

# Strong Flying Women and Weak Invisible Men: How People Make Superhuman Concepts Coherent

M. Afzal Upal (Afzal.Upal@drdc-rddc.gc.ca)

Effects & Influence Research Group, Socio-Cognitive Systems Section  
Defence Research & Development Canada, Toronto Research Centre  
1133 Sheppard Ave W, Toronto, ON, Canada

## Abstract

This paper reports on a study designed to investigate how people understand superhuman concepts that are of interest to cognitive scientists of religion. Similar to findings of previous studies of surprising social conceptual combinations, we found that people generated numerous emergent properties for such concepts. These results support the knowledge-based models of conceptual combination.

**Keywords:** Semantic memory, folk psychology, conceptual development.

## Introduction

Since the early days of cognitive science, study of concepts has formed the core of the discipline because concepts are thought to be “the building blocks of thought” (Franks, 2003) and “the basis of word meaning” (Murphy, 1988). Understanding creation of complex concepts by combining simpler concepts is crucial to the success of this enterprise (Kunda, Miller, & Claire, 1990; Murphy, 1988; Osherson & Smith, 1981). Understanding how concepts with contradictory properties are combined has also been of recent interest to cognitive scientists of religion investigating the spread of counterintuitive religious concepts (Boyer, 1994, 2001; Franks, 2003). Boyer (1994; 2001) argued that most widespread religious concepts around the world are minimally counterintuitive (or MCI for short) and that this is because minimally counterintuitive concepts are more memorable than intuitive and maximally counterintuitive concepts. MCI concepts such as “a listening tree” are minimally counterintuitive because they violate a small number of intuitive expectations associated with the basic category (e.g., tree in this case) that along with a counterintuitive property (e.g., listening in this example) constitutes such concepts. Franks (2001) argued that MCI concepts are best considered as combinations of concepts with contradictory properties. He further argued that at least “some religious representations may involve relation mapping combinations” (Page 50). Unlike property mapping combinations where a property of the constituent concepts is simply transferred to the combined concept, in relational mapping a meaning relation that is not represented in either of the constituent concepts indicates how they are related to make the combined concept (Page 46). The relationship establishment processes, especially in the context of conflicting properties (Heit, 1998), are thought to use relevant background knowledge to create a coherent conceptual combination. However, as an extensive review of the literature by (Ran & Duimering, 2009) recently noted, the precise nature of how relevant

knowledge is selected and applied is not clear. This paper reports on a study we carried out to investigate this process for the superhuman concepts that are of particular interest to cognitive science of religion.

## Supernatural Agents & Religion

*Religion: the belief in and worship of a superhuman controlling power, especially a personal God or gods.*

(Oxford-Dictionaries, 2010)

Boyer was not the first scholar of religion to observe the crucial role played by supernatural concepts in general, and superhuman concepts in particular, in religious cognition of people around the world. Scholars of religion from a variety of traditions have argued that belief in superhuman entities is a hallmark of religion (Giddens, 1989; Horton, 1960; Lawson & McCauley, 1990; Spiro, 1966; Tylor, 1871; Wallace, 1966). One of the oldest definitions of religion comes from Tylor (1871) who defined it as “the belief in spiritual beings.” Preferring the term “supernatural beings” over “spiritual beings”, Wallace (1966) defined religion as “behavior that can be classified as belief and ritual concerned with supernatural beings, powers and forces” (Page 5). Lawson and McCauley (1990) define a religious system as a “symbolic-cultural system of ritual acts accompanied by an extensive and largely shared conceptual scheme that includes culturally postulated superhuman agents” (Page 5).

Lawson and McCauley have joined a growing group of scholars of religion advocating a new cognitive science of religion to understand how human minds represent and acquire superhuman agent conceptual schemas (Guthrie, 1993; Whitehouse, 2004). These cognitive scientists of religion argue that an understanding of psychology of language comprehension and learning is needed to understand why some ideas spread widely to become cultural successes while others quickly perish. Memorability advantages have been a particular focus of this work. A number of studies have found that minimally counterintuitive (MCI) concepts are remembered better than intuitive and maximally counterintuitive concepts (Atran, 2004; J. Barrett & Nyhof, 2001; Boyer & Ramble, 2001; Upal, 2005). Attempts to account for these findings have differed on whether contextual factors play a crucial role in making MCI ideas memorable, and whether memory for MCI concepts is a distinct phenomenon or whether it is related to memory for schema-violating/distinctive concepts (J. L. Barrett, 2008; Russell, 2013; Upal, 2009). While the context-based view (Upal, 2005, 2009; Upal, Goncę,

Tweney, & Slone, 2007) has argued that a concept can only be counterintuitive in a specific context for a specific individual at a specific time, the content-based view (J. Barrett & Nyhof, 2001; J. L. Barrett, 2008) has downplayed the role of context by arguing that certain concepts can be universally counterintuitive for all people all the time. Contrary to the proponents of the content-based view that a “fundamentally different theory” (Page 92: Barrett 2008) is needed to explain the MCI effect, Upal (2005; 2009) developed his explanation of the MCI effect based on the traditional cognitive science work on schema/script-based semantic memory (Graesser, Gordon, & Sawyer, 1979; Kintsch, 1998; Schank, 1999; Schank & Abelson, 1977) and conceptual combinations (Ran & Duimering, 2009). While early models of conceptual combination (Osherson & Smith, 1981) were content-based and ignored the role of background knowledge, more recent work (Hampton, 1997a; Kunda et al., 1990; Murphy, 1988; Wisniewski, 1999) has emphasized the role played by this knowledge in making combined concepts coherent.

In a set of studies (Hampton, 1997b; Hastie, C., & Weber, 1990; Kunda et al., 1990), when researchers asked people to generate properties of surprising (such as a “blind marathon runner”) and intuitive social concepts (such as a “female nurse”), they found that people generated more *emergent* properties for surprising than intuitive concepts. Emergent properties are those properties that participants believe are characteristic of the combined concept but do not characterize any of the constituent concepts. Emergent properties are thought to result from reasoning processes (variously labeled creative (Hastie et al., 1990), elaborative (Murphy, 1988), problem solving (Hampton, 1997b), and explanatory) that use contextual information to resolve the perceived inconsistency between the constituent concepts. This explains why it takes longer to process surprising conceptual combinations than the intuitive ones (Hampton, 1997b). While results from previous studies are suggestive, none was designed to study people’s expectations of counterintuitive concepts as defined by cognitive scientists of religion (J. L. Barrett, 2008). The study we describe next was specifically designed to address this gap.

## Experiment 1

Following Barrett’s (2008) guidelines, we created the following five minimally counterintuitive concepts:

1. man who can walk through walls
2. person who can see through walls
3. woman who can hear whispers from miles away
4. man who can fly, and
5. person who is invisible.

We also included the person concept to elicit people’s baseline expectations of the category person.

## Material & Procedure

The materials consisted of an online form that listed the six concepts each followed by a text field. Using the instructions developed by McRae et al. (2005), we asked participants to type in as many properties of each of the four concepts as they could think of in the text-box.

## Results & Discussion

The participant responses were coded by following a two-step process. The first step involved creating semantically similar clusters for features produced by participants. Thus the following participant responses to features for the category person

- “can feel”,
- “has emotions”, and
- “has feelings”

were all put into one feature labeled “has emotions.”

Once the most representative feature labels had been created, the second step was carried out. This involved assigning a 1 if the participant was judged to have indicated the feature and assigning a 0 otherwise. Each category feature was assigned a weight by computing the average coded value. Thus, a category feature that was indicated by all 150 participants would be assigned a value of 1, and a feature not mentioned by any participant would be given a zero weight. The category features were ranked by weight from the most prevalent to the least prevalent. Results are shown in Figures 1 to 6 below.

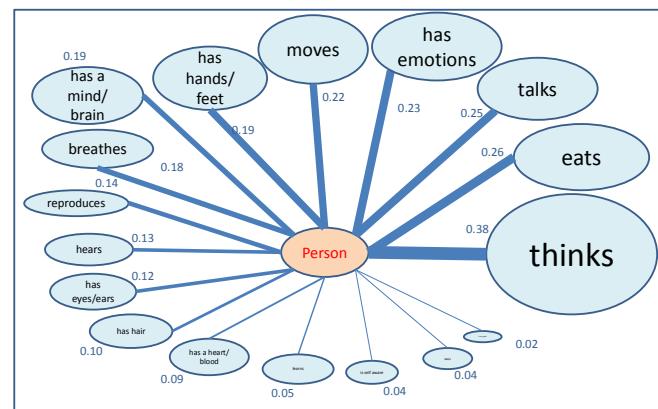


Figure 1: Most commonly mentioned features of the category person

Results show that participants generated a number of properties for the superhuman concepts that were not included in the person concept:

1. is strong
2. is a superhero
3. has super powers
4. is fictional
5. rescues people
6. can spy
7. steals/commits crimes, and
8. is lonely.

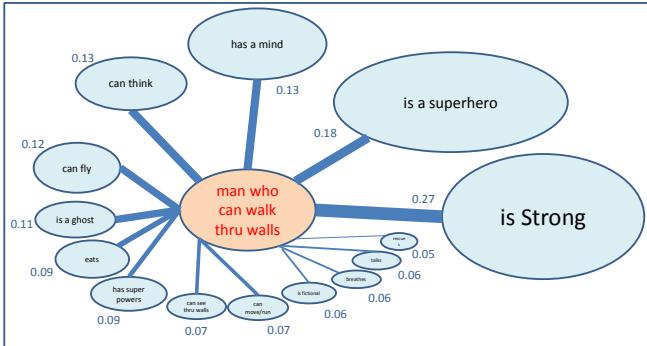


Figure 2: Most commonly mentioned features of the category "man who can walk through walls."

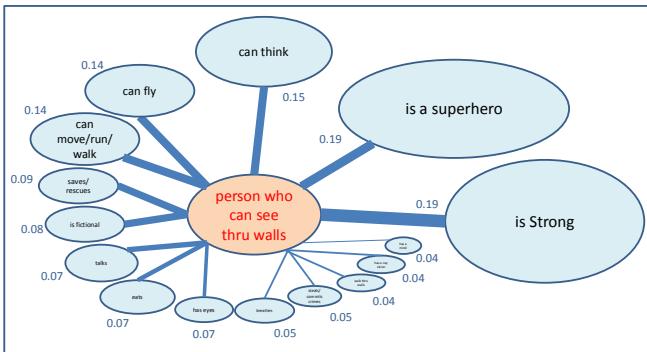


Figure 3: Most commonly mentioned features of the category "person who can see through walls."

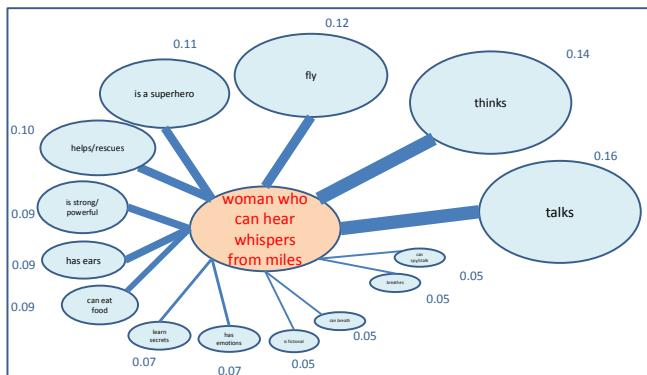


Figure 4: Most commonly mentioned features of the category "woman who can hear whispers from miles away."

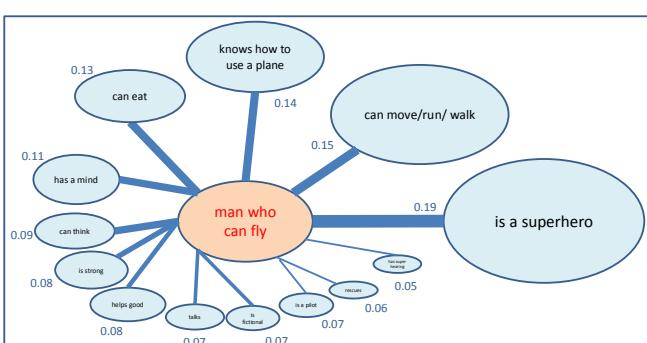


Figure 5: Most commonly mentioned features of the category "man who can fly."

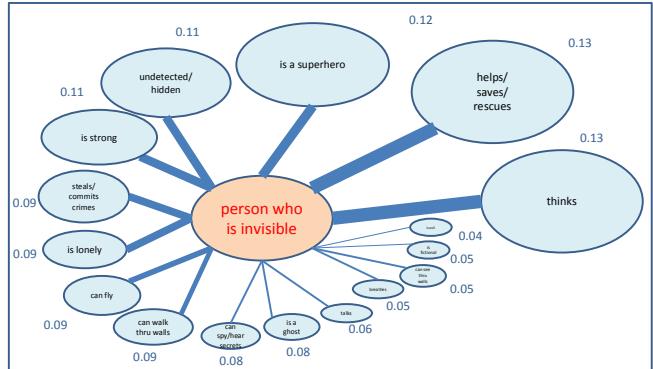


Figure 6: Most commonly mentioned features of the category "person who is invisible."

There are significant differences between the new properties people generated for the five superhuman conceptual combinations. While "is strong" and "is a superhero" were the most commonly mentioned features for both "man who can walk through walls" and "person who can see through walls," and "woman who can leap over skyscrapers," this was not the case with other three superhuman concepts. While "is a superhero" was the top feature for "man who can fly," similar to the two aforementioned concepts, it was not among the top two features listed for either of the two concepts of "woman who can hear whispers from miles away" or "person who is invisible." The most surprising finding for us was the inclusion of negative cluster of features by our participants among the features of the concept "person who is invisible." This shows that while the other four superhuman concepts were mostly thought about in positive terms, people had mixed positive and negative feelings about invisible people.

What do our results tell us about people's propensity to generate emergent feature as seen in previous studies of conflicting conceptual combinations? Can we call the new properties generated by our participants to be emergent? Not quite, because we only elicited features of one of the constituent concepts and not the other. The next study was designed to fill this gap.

## Experiment 2

This study was designed to elicit people's perception of the features of beings with the following five superhuman properties we used in Experiment 1:

1. walking through walls
2. seeing through walls
3. hearing whispers from miles away
4. flying, and
5. being invisible.

Eliciting features of objects with these properties is, however, not as straightforward as it may first seem. Clearly, the action properties such as walking, seeing, and hearing cannot be investigated without assigning an actor to the actions. If this actor is perceived by our participants to be conflicting with the property, we are back to the set-up of

Experiment 1. We decided to use superhero as an actor because superheroes can be expected to have counterintuitive properties and thus the conceptual combination would not be seen as conflicting by our participants. We elicited features for the following five concepts in this study.

1. Superhero who can walk through walls
2. Superhero who can see through walls
3. Superhero who can hear whispers from miles away
4. Superhero who can fly, and
5. Superhero who is invisible.

## Results & Discussion

The participant responses were coded by following a two-step process used in Study 1. Results are shown in Figures 7 to 11 below.

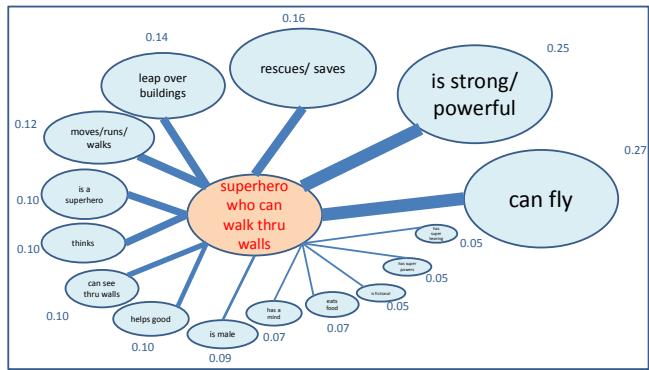


Figure 7: Most commonly mentioned features of the category Superhero who can walk through walls.

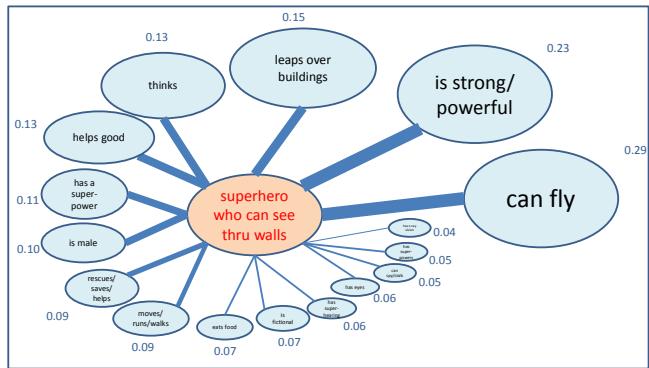


Figure 8: Most commonly mentioned features of the category Superhero who can see through walls.

To determine properties that emerged through combination of the person concept with a counterintuitive property  $p$ , we searched for properties people produced for the combined concept but that were not included either in the person concept (shown in Figure 1) or the corresponding combined superhero concept with the property  $p$ . Table 1 shows the properties that were generated by at least two participants.

The results show that the largest number (10) of emergent features was generated for the concept of “a man who can walk through walls” and the fewest number (2) was generated for the concept of “a person who can see through walls.” In general, people generated fewer emergent features for the concepts of “person who can see through walls” and “woman who can hear whispers from miles away” as compared with the other three superhuman concepts. Also a smaller proportion of participants mutually agreed on the fewer emergent features for these two concepts.

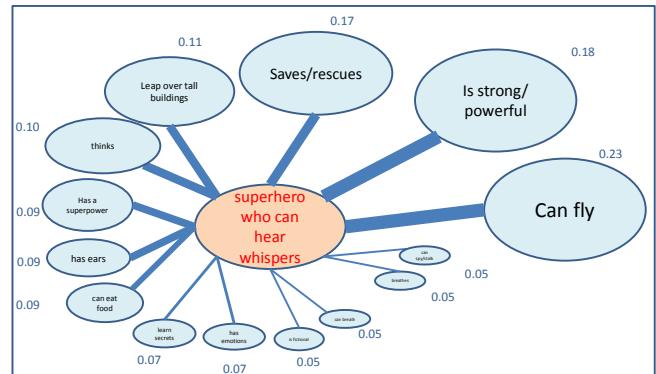


Figure 9: Most commonly mentioned features of the category Superhero who can hear whispers from miles away.

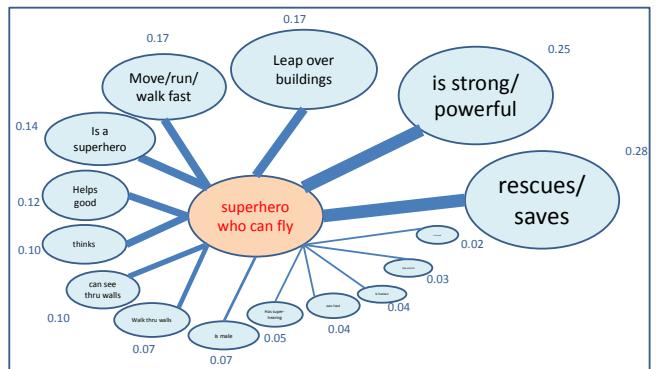


Figure 10: Most commonly mentioned features of the category Superhero who can fly.

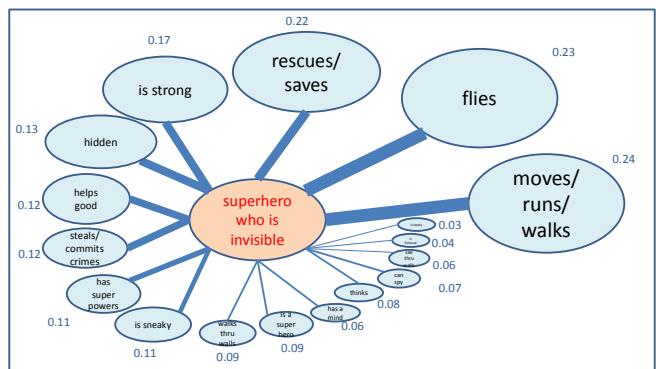


Figure 11: Most commonly mentioned features of the category Superhero who is invisible.

Table 1: Emergent features generated by participants for various superhuman concepts. Proportion of people who included these features appears in the parenthesis besides each feature.

person who is invisible	is a ghost (0.08) is lonely (0.06) can do evil (0.04) has emotions (0.04) is dead (0.03) peeps on people (0.01) is an outcast (0.01) is shy (0.01)
man who can fly	Knows how to use a plane (0.14) Has wings (0.09) Is a pilot (0.07) Is unique (0.03) has a jetpack (0.02) Is in a helicopter (0.2) Travels for free (0.02) Is thin/skinny/light (0.02) Is handsome (0.01)
man who can walk through walls	is a ghost (0.11) knows to use a door/window (0.05) is dead (0.04) is big (0.02) is arrogant (0.02) is invincible (0.01) has many friends (0.01) is an alien (0.01) is muscular (0.01) go anywhere (0.01)
person who can see through walls	can read minds (0.03) is a scientist (0.02)
woman who can hear whispers from miles away	is loud (0.04) has big ears (0.02) has trouble sleeping (0.02) is nosey (0.01) can go insane (0.01)

“Is a ghost” was the emergent feature listed most frequently for both the concepts of “a person who is invisible” as well as “a man who can walk through walls.” Since being invisible and being able to walk through walls are strongly associated with the concept of a ghost, it makes sense that our participants were strongly reminded of the ghost concept upon hearing of these properties. Furthermore, the person’s being a ghost allows our participants to explain as to why the person can walk through walls and why the person is invisible. Generating such justifications for the counterintuitive property is a crucial part of the context-based model as well as knowledge-based conceptual combination approaches that the model is based on.

Looking through the list of emergent properties, it seems clear that most emergent properties are a byproduct of this justification process. Thus being lonely, shy, and being an outcast readily come to mind if one interprets being invisible metaphorically while “is dead” and “is a ghost” come to mind if one interprets the expression literally (Upal, 2007). Similarly, “knows to use a plane,” “is a pilot,” “is in a helicopter,” “has a jetpack” come to mind if one interprets “person who can fly” as an intuitive concept. A counterintuitive interpretation of the person as being bird-like, makes one think of the features of “has wings” and “is thin/skinny/light.” “Is a ghost,” “is dead” and “is an alien” are results of interpreting “person who can walk through walls” as a counterintuitive concepts while “knows to use a door/window” result from a creative intuitive interpretation of the expression. Being a scientist who has invented a crazy machine to see through walls allows one to justify the concept of “a person who can see through walls.” Finally, “being nosey” and “having big ears” allows one to make some sense of the concept of “a woman who can hear whispers from miles away.”

The second type of emergent features are the features that are most commonly associated with the coherent combination achieved through the justification process i.e., these are the consequences of the combined concept. Thus “travels for free” and “is handsome” is a consequence of the “man who can fly” being interpreted as a pilot. Being big, muscular, arrogant, invincible, “has many friends” and “can go anywhere” can be seen as consequences of being a man who can force one’s way through walls. Being able to read minds can be seen as a consequence of the ability to see through skulls and detect mental states. “Has trouble sleeping,” “can go insane,” and “talks loudly” are consequences of the ability to hear everything being talked about for miles and feeling the need to talk over others.

The fact that people generated fewer emergent features for “person who can see through walls” and “woman who can hear whispers for miles” may be because people had trouble justifying these two concepts because they were seen as more counterintuitive than the other three superhuman concepts. This is also suggested by the fact that only a small proportion of participants agreed on the emergent properties. A direct test of this hypothesis, however, must wait further work as the current study did not ask participants to rate concepts for plausibility.

## Conclusion

Superhuman concepts are thought by scholars of religion to be hallmarks of religious cognition. This paper reports on a study carried out to investigate how people understand such complex concepts. Similar to findings of previous studies of surprising social conceptual combinations, we found that people generated numerous emergent properties for such concepts. These results support the knowledge-based models of conceptual combination.

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