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Title

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Permalink

<https://escholarship.org/uc/item/8mv770rc>

Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 29(29)

ISSN

1069-7977

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Publication Date

2007

Peer reviewed

The Optimal Cognitive Template of Minimally Counterintuitive Narratives

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Abstract

After studying the differences between culturally successful and unsuccessful folk tales, Norenzayan *et al.* (2006) recently postulated that culturally successful folk tales share a structure. In particular, they argued that having two or three minimally counterintuitive concepts made a story more memorable which in turn gave it transmission advantages allowing it to become widespread. This paper reports on a study conducted to test that hypothesis. This involved presenting subjects with stories containing 1, 3, or 6 minimally counterintuitive concepts and measuring the story recall. The experiments do not support the Norenzayan *et al.* hypothesis and suggest that there is no one optimal template for counterintuitive narratives. The paper suggests that an alternative account is needed to explain recall and comprehension for stories containing counterintuitive ideas.

Keywords: Anthropology, Cognitive Science, Language understanding, Social cognition.

Introduction

Why do some stories become widespread as successful folktales while others die soon after their creation? Memorability has been considered to be an important variable that explains some of the differences in distribution of cultural concepts (Boyer 1994). Everything else being equal, stories that are easier to remember and recall would be more likely to be transmitted in a population. Systematic studies of story memorability started with Bartlett's classic studies (Bartlett 1932). In a series of experiments, Bartlett asked British university students to read passages from various folk tales including the Native North American folk tale "the war of the ghosts" (Erdoes & Ortiz 1984) and retell it to others in writing who then retold it to others. Bartlett analyzed the transformation of various concepts over successive retellings. He concluded that culturally unfamiliar concepts were distorted and replaced by more familiar concepts; for instance, a canoe was replaced by a rowboat. In none of the series of ten reproductions of, "the war of ghosts," did a mention of ghosts remain, even though the story's title mentions ghosts. Bartlett reasoned that culturally unfamiliar concepts such as canoe and ghost are more difficult to represent in human memory and therefore they are more likely to get distorted. Even though, Bartlett did not systematically measure and compare the recall rates of culturally familiar and unfamiliar concepts, he argued that culturally unfamiliar concepts are less likely to be remembered and recalled and hence less likely to be transmitted than familiar concepts.

Kintsch and Greene (1978) selected an Apache tale and a story from Brothers Grimm. Similar to Bartlett, they found that five retellings of the Apache story introduced more severe distortions than the Grimm story. They concluded that this happened because the Grimm story better conformed to the structure expected by their subjects.

Barrett and Nyhoff (2001) also repeated Bartlett's methodology using a larger set of Native North American folk tales from Erdoes & Ortiz (1984). Six stories of about 500 words or less, containing both intuitive concepts such as the river, mountain, and bird and expectation violating counterintuitive concepts such as a talking bird and a walking stone, were chosen. They found that recall rates for counterintuitive concepts were significantly higher than recall rates for intuitive concepts. Barrett and Nyhoff also designed an artificial story to better control for the number of intuitive and counterintuitive concepts, narrative structure, and the amount of repeated exposure to a concept. The futuristic story about a person visiting a museum to see alien beings and artifacts was designed to contain six concepts of each of the following three types:

1. intuitive concepts that conform to expectations such as a being who is aware of its existence
2. minimally counterintuitive concepts that violate one intuitive expectations such as a being who never dies, and
3. bizarre concepts that do not violate any category expectations but have an unusual feature value such as a being who weighs 1000 pounds.

They found that after three retellings, counterintuitive concepts were better recalled than bizarre concepts which were better recalled than intuitive concepts.

Boyer and Ramble (2001) used a variant of Barrett and Nyhoff's (2001) alien museum story but did not use a serial reproduction task. Instead, they had subjects read a story and following a brief distraction task answer a question requiring reproduction of as many intuitive, counterintuitive and bizarre items mentioned in the story as the subject could recall. Their results supported Barrett and Nyhoff's conclusion that minimally counterintuitive items are best recalled and the intuitive items are worst recalled. However, none of these studies addressed the question of whether *stories* containing minimally counterintuitive ideas are recalled better or not? i.e., does the presence of minimally counterintuitive ideas improve story recall? If so is there a particular number of counterintuitive concepts that

does so? What is the optimal cognitive template of folktales for memorability?

Norenzayan, Atran, Faulkner, and Schaller (2006) conducted experiments to address this questions. They select 42 Grimm Brothers folktales such that half of the stories were judged to be “culturally successful” (they attained more hits on 400 world wide web Google searches) and the other half were considered to be “culturally unsuccessful” (because they had fewer Google hits). The numbers of counterintuitive ideas present in each story were then counted. The results indicated that a large majority of the folk tales deemed culturally successful had two or three counterintuitive ideas whereas the number of ideas was more distributed from none to six. Subjects were then asked to read these stories and answer a number of questions to determine if the subjects thought that the stories were memorable, easy to transmit, interesting enough to tell their peers, and appropriate for children. Their results indicated that subjects thought that stories that had more Google hits were indeed judged by subjects to be more memorable and worth telling their friends. On the basis of this evidence, Norenzayan *et al.* argued that stories that contain two or three counterintuitive ideas enjoy memorability advantages over stories that have fewer (0 or 1) or more (4, 5, 6, or larger) counterintuitive ideas and hence they should be considered an optimal template for culturally successful folktales.

However, Norenzayan *et al.* did not directly measure the recall rates for stories containing various numbers of counterintuitive ideas. Subject judgments about what they think should be memorable may not correspond with what is actually memorable and the Grimm Brother stories selected as “culturally successful” may be widespread for a number of other reasons and not because they are more memorable for people. We believe that the hypothesis that “stories containing 2 or 3 counterintuitive ideas are more memorable than stories that contain fewer or more such ideas” can be tested directly. Next, we report on an experiment designed to do precisely that.

Experiment

Material & Method

We decided not to use the Grimm Brother’s stories used by Norenzayan *et al.* for the following reasons. First, because we wanted to control the number of concepts embedded in each story. Second, because of the practical difficulty of measuring recall for long stories.¹ We designed three short stories containing 300-400 words each. Two of the stories, namely, “The Journey Home” and “The Trader” have been previously used in previous experiments (Barrett & Nyhoff 2001; Boyer & Ramble 2001; Upal 2005) while the third story “The Night” (shown in Appendix) was used for the

first time. Three versions of each story were then designed. The first version had one counterintuitive idea, while the second version had three and the third version had six counterintuitive ideas. Six packet-groups were then designed such that each packet-group contained all three stories and all three versions. For instance, the first packet group contained Version 1 of Story 1, Version 2 of Story 2, and Version 3 of story 3 while the second packet group had Version 2 of Story 1, Version 1 of Story 2, and Version 3 of Story 3. By varying the order in which stories appear six different versions of each packet group were designed for a total of thirty six different packets. So, for instance, Packet 1 of the first packet group had Story 1 as its first story, and Story 2 as its second story and Story 3 as its third story while Packet 2 had Story 1 as its first story, and Story 3 as the second story and Story 2 as its third story. Thirty six University of Toledo undergraduate and graduate students ranging in age from 18 to 24 were then recruited to participate in the experiments.

Subjects were asked to carefully read all three stories so that they can answer some questions about them. Then they were asked to solve simple arithmetic problem for one minute. Following that they were asked to write down as much of each story as they could remember. Story recall was then measured by dividing each story into individual idea units constituting each story. The ideas roughly corresponded to the sentences in each story, although this wasn’t always the case as some sentences were judged to have multiple concepts in them. “The Trader” was determined to have significantly smaller number of ideas (around 30) than the “The Journey Home” and “The Night” had roughly the same number (around 50 each) idea units. Subject responses were then graded by how well they recall each idea. Numbers between 0 to 1 were assigned based on how closely the subject had recalled the idea with 1 being assigned to ideas that were deemed to have been recalled very well and 0 was assigned to ideas that were not recall by the subjects. Story recall was measured by adding the recall numbers for individual ideas constituting each story and dividing the sum by the total number of ideas in the story. Thus a perfectly recall story would be assigned the recall value of 1 while a story that is not recalled at all would get the recall value of 0.

Results & Discussion

We compared the recall rates of different versions of each story. If Norenzayan *et al.*’s hypothesis is correct then stories containing 3 counterintuitive concepts should be recalled significantly better than stories containing 1 or 6 counterintuitive concepts.

The results are shown in Table 1. It shows that recall rates do not vary significantly as a function of the number of concepts embedded in each story. While there is no statistically significant difference, for Story 1 and 3 recall rates actually increase as the number of counterintuitive

¹ Although this concern may be partly addressable by the use of automatic story recall software such as AutoCoder (Golden 2005).

concepts is increased. However, this trend is reversed for Story 3 where the recall actually decreases as the number of counterintuitive concepts is increased from 1 to 3 to 6. These results indicate that there is no unique optimal template for counterintuitive stories.

Table 1: Recall Results for each version of the story. *N*-MCI is the version of the story containing *N* minimally counterintuitive ideas.

	1-MCI	3-MCI	6-MCI
1- The Journey Home	0.26	0.28	0.31
2- The Night	0.26	0.24	0.23
3- The Trader	0.17	0.20	0.23

Our results beg for a theory that can explain as to why we observe the trends that we did. Previously (Upal 2005; Upal et al. 2007) we have argued for the need to connect the cognition and culture work with the traditional cognitive psychological work on language comprehension (Kintsch 1998). We believe that such a theory is needed to explain the recall for a satisfactory explanation of the recall for stories containing counterintuitive ideas.

The work on story comprehension suggests that when subjects read a story they attempt to infer a coherent theme from it. Memorability of a story is a function of the strength of connections that are established between the cue (e.g., the story title) and the mental model the readers construct from a story. Reader's success at inferring a coherent theme and establishing strong connections between the story theme and ideas constituent in a story depends on the prior knowledge that is activated in the subject's minds. Counterintuitive ideas and expectation violating ideas, in general, are remembered better to the extent to which they activate a subject's background knowledge that can help in integration those ideas and fit it in the theme of the story. If these unexpected ideas cannot be integrated with the main theme and are judged to be irrelevant to the story then they are not remembered as well. This explains that minimally counterintuitive ideas are recalled well because they violate a subjects expectations about objects/events of that type. Minimally counterintuitive ideas of the type found by cognitive anthropologists such as Boyer (1994) and Sperber (1996) to be widespread across the globe, however, are distinct from any garden variety expectation violating concepts (Schank & Abelson 1972) in that they involve violation of basic category assumptions. The extent to which people from different cultures share the knowledge of basic categories such ideas would have memorability advantages beyond those obtained by other expectation violating concepts.

This also explains as to why maximally counterintuitive concepts are not recalled as well as the minimally counterintuitive ideas even though they are even more

expectation violating then minimally counterintuitive ideas. This is so because subjects fail to integrate such concepts with the story theme using the available background knowledge. Since we know that people from different cultures differ in the background knowledge that they bring to bear on understanding a narrative, by making connections between comprehension, memorability, and transmissibility of ideas explicit such a theory would allow us to not only explain the aspects of a culture that are common with other cultures but also those aspects of a culture that are unique to it. For instance, this explains that the reason why Barlett's British subjects did not remember canoe is that is that they did not judge canoe to be a crucial part of the theme of these stories (replacing canoe with "row boat" instead in their recreated stories). This can also explain that recall did not increase as the number of counterintuitive concepts was increased in the culturally unfamiliar "The Night" as it did in the culturally familiar stories because the addition of even more counterintuitive ideas in a story that was hard to integrate into a known pattern to begin with made the aspects of story too difficult to integrate for our subjects.

The "Journey Home" and "The Trader", on the other hand, could be integrated even when they had six counterintuitive concepts in them. The presence of a larger number of counterintuitive concepts, however, made subjects spend more cognitive effort to activate more background knowledge to integrate more expectation violating concepts into a coherent theme. This resulted in an increased recall for these stories. However, the recall for "The Trader" story was less than that of "The Journey Home". This is because, as several of our subjects spontaneously indicated to us during the debrief, the list-like nature of this story makes it more difficult to integrate descriptions of the individuals in the story with the overall theme of the story.

Conclusions

The paper contradicts the notion that there is one unique optimal template for counterintuitive narratives. Unlike, previous work, experiments reported here were designed to directly address the question of memorability for stories containing various number of counterintuitive concepts show that the presence of two or three counterintuitive ideas, on its own, does not make stories more memorable than stories containing fewer or larger number of ideas. However, unlike Norenzayan *et al.*'s (2006), we used short artificially designed stories which gave us more control but also limits the results. It would be interesting to conduct a similar study with longer stories.

Considerable work needs to be done to further clarify the theory we outline above to have an accurate cognitive model of the comprehension, memorability, and transmissibility of narratives. We are planning several studies to further clarify these issues.

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Appendix

“The Night”

The 1-MCI version:

I woke up in the middle of the night and heard someone call my name. I put on my shoes and headed out to find out what was going on. As soon as I opened the front door, a gust of wind picked me up and carried me to the graveyard across from our house. I followed the voice which seemed to be coming from the mausoleum of Sheik Abdul Qadir Jilani located at the center of the graveyard.

A man opened the door for me and asked me to enter. As I entered, the great sheik walked out of his grave and said, "welcome Ali, I have been waiting for you." As I heard his voice, I recognized that the voice I had heard earlier in the

night was that of the Sheik himself. He hugged me and placed a kiss on my forehead. He said, "ask me what's in your heart son and I'll answer it." I asked him about the heaven.

He told me to hold his hand and come with him. I did as he said. We walked out of the mausoleum into the woods behind the graveyard. The path led us into the most picturesque valley the likes of which I've never seen before or since. There were trees full of delicious fruits and streams of milk and honey. They were full of the most beautiful animals: butterflies, birds of paradise, rabbits, and deer.

As we approached the ground the birds seemed to welcome us with their chirping. The water flowing through the river seemed to be singing in unison with the birds. Two maidens brought us the most delicious food and drinks I have ever tasted. I ate as much as I could while the Sheik watched me.

The sheik told me that the time of the morning prayer was upon us and that we should go to the mosque and pray. Next thing I remember is prostrating in prayer in my local mosque. I quickly finished my prayer and walked home. I came home and decided to write down this blessed incident.

The 6-MCI version:

I woke up in the middle of the night and heard someone call my name. I put on my shoes and headed out to find out what was going on. As soon as I opened the front door, a gust of wind picked me up and threw me on top of a carpet. The magic carpet started flying. It flew over the city, the desert, the oceans and great mountain ranges dropping me at the Golden gate of the Sheik Hasan Jilani's mausoleum in Baghdad.

A man opened the door and asked me to enter. As I entered, the great sheik walked out of his grave and said, "welcome Ali, I have been waiting for you." I recognized that voice. It was the same haunting voice that had woken me up from my sleep. He hugged me and placed a kiss on my forehead. He said, "ask me what's in your heart son and I'll answer it." I asked him about the heaven.

He told me to hold his hand and come with him. I did as I was told. As we walked to his grave, it opened up and we descended into the most picturesque valley the likes of which I've never seen before or since. There were trees full of delicious fruits and streams of milk and honey. I saw the most beautiful animals I have ever seen: butterflies, birds of paradise, rabbits, and deer. As we approached the ground the birds welcomed us with the song

salam O beloved of Allah
Salam O Sheik of Sheiks

The whole world (the deer, the water, and the ground) joined in with the birds and started singing to welcome us. The ground danced rhythmically as we stepped on it. Two beautiful angels with wings of heavenly hues brought us the most delicious food and drinks. I ate as much as I could but the plates were still full. It was as if I hadn't touched anything.

The sheik told me that the time of the morning prayer was upon us and that we should go to the mosque and pray. My next memory is that of lying on the ground prostrated in prayer at my local mosque. I quickly finished my prayers and walked home so that I could write down this blessed incident.

“The Trader”

The 6-MCI version:

There was a person who was at two places at same time. She was at one place and at another place at the same moment.

There was another person who could recognize people he had met before. If she met someone she would remember them.

There was another person who weighed more than an ox. It was terribly difficult to lift him.

There was another person who could guess future events. She knew exactly what was going to happen.

There was another person who was taller than a house. He was very tall and impressive.

There was another person who could hear what people said. If people talked next to him he heard what they said.

There was another person who ran faster than a horse. He went so fast that the horse could not catch up with him.

There was another person who went through walls. If he wanted he could walk right through a wall.

There was one person who had no shadow. Even in broad daylight, he did not have a shadow.

There was another person who could understand jokes. If you told her a joke she laughed.

There was another person who could see through a mountain. He could see what was on the other side of the mountain.

There was another person who could remember thousands of different names. He recalled the names of thousands of people.

There was another person who could see villages very far away. He could even see villages many miles away.

There was another person who was five feet tall. His height was a little above that of a woman.

There was another person who cried if you punched him. It hurt him wherever you were to hit him.

There was another person who has read thousands of books. He has read huge collections of books.

Nyima had finished telling people what he had seen in these far-away places. He told them that after he had traveled to those places he had felt homesick and that was why he had come back to be with his family.

“The Journey Home”

The 6-MCI version:

My sister and I were walking home from school. We saw a cat belonging to one of our friends. The cat crouched on the front lawn as she composed a symphony. Since the cat was completely absorbed in her work, we continued on our way chatting about what we had learned in school that day until a beautiful rose jumped right in front of us. We knew that we must get home soon before our mother starts worrying so we slipped away from the rose.

We had hardly moved when we noticed an earthworm crossing the sidewalk. I picked it up and felt its slimy texture and the squirm of its movement. I put it on the grass on the other side of the pavement and we continued on our way.

As we were walking my sister's shoes sprouted roots which broke up the pavement below and impaired her movement. I remembered that she had had this trouble with these shoes before and carried a pocket knife in order to cut the roots. While she was uprooting herself a crumpled piece of newspaper blew past me in the cool breeze almost brushing my leg.

The leaves, which had fallen from the trees a while ago were brittle and crackled under our feet. We swished our way through the numerous leaves. I grabbed a bunch of leaves and throw them at my sister.

I was getting kind of hungry so I reached into my backpack to retrieve a bag of carrots which I had not eaten during lunch. I was just about to take a bite of one of the carrots when it screamed, "Stop!" I decided to spare the carrot and put it back in the bag.

My sister was getting farther away from me. The sky had become darker. A few snow flakes had started falling and the wind had picked up quite a bit. I was getting really cold and worried. That is when I saw our dog Jack. He asked me if I needed help getting home and offered me a ride. I jumped on his back. He jumped into the air and started flying. My sister grabbed my right leg as I flew by her. I almost fell off the dog but I quickly grabbed Jack's ears.

Soon we caught sight of the white picket fence in the front yard. Finally we were home