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# Emotion, Memory, and Religious Concepts

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## Abstract

Recent work has shown that ‘minimally counterintuitive’ (MCI) concepts are more memorable than both normal and bizarre concepts in ways that may explain why supernatural ideas lie at the heart of religious systems. However, such investigations have ignored other factors, including especially emotional loadings, that may also be relevant. The present study replicated previous findings of an MCI effect on memorability, adding new information about delayed effects. We also found interesting interactions between MCI structure and emotional loading that suggest a more complex account of what makes supernatural or religious concepts special.

**Keywords:** Memory, emotion, religion, concepts, MCI

## Introduction

A longstanding theoretical problem for researchers studying the nature of religious concepts is to explain how the same cognitive machinery that tracks ordinary, mundane events and objects might also be responsible for the extraordinary, supernatural concepts that lie at the heart of religious systems. Although it has been argued by some that there are dedicated modules for handling at least some religious concepts (Bering, in press) and by others that religious ideas reflect the operation of genes that increase access to self-transcending religious experiences and ideas (Hamer, 2004), most students of the cognitive science of religion are committed to the search for ways to explain religious cognition using well-established research and theory about the operation of basic, and general, cognitive processes (Barrett, 2000; Lawson & McCauley, 1990; Whitehouse, 2004). One of the most interesting ideas about how to do this is grounded in theories about how the organization of our domain categories interacts with memory systems to enhance the likelihood that some concepts or ideas will be especially likely to capture attention and cognitive resources long enough to be encoded and vividly remembered (Boyer & Ramble, 2001). Boyer and Ramble argue that religious concepts always point to a natural domain that is represented richly enough to allow extrapolation beyond the information given for any new exemplar. By doing so, these concepts gain access to familiar, default expectations for members of the category. However, counter-intuitively, some ideas violate the normal domain expectations either by negating some expectation for natural category members, or

by importing expectations from another category. For example, “a dog that walks through walls,” captures all of the normal expectations for dogs except the expectation that, as a physical object, dogs and walls are both permanent and cannot occupy the same space at the same time. “A plant that sings,” engages the plant category but imports the capacity to sing from the human category domain. In both cases, what results is what Boyer and Ramble (2001) call a Minimally Counterintuitive (MCI) concept.

MCI concepts have a supernatural quality in virtue of their violation of natural domain expectations and thus seem a likely candidate for helping to explain certain key ideas at the heart of religious systems of belief. Particularly interesting is the claim that the distinctive structure of these ideas makes them anomalous enough to capture increased attention from those exposed to them. They are considered *minimally* counterintuitive because more than one, or at most two, violations of domain expectations seems to produce an idea that strikes people as simply bizarre or incoherent and thus not worth further attention. The greater attention devoted to MCI concepts increases the likelihood that they will be remembered, while their counterintuitive nature leads to processing at a deeper level in an effort to resolve the expectation violation. Boyer argues that this novel way of engaging perfectly ordinary cognitive systems lies at the heart of any system that we consider religious (Boyer, 2002).

The MCI hypothesis has received considerable experimental support. Boyer and Ramble (2001) found that MCI concepts, presented as part of a simple narrative, had a higher rate of recall than both normal and bizarre concepts for samples based in France, Gabon, and Nepal. Likewise, Barrett and Nyhof (2001) found memory and transmission advantages for MCI concepts over mundane and bizarre concepts. There is also some evidence that even theologically complex concepts, such as the Abrahamic God, may utilize an underlying MCI-like structure when subjected to real-time processing demands (Barrett & Keil, 1996). Even though God is often explicitly thought of as being omniscient, omnipotent, and omnipresent, believers appear to subconsciously apply constraints on His abilities. Implicit measures of story comprehension confirm this effect for both God and various Hindu deities (Barrett, 1998).

Recently, however, Atran (2002) has challenged the MCI account. In a list-recall task, Atran found better initial recall for normal concepts than MCI ones, contradicting a central prediction of the theory. Atran did find that recall for MCI concepts degraded less than that for normal concepts when participants were asked to recall them again one week later, which is at least consistent with the claimed memory enhancing effects of such ideas. On balance, it seems that there is a genuine memory enhancement effect of MCI concepts, although the time course of that effect remains unclear.

While the MCI hypothesis has produced a growing body of interesting research and new ideas about the special memorability of concepts that fit a supernatural template, it has typically been explored without regard for other factors known to affect how well material is recalled. One set of psychological processes that would seem an obvious source of effects is found in the emotional domain. Even a cursory reading of the most widely known and oft repeated narrative stories in the major religious traditions reveals a strong emotional component. The talking serpent of the biblical creation story tempts Eve, leading to mankind's downfall and evoking strong negative emotions associated with snakes, temptation, and loss. Similarly, Muhammad survives a horrendous evisceration while being purified by the angel Gabriel in a well-known Islamic story. It seems a reasonable hypothesis that emotional factors affect the memorability of religious concepts quite independently of the effects of MCI structure and may well interact with the MCI nature of those concepts in important ways. The goal of the research described here is to explore the contribution of emotion to the memorability of MCI concepts.

The link between cognition and emotion in general has been the focus of investigation for many decades and there is now considerable evidence that emotional arousal serves to focus attention on those stimulus features responsible for the arousal (Easterbrook, 1959) and that arousal also enhances consolidation of long-term memory in both animals (McGaugh, 2004) and humans (Heuer & Reisberg, 1992). Research has shown that emotion, and particularly negative emotion, appears to enhance the quality and accuracy of memory in at least two ways. The first concerns the emotional context in which memory is presented. The most extreme example of this can be found in the work on 'flashbulb' memories. Under conditions of extremely high emotional arousal, surprisingly detailed information about where one is and what one is doing are preserved in an especially vivid form (Christianson, 1992). However, less extreme emotional situations have also been shown to enhance memorability. Cahill and McGaugh (1995), for example, found that participants who saw a series of pictures accompanied by a highly emotional story recalled details of those pictures with greater accuracy and detail than participants who saw the same pictures accompanied by a relatively non-emotional story. The effect was particularly prominent for pictures that were made highly emotional in one story, but not the other.

Memory is also significantly affected by the emotional valence (whether it is seen as inherently positive or negative) attached to encoded information. Kensinger and Corkin (2003) found enhanced recall for emotional material at the level of individual words. While taboo words (i.e. 'curses', ethnic slurs), which are assumed to be both arousing and highly negatively valenced, were remembered with the greatest accuracy and contextual detail (presentation color), even words that were only mildly valenced (e.g., "sad") were remembered significantly better than non-emotional words. Similar effects appear to hold for young children, who show increased recall for emotional events in a story as compared with non-emotional events (Davidson, Luo, & Burden, 2001).

These findings suggest a likely role for emotional context and content in the memorability of the kind of material used to study the effects of MCI concepts on recall. In the absence of previous work on the relationship between these two factors, it is hypothesized that one or both of these emotional factors will produce additive effects in conjunction with MCI concepts. Although it is possible that there are discrete processing effects for specific emotions, the present study only examined negative affect, which is associated with focused processing strategies and has been most consistently shown to enhance memory (Levine & Pizarro, 2004). In addition, the study design provides an opportunity to weigh in on the basic dispute about the size of the MCI effect itself using a procedure that assessed both immediate and delayed recall. To that end we created narrative-like stories that manipulate MCI structure, affective context, and affective loading of specific stimuli and assessed recall for this material both shortly after it is encountered and one week later.

## Method

### Participants

Participants were 35 Vassar College undergraduates recruited from introductory psychology classes and the general college population. Participants included 4 men and 31 women. One female subject was excluded due to an inordinate amount of missing data.

### Materials

**Narratives** Narratives consisted of two basic story templates presented using Superlab experimental software running on an iMac computer under OS 9.2. In addition to an introduction and conclusion, each story contained 24 three-sentence descriptions of the protagonist encountering various objects (See Table 1). The length of each three-sentence event was restricted to  $30 \pm 3$  words. The objects for each story varied by structure (MCI versus non-MCI) and emotional valence (negative emotional vs. neutral) such that six were non-MCI and neutral, six were non-MCI and emotional, six were MCI and neutral, and six were MCI and emotional. The events were presented individually in

randomized order for each participant to control for possible order effects.

Each story was presented with one of two possible introductions. In the emotional context condition, a family member of the protagonist suffers a life-threatening injury and the protagonist goes on a journey to get help. In the neutral context, the protagonist's activities are to help his or her family (one of the stories is about a character named John, the other about a character named Sarah) with a less important task. Order of introductions was counterbalanced by type. The two introductions were of nearly equal length (196 and 197 words).

Table 1: Sample Story Events

Concept Type	
Neutral Non-MCI	A woman sleeping under a tree
Emotional Non-MCI	A poisonous snake
Neutral MCI	A plant that moves around
Emotional MCI	A rock that eats people

**Context Ratings** To check for the effectiveness of the emotional context manipulation, participants were asked to rate the emotional impact of each introduction immediately after reading it. Ratings were made using a 7-point scale, with higher ratings indicating greater emotional impact.

**Concept Ratings** To test the effectiveness of the emotional valence manipulation, participants were asked to rate how dangerous, disturbing, or emotional they thought each event was. To control for possible effects due to previous familiarity with similar concepts, participants were asked to rate how familiar each concept was from real life and entertainment. Ratings for both questions were made on a 5-point scale with larger values indicating greater familiarity and emotional impact.

**PANAS** Prior to reading the stories participants were asked to complete a short version of the Positive and Negative Affect Schedule (PANAS) to provide a measure of mood at the time of the experiment (Watson, Clark, & Tellegen, 1988).

## Procedure

After obtaining informed consent and data archival permission, participants were asked to complete the PANAS. Participants were then presented with the first narrative introduction and asked to rate it for emotional impact. Participants then read the story events, which were presented one at a time on screen, in random order. The duration for presentation of each event was under participant control. Upon completion of the story, participants completed a 5-minute distraction task (mental arithmetic based on counting letters and syllables in long words). Participants were then given a sheet of paper and asked to write down as many of the story events as they could remember in as much detail as possible. This procedure was repeated for the second narrative. Upon completion of the second recall task, participants were asked to rate each concept for emotional valence and familiarity.

Participants were asked to return one week later. They then performed an additional recall task where they were asked to write down as many events from both stories in as much detail as possible. Participants then gave a second set of emotional valence and familiarity ratings for each concept. Participants were then thanked and debriefed.

## Data Reduction

Items were counted as recalled if they were remembered accurately or had only slight distortion (i.e. a man was remembered as a woman; a statue that told lies was remembered as rock instead). Generally, this was not an issue and distortions were very slight. Given this study's emphasis, distortion patterns in the data, as described by Atran (2002), were not examined.

Unfortunately, one 'neutral normal' concept (a lake) was repeated in both stories. For the second recall session, the concept was scored normally for both stories if it was recalled twice. For cases where it was only recalled once, a proportion score was calculated from the first round for how often it was recalled for the first and second story. These proportions (.45 and .55 respectively) were then used for scoring the second week's recall task accordingly.

The data were prepared for two separate analyses. For the first analysis, which was designed to look at the pattern of an individual's responses, the number of each type of concept remembered during each session was computed. Individual response pattern was of interest due to potential confounds with the emotional context manipulation (see below). In addition, because events were not randomly assigned to the two different stories (always appearing in the same set of 24), it was possible that some differences could be due to one set or the other tending to have more memorable items in general. The second analysis attempted to circumvent some of these potential issues by examining individual concept memorability across participants. For this latter analysis, the number of people who remembered a given concept was looked at for each session.

## Results

### PANAS

The mean positive affect score on the PANAS was 26.35 (STD=6.4). The mean score for negative affect was 14.6 (STD=4.25). Both positive and negative affect were used to perform a variety of ANCOVAs, but no systematic relationships with the study's main dependent measures were found.

### Manipulation Checks

**Context Manipulation** Results are summarized in Figure 1. The effectiveness of the context manipulation was tested by examining the difference in emotion ratings for the story introductions in a 2 (context-order) x 2(story order) ANOVA. There were main effects of both context order,  $F(1,30)=8.00$ ,  $p<.01$  and story presentation (John story

followed by Sarah story (order A), or vice versa (order B),  $F(1,30)=15.00$ ,  $p<.001$ . There was also a significant interaction between context presentation order and story presentation order,  $F(1,30)=10.09$ ,  $p<.01$ .

**Emotional Valence** Emotional valence scores are summarized in Table 2. The average of the ratings scores from the two sessions was used for analysis. A 2(story) x 2(neutral vs. emotional) x 2(normal vs. MCI) between subjects ANOVA was used to examine the data. Main effects of both emotional valence,  $F(1,40)=324.14$ ,  $p<.0001$ , and structure,  $F(1,40)=52.12$ ,  $p<.0001$ , were found, such that MCI concepts were more disturbing than normal ones. A highly significant interaction effect was

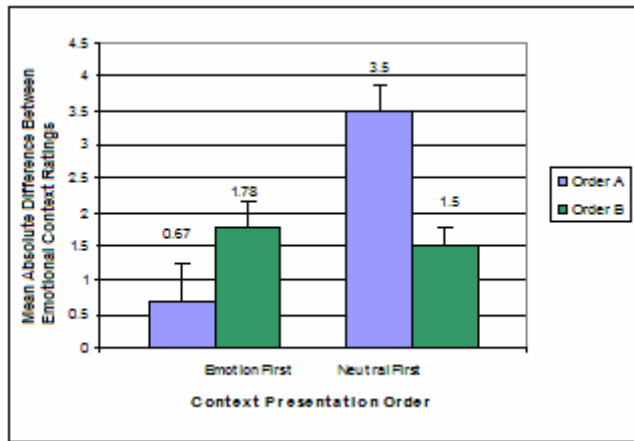


Figure 1. Average absolute difference in emotion ratings for introductions with standard error bars.

also found,  $F(1,40)=11.56$ ,  $p<.001$ , such that emotional MCI concepts were rated as being the most disturbing. There was also a significant interaction between story and structure,  $F(1,40)=6.22$ ,  $p<.02$ .

Table 2: Average Emotional Valence Ratings  
Higher numbers indicate greater emotional valence

Valence	Conceptual Structure	
	Normal (Mean ± SD)	MCI (Mean ± SD)
Neutral	1.09 ± 0.08	2.17 ± 0.52
Emotional	3.26 ± 0.42	3.65 ± 0.35

**Familiarity** The familiarity scores from the two different rating sessions were averaged for this analysis. Results are summarized in Table 3. A 2(story) x 2(emotional vs. neutral) x 2(normal vs. MCI) ANOVA indicated main effects of valence,  $F(1,40)=17.98$ , and structure,  $F(1,40)=328.91$ ,  $p<.01$ . Participants rated negatively valenced and MCI concepts as being less familiar. There was also an interaction between valence and structure,  $F(1,40)=5.57$ ,  $p<.02$ , such that valence made normal concepts more unfamiliar than MCI ones. A regression found that familiarity and emotional valence were significant predictors of one another,  $r(47)=0.51$ ,  $p<.001$ .

Table 3: Average Familiarity Ratings  
Higher numbers indicate less familiarity

Valence	Conceptual Structure	
	Normal (Mean ± SD)	MCI (Mean ± SD)
Neutral	1.34 (0.17)	3.87 (0.54)
Emotional	2.15 (0.53)	4.10 (0.31)

## Participant Recall

A series of mixed-model ANOVAs examining the types of concepts recalled by individual participants were performed with story order and context order as 2 x 2 between subjects factors and a 2 (week 1 vs. week 2) x 2 (neutral vs. emotional context) x 2 (normal vs. MCI) x 2 (emotional vs. neutral valence) within-subjects design. The average recall pattern across all groups is presented in Figure 2. Only significant results are reported below.

**Time** As expected, there was a highly significant effect of testing session (week 1 vs. week 2),  $F(1,30)=40.70$ ,  $p<.0001$ , with better recall at week 1.

**Structure** A main effect of structure,  $F(1,30)=50.03$ ,  $p<.0001$ , is the result of enhanced MCI recall as compared with non-MCI concepts. There was also a significant interaction effect between testing session (week 1 vs. week2) and structure for recall,  $F(1,30)=5.15$ ,  $p<.03$ , though this was confounded by significant interactions with contextual presentation order,  $F(1,30)=4.00$ ,  $p<.05$  and a three-way interaction with both story and contextual presentation orders,  $F(1,30)=4.78$ ,  $p<.04$ . There was also a significant interaction between conceptual structure and emotional valence,  $F(1,30)=5.96$ ,  $p<.02$ . Emotionally loaded MCI concepts are better recalled than neutral MCI; the pattern reverses for non-MCI concepts (see Figure 2).

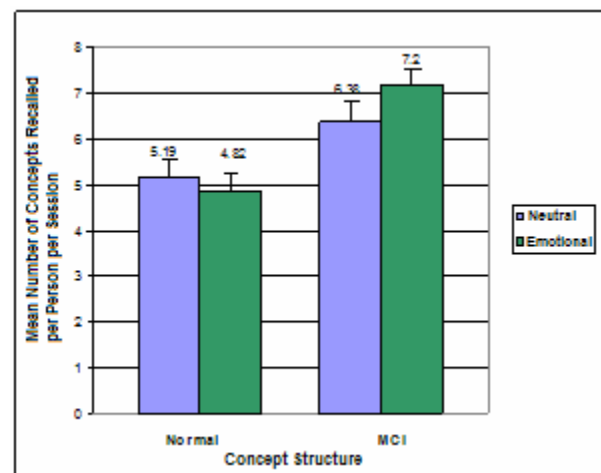


Figure 2. Average participant recall pattern with standard error bars.

**Context** There was no main effect of presentation context on recall, but the interaction with concept valence approached significance,  $F(1,30)=3.71$ ,  $p=.06$ . Unfortunately, this was confounded by a highly significant

interaction with context presentation order,  $F(1,30)=10.90$ ,  $p<.001$ . Presentation context had confounding interactions with both story and emotion presentation orders,  $F(1,30)=6.39$ ,  $p<.07$  and with structure, valence, and both emotion and story presentation orders,  $F(1,30)=19.14$ ,  $p<.01$ .

### Concept Memorability

**Average Memorability** Individual concept memorability across participants was examined in a 2 (story) x 2 (neutral vs. emotional) x 2 (normal vs. MCI) ANOVA using an average of the recall from both sessions. Here, the MCI-memorability main effect was replicated,  $F(1,40)=14.28$ ,  $p<.001$ . Neither a main effect of negative emotional valence nor an interaction of valence with structure was found. Results are summarized in Figure 3.

**Degradation** In similar analysis with repeated measures on testing session (week 1 vs. week 2), the expected decrease in recall across sessions was found,  $F(1,40)=130.02$ ,  $p<.0001$ . However, the lack of any significant interactions in this second analysis suggests that recall for both types degraded similarly across sessions, contrary to results reported by Atran (2002).

**Emotional Context** In a third analysis, examining differences in memorability for concepts presented in emotional and neutral contexts, there was a significant interaction of context and valence,  $F(1,40)=4.23$ ,  $p<.05$ , such that nonemotional concepts were remembered better in emotional contexts. No main effects of emotional valence were found nor were any interactions between valence and structure for any of these analyses.

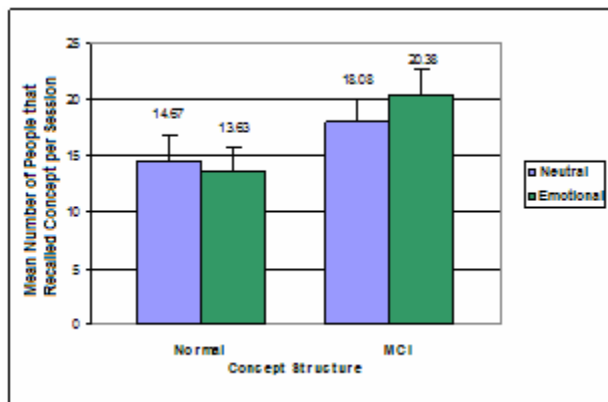


Figure 3. Average concept recall with standard error bars.

### Discussion

Among the most compelling results of this study is the clear replication of the MCI memory enhancement effect demonstrated by Boyer and Ramble (2001). Further work will be needed, however, to properly explain why this effect is not observed in other research (Atran, 2002). It may be relevant that Atran used a list-recall paradigm whereas the present study used the same kind of narrative structure

employed by researchers who do find the effect (Barret & Nyhof, 2001; Boyer & Ramble, 2001). Embedding concepts in narrative stories may require different kinds and/or greater depth of processing than presenting them in a straightforward list. The fact that so much of the information in doctrinal religious traditions (cf. Whitehouse, 2004) is transmitted in stories may reflect the implicit appreciation by those who would spread the religion that there is something special about how concepts are processed when in narrative form. On the other hand, there was some evidence from the present research that confirms Atran's (2002) finding that conceptual structure does affect degradation of memory over time, suggesting that this pattern may be independent of mode of concept presentation.

Results of the manipulation of emotional valence were also particularly interesting. The failure to find a main effect of emotional valence on item recall is somewhat surprising given that such effects are commonly described in the literature (see Kensinger & Corkin, 2003), but the effect is not always found (e.g., Ochsner, 2000) and we did find an important interaction between emotional valence and conceptual structure in which emotionally laden MCI concepts were particularly memorable. This is again consistent with the informal observation that so many of the most oft repeated, canonical stories in many religious traditions have a strong emotional component. Had there been a main effect of emotional valence one might have referred to an additive effect of MCI structure and affect. As it is, further research will be needed to refine our understanding of how these two facets of a concept are related during encoding and processing. Recent fMRI work has begun to indicate complex regulating effects of frontal-lobe-mediated cognitive processes on emotion (Ochsner, Bunge, Gross & Gabrieli, 2002). What has become the standard story about the effects of emotion on cognitive processing may be too simple to capture the dynamic interaction between cognitive and emotional systems and MCI-emotion interactions may be especially fertile ground for such research.

Analyses of the emotional valence and familiarity ratings, obtained to check manipulation effectiveness and control for cultural familiarity, provided interesting results in their own right. For example, the main effect of conceptual structure on emotional valence scores was not predicted, although in hindsight it seems a perfectly reasonable hypothesis that a violation of such basic ontological expectations about the world would trigger some type of affective response. In a similar vein, the fact that familiarity with a concept is associated with lowered emotional valence makes perfectly good sense. It is an interesting question for further research whether even emotionally arousing MCI concepts become less so as they become familiar, a result that would be consistent with the theory that doctrinal religions require frequent ritual repetition of core concepts precisely because their familiarity makes them less memorable (Whitehouse, 2004).

Unwittingly, the design of the present study also raises some deeper questions about the nature of the role played by context in the processing of the kinds of concepts explored here. For example, contrary to all expectations, which of the two stories was presented first interacted with the emotional context to affect emotion rating of the stories. Further research will be needed to understand the nature of these effects, but whatever their source, it is interesting to note that the same story may have a very different effect when read “cold,” as it were, without previous narration, than when read after another story has already been processed. The narrative structure of religious instruction in real world settings, whether in sermons or the simple reading or retelling of stories from the tradition, may well be able to take advantage of such effects. Indeed, even the historical redacting of religious texts may be shaped in part by discoveries of more and less effective sequencing of religious narratives. In the present study, these effects operate as confounds that raise more questions than they answer, but they do point the way to important ideas for further investigation.

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