original context. In the present study, twenty-two participants were presented with a series of negative and neutral pictures and then asked to recall them, either in the same room as they were originally shown or in a novel location. This was to test if emotional material could simulate FBM's*,* leading to contextual binding and facilitated recall for the negative pictures in the same-room condition. While the negative pictures were remembered better than neutral ones, there was no significant effect of location on recall or any significant interaction between emotion and location. This study holds theoretical implications for the nature of FBM's and their production in laboratory settings.

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II. Introduction

Researchers have been struggling in recent years to create a consistent theoretical account of what *flashbulb memories* (FBM's) consist of and their empirical effects on memory (Curci and Lanciano, 2009). At present, an FBM may best be thought of as an emotionally salient combination of both the reception context of the memory (ie. where one is when they hear of the 9/11 attacks) and semantic information about the event, or *event memory* (EM). Curci and Lanciano argue that one distinguishing factor between FBM's and EM's may be the autobiographical nature of FBM's: knowledge and recall of them depends on both basic, public knowledge (ie. two planes hit the World Trade Centers, an example of EM) and, crucially, more episodic details (ie. "After the crash, I ran away from the smoke.").

While the debate between the differences and overlap between EM and FBM has yet to be fully resolved, there have been attempts to recreate and study the impacts of FBM's in laboratory settings. MacKay and Ahmetzanov found that the screen location of words in a Stroop-task was remembered better for taboo, emotional words than neutral words, results which support the *binding hypothesis*, which states that emotional reactions induced by FBM's bind the inducing event to salient contextual details, such as location. The authors provide strong evidence for the binding of context to emotionality, but do not seriously consider whether the memory of taboo words presented on a computer screen constitute a true FBM as opposed to an emotional EM, an important point in the present study. Furthermore, we were interested to what extent the manipulation of overall context and not just screen location might impact the recall of emotional memories.

On this latter point, there exists a wealth of literature, most prominently from Godden and Baddeley in 1975. In at least one study, these researchers showed that recalling information learned in the same environment as it was learned (underwater or on dry land) facilitated better recall. This initial evidence for context-dependent memory, alongside our interest in the *binding hypothesis* for FBM's in laboratory settings led to the research question: due to the potentially increased contextual binding in FBM situations, does context influence memory for high arousal, emotional pictures more than for neutral pictures?

We hypothesized that when subjects are tested in congruous environments as those in which they were presented with a series of pictures, recall will be facilitated more (just as in Godden and Baddeley) for emotional pictures than for neutral pictures (in line with Mackay and Ahmetzanov). Searching for an interaction between location and emotion in this way better simulates FBM's than any previous study (according to Curci and Lanciano's research) by manipulating the subject's entire location- a component of autobiographical memory- when asking for the recall of a series of emotional and neutral pictures. This more complete integration of the theory of FBM's with the practice of context-manipulation also allows for insights into whether it is possible to accurately simulate the memory effects of real-world FBM's in controlled settings.

III. Methods

Participants

The study was comprised of 22 college students, 14 females and 8 males, aged 18-23. All participants were chosen by means of convenience from the Claremont Colleges. Informed consent was given by all participants, which emphasized the appearance of potentially disturbing images. No participant was excluded.

Materials

Two slideshows of 20 pictures each were presented on a Mac desktop computer using the program SuperLab, with each picture presented for 2.5 seconds. The 40 pictures were chosen from the International Affective Picture System (IAPS) database and were either "negative" (emotional) or "neutral" (see Table 1 for a complete list of pictures used). According to the IAPS pre-rated norms, the negative and neutral pictures differed significantly in valence, $t(38) = 12.06$, $p < .001$, and in arousal, $t(38) = 14.05$, $p < .001$. More specifically, the negative pictures were lower in valence ($M = 3.31$, $SD = 0.69$) and higher in arousal ($M = 5.97$, $SD = 0.69$), when compared to the valence ($M = 5.48$, $SD = 0.41$) and arousal ($M = 3.41$, $SD = 0.43$) of the neutral pictures. The 40 pictures were divided into two sets of 10 negative and 10 neutral pictures each, and there were no differences between these sets in terms of valence or arousal of their negative and neutral pictures, all p's > .1 (see Table 2). Within each set, the order of the pictures was randomized.

A pilot study ($N = 5$) was conducted prior to the experiment to test for ceiling effects in the free-recall task for both sets of pictures. Participants in the pilot study simply viewed one of the sets of pictures, waited 10 seconds, and recalled as many pictures as possible. No participant recalled more than 15 out of 20 pictures; as such, it was concluded that ceiling effects on recall would not be an issue in the main experiment, which was more complex. Paper and pens were provided for the free-recall task in both the pilot study and the actual experiment.

Procedure

A within-subjects experimental design was used, in which all participants completed four conditions, which differed in the location of picture recall (the same room as original presentation or a different room) and in the emotion of the pictures (negative or neutral).

Emotion was manipulated randomly within each set of pictures, whereas location was manipulated for each set as a whole. Different sets of images were used so that participants would have different stimuli to recall, but the sets were statistically equivalent. The first set of pictures was always presented first, but the order of the location conditions was counterbalanced across participants.

All participants were shown a set of images in the first room, which was a small testing room with a few computers and chairs. The program instructed participants to simply view the images, which were presented automatically, and to alert the experimenter when finished. The experimenter then instructed participants to exit the first room and to walk around a common room while counting backwards from 100 by sevens as a distractor task. After 20 seconds, participants were told to enter either the original room or a novel room—a larger room with more decor than the first—and to write down descriptions of as many images as they could remember from the set. Participants were given approximately two minutes for this free-recall task. This procedure was then repeated with recall in the other room and starting at 150 for the distractor task.

IV. Results

A 2 (emotion: negative, neutral) x 2 (location: same room, different room) repeated measures ANOVA on number of pictures recalled (see Table 3) revealed that there was a large, significant main effect of emotion, $F(1,21) = 25.583$, $p < .001$, $eta^2 = .549$, whereby more emotional pictures ($M = 6.045$, $SD = 1.31$) were recalled than neutral pictures ($M = 4.136$, $SD = 1.43$). However, there was no significant main effect of location, $F(1,21) = .379$, $p = .545$, and no significant interaction between location and emotion, $F(1,21) = .811$, $p = .378$ (see Figure 1). Means and standard deviations for each of the four conditions are reported in Table 4.

V. Discussion

The present study failed to fully support our hypothesis that subjects tested in congruous environments as those in which they were presented with a series of pictures would recall more emotional pictures than neutral pictures when compared with their recall of emotional versus neutral pictures in a different environment. While we did find a significant main effect of emotion (negative pictures were remembered better than neutral ones), we did not find that manipulating the location of recall had any significant effect, and, accordingly, there was no significant interaction between emotion and location.

Sources of error for this experiment include the possibilities that the negative pictures were not emotional enough (which is not likely given their IAPS ratings and the main effect of emotion), that the locations were not different enough to be effective variables, or that our limited access to participants prevented noticeable differences from emerging. In the future, we could redesign this experiment to account for those factors, and possibly also implement a between-subject design with a greater sample size to prevent participants from "catching onto" the purpose of the study and thereby affecting their results. Despite any of these potential structural issues, though, it is legitimate to question at this point whether there is a more theoretical fault underlying this study on *flashbulb memories* (FBM's) and other similar ones.

The failure to find a contextual-binding effect prompted by a change in room location brings up questions about what constitutes "context" in FBM situations, or if what we were inducing in the lab can even be considered a FBM. In this study, a change in the décor of a room was not enough to replicate findings resembling either Mackay and Ahmetzanov or Godden and Baddeley, despite the fact that Curci and Lanciano's paper suggests that autobiographical memory details such as location should be associated with and prompt better recall of FBM's.

While the proper context to stimulate such an effect might lie in more distinct locations, sounds, smells etc., there is also the high likelihood that, in this experiment and others like MacKay and Ahmetzanov's which did something similar with taboo words, the emotional picture stimuli are not enough to simulate FBM's like those we encounter in more lifelike situations, such as terrorist attacks or the death of a loved one.

This interpretation does not directly threaten the *binding hypothesis* (there is still clear and accumulated proof that emotionality can bind things to their context, even if that was not elicited in this case), although it does point out that the presentation of emotional material on a screen may more closely resemble *event memory* (EM), instead of more complex FBM's which require an integration of contextualized, autobiographical, and episodic details to accompany the semantic information. Put more simply, seeing an IAPS picture with a high negative valence rating will never be shocking enough to induce a response similar to, for example, seeing live video of the attacks on 9/11. The experimental paradigm we relied upon, which of course drew from Mackay and Ahmetzanov, is effective at directly measuring EM, even emotional EM, but can only reveal things about FBM indirectly, if at all. We may need to end up admitting that, with regards to testing the effects of FBM's on contextualized memory recall and in similar experiments, the lab is simply too different from the real world.

VI. References

Curci, A., & Lanciano, T. (2009). Features Of Autobiographical Memory: Theoretical And Empirical Issues In The Measurement Of Flashbulb Memory. *The Journal of General Psychology, 136*(2), 129-152.

Godden, D., & Baddeley, A. (1975). Context-Dependent Memory in Two Natural Environments: On Land and Underwater. *British Journal of Psychology, 66*(3), 325-331.

MacKay, D., & Ahmetzanov, M. (2005). Emotion, Memory, And Attention In The Taboo Stroop Paradigm. *Psychological Science, 16*(1), 25-32.

VII. Tables and Figures

Set 1 Negative	Set 1 Neutral	Set 2 Negative	Set 2 Neutral
Woman Held Hostage	Keyring	Crying Baby	Hammer
Child Running Away	Man with Newspaper	Gun to Head	Outlet
Woman in Fire	Satellites	Bugs on Food	Buffalo
Gun to Subject	Dice	Car Crash	Fire Hydrant
Mutated Cat	Shopper	People in Fire	Coffee Cup
Snake	Chess Game	Spider	Doctor
Police vs. Civilians	Clothespin	Cop with Gun	Farmer
Dog	Violinist	Plane Explosion	Woman Golfer
Dentist	Birds	Shark	Man on Bike
Skulls	Runner	Molten Corpse	Fast Food

Table 1. List of IAPS pictures used in the study, separated by the set number

Means(SD)	**Negative (Overall)**	**Neutral (Overall)**	**Negative (Set 1)**	**Neutral (Set 1)**	**Negative (Set 2)**	**Neutral (Set 2)**
Valence	3.31(.69)	5.48(.41)	3.30(.70)	5.44(.32)	3.32(.72)	5.52(.50)
Level of Arousal	5.97(.69)	3.41(.43)	6.02(.87)	3.30(.41)	5.92(.50)	3.52(.45)

Table 2. Pre-rated statistics for the different sets of pictures, taken from the IAPS database

2x2 Repeated Measures ANOVA	**F-value**	**Significance, alpha level = .05**	**eta^2 (effect size)**
Location	.379	p = .545, ns	.018
Emotion	25.583	p < .001, significant	.549
Location*Emotion	.811	p = .378 , ns	.037

Table 3. Within-subject Repeated Measures analysis of variance results for main effects (location and emotion) and main interaction (location by emotion)

Condition	Overall Means (SD)
Same Room, Emotional Pictures	6.09 (1.74)
Same Room, Neutral Pictures	3.91 (1.44)
Different Room, Emotional Pictures	6.00 (1.60)
Different Room, Neutral Pictures	4.36 (1.94)

Table 4. Mean recall responses and standard deviations to each category of pictures across twenty-two participants

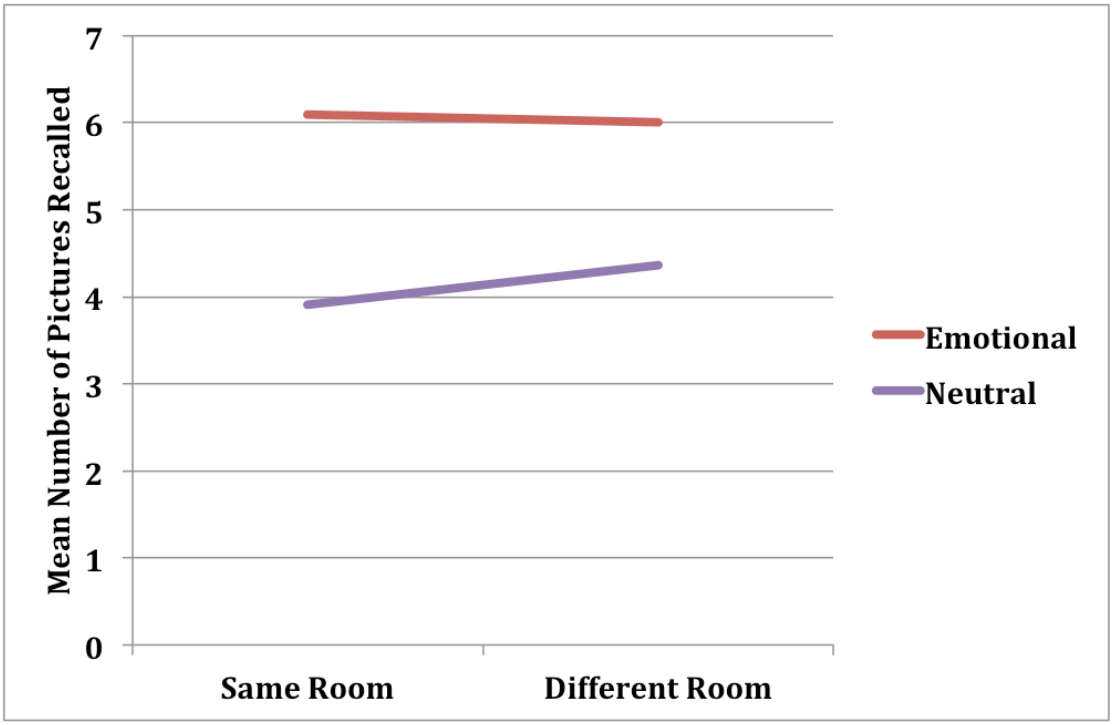

Figure 1. Mean number of pictures recalled in the same room and different room conditions by emotionality of pictures.