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# Looking at metaphors: a picture-word priming task as a test for the existence of conceptual metaphor

Javier Valenzuela & Cristina Soriano  
Universidad de Murcia

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## Abstract

Since 1987 a number of scholars have investigated the conceptualization of anger in several linguistic studies (Lakoff & Koveckes 1987, King, 1989, Matsuki, 1995). In their research, a body of conceptual metaphors have been identified that are supposed to structure the way we think about the emotion. In this paper, we evaluate the claim that conceptual metaphors are stable structures in the speakers' minds (Murphy 1996; Lakoff & Kövecses 1980; Glucksberg & McGlone 1999).

The present experiment was designed to investigate the use of conceptual metaphors by speakers of peninsular Spanish in relation to the emotion concept ANGER. The study evaluates the claim that conceptual metaphors are stable and automatic cross-domain conceptual projections in the speaker's minds (Lakoff, 1993: 227-228, 245). Specifically, we examine the participation of domains like HOT FLUID or PRESSURIZED CONTAINER in the processing of anger expressions. Our specific goal is to study whether the activation of such source domains facilitates the recognition of anger words in a categorization task. In order to test this, a priming experiment was conducted in which subjects had to perform a categorization task after being exposed to an image. When the image was related to the source domain of an anger-related conceptual metaphor (Lakoff & Kövecses, 1987, Soriano, 2005), the emotion was more easily identified in the subsequent task than it was after an unrelated image.

## 1 Introduction

Cognitive Linguistics is a theory of language that purports to describe language in connection to the rest of cognition. One of the most influential branches in the field is the so called Cognitive Theory of Metaphor and Metonymy (CTMM). Faithful to the cognitive commitment adopted in the field, the CTMM does not look at metaphor as an isolated linguistic phenomenon, but seeks to interpret the phenomenon of metaphorical talking in the light of what we know about cognition, categorization, mental representation and so forth. In this new light, metaphor is no longer seen as a rhetorical device (a manipulation of literal language) used for aesthetic purposes, but rather as a mental phenomenon that articulates reasoning and conceptual representation. Metaphor is a way of thinking; it is, in fact, one of the basic operations in human cognition.

Within this paradigm, metaphor can be defined as “the cognitive mechanism whereby one experiential domain is partially ‘mapped’, i.e. projected, onto a different experiential domain, so that the second domain is partially understood in terms of the first one. The domain that is mapped is called the **source** or **donor** domain, and the domain onto which the source is mapped is called the **target** or **recipient** domain” (Barcelona, 2000: 3). Target domains tend to be more abstract and difficult to apprehend than their source ones. By contrast, the latter are often related to physical scenarios and serve to ground our abstract thinking in kinetic experiences and sensorial perception. This is why we can say that “metaphor is the main mechanism through which we comprehend abstract concepts and perform abstract reasoning” (Lakoff, 1993: 244) and one of the reasons why Cognitive Linguistics argues that thought is embodied, i.e. grounded in experience.

It, therefore, becomes crucial to distinguish between conceptual metaphors and their linguistic manifestations, which constitute the surface expression of an underlying thought process. Conceptual metaphors can be conceived of as cognitive templates that license or motivate an open-ended number of metaphorical expressions. But these conceptual associations can have much more than linguistic manifestations; they can also be gestural, pictorial, behavioral, ideological, etc. (for a survey of these see Soriano, 2005).

Conceptual metaphors are conventionally represented through the formula A IS B (e.g., MORE IS UP) written in small capital letters, where A is the target domain and B is the source one. The formula itself does not necessarily reveal one of the cross-domain mappings of the metaphor, although this is frequently the case. Thus, ANGER IS FIRE happens to reflect the mapping of the source domain element FIRE onto the target domain element ANGER but that is not the case in the EVENT STRUCTURE or the TIME-MOVING metaphors.

Conceptual metaphors are characterized by a number of features. First, the mappings are partial, that is, not all the structure of the source domain is mapped onto the target (Lakoff and Johnson, 1980). They are also culturally constrained, which implies that even though some mappings seem to be universal (e.g., MORE IS UP), many of them (specially the more specific ones) are culture-specific and reflect the sociocultural context in which they are used (see Kövecses, 2005 for a lengthy discussion of cultural variation in metaphor). Thirdly, the metaphorical mappings are hierarchically organized (Lakoff, 1993), so that they inherit the structure of the more general projections from which they derive. Fourth, mappings are unidirectional, that is, they only occur from source to target and not the other way round (Lakoff and Johnson, 1980); cases of apparent bidirectionality are better explained as realizations of two different metaphors involving the same two domains, as in PEOPLE ARE ANIMALS (*Achilles is a lion*) and ANIMALS ARE PEOPLE (*The butterfly thanked the sun with its dance*). Finally, the most important feature of metaphor for our purposes in the present work is its alleged automaticity. According to George Lakoff (1993: 245), the activation of metaphorical mappings is *automatic, unconscious and effortless*.<sup>1</sup>

## 2 Some Criticisms

The view of metaphor defended by the cognitive paradigm has been challenged in at least two ways. The first one concerns the frequent circularity exhibited in metaphor research, that is, the fact that the existence of linguistic structures is used both as a reason to hypothesize the existence of conceptual metaphor and as post-hoc evidence of their reality. In order to break the circularity, non-linguistic evidence and the empirical psycholinguistic validation of those linguistic claims are necessary. This is what the present study attempts to achieve: the investigation of the conceptual nature and functioning of metaphor through psycholinguistic experimentation.

The second criticism relates to the dichotomy availability vs. accessibility in conceptual metaphor. Availability refers to the possibility that metaphors are stored in the mind as pre-packed associations that structure our understanding and reasoning about reality. This view has been challenged by Murphy (1996), according to whom metaphorical conceptual representation does not exist. His theory, the Structural Similarity View, argues that entities are represented in their own terms, i.e. literally, and metaphors arise in an ad hoc fashion, out of structural similarities between two domains. In other words, there are no stable cross-domain mappings in the speakers' minds.

However, it is intuitively very unlikely that the comprehension of expressions like *He flipped his lid* is unrelated to the comprehension of other semantically very similar linguistic items, like collocations around the word anger (e.g., *Burst with anger*), novel expressions about the emotion (e.g. *When my father explodes, my mother follows as in a chain-reaction*), anger-related words (*Explode, Erupt*), and even drawings of angry people, all of which can be coherently explained hypothesizing the existence of a conceptual metaphor ANGER IS A HOT FLUID IN A CONTAINER (see Soriano, 2005 for examples of these sorts in English and Spanish). Furthermore, there is empirical evidence that the meaning of idioms like *He flipped his lid* and *He blew his stack* are not arbitrary and unrelated to one another, but motivated by a conceptualization of anger as a fluid contained in a pressurized recipient (Gibbs and O'Brien, 1990; Gibbs and Nayak, 1989).

Accessibility is related to the claimed automaticity of conceptual metaphors. According to Lakoff, "the system of conventional conceptual metaphor is mostly unconscious, automatic, and used with no noticeable effort" (1993: 245). If conceptual metaphors are in fact automatic and, therefore, "inescapable", they should always be accessible in the speakers' minds and, as a result, a reference to the source domain should inevitably activate the metaphor in the speakers' minds.

Such a hypothesis has been challenged by some psycholinguists (Glucksberg and MacGlone, 1999; Keysar et al, 2000; Gibbs, 1994), since metaphors may be available in long-term memory (Nayak and Gibbs, 1990; Gibbs and O'Brien, 1990; Gibbs, 1992), and yet not be activated each and every time people speak. Their activation could well be context or task dependent. Evidence is still scarce and contradictory as regards the automaticity (i.e., automatic accessibility) of conceptual metaphors in language processing, and it is therefore necessary to further investigate exactly under what circumstances it takes place.

### 3 The current study

The experiment that we present in this paper was designed to investigate the use of conceptual metaphors by speakers of peninsular Spanish in relation to the emotion concept ANGER. Our knowledge of this emotion is said to be largely based on a number of projections between ANGER and other domains, such as HOT FLUID IN A PRESSURIZED CONTAINER or NATURAL FORCE (Lakoff and Kövecses, 1987; Kövecses, 1995; Barcelona, 1989; Soriano, 2005). In other words, we use our understanding of the behaviour of fluids in pressurized containers or our knowledge of natural forces to structure and develop our understanding of anger.

The method chosen for this study was a priming task. In this type of experiment two stimuli occur in succession. Subjects are asked to respond to the second— the target—, but before that they are exposed to a preparation stimulus or *prime* that is related to the target along some dimension (semantic, phonetic, visual, etc.). Inasmuch as both prime and target are related and inasmuch as that relation is relevant for the task required, the presence of the prime facilitates the subject's response to the target. In other words, the response is faster following a related prime than it is after an unrelated one.

Meyer and Schvaneveldt (1971) were the first researchers to observe priming effects in lexical-decision tasks. Since Collins & Loftus's work (1975), priming effects have been considered in experimental psychology as a standard measurement of the activation achieved by the representation of the prime, on the one hand, and of how it affects the activation of the related target, on the other hand. These studies have been replicated on numerous occasions (Neely, 1991) with similar results, and priming is now considered to be an adequate tool for the study of human cognition.

The use of this kind of technique has two major advantages for our field. First, it allows for a more direct observation of metaphorical representation and automatic processing. Second, it allows us to escape the kind of circularity the CTMM is frequently accused of. As mentioned in the previous section, such circularity resides in the use of linguistic information to infer the existence of conceptual metaphor and then the use those metaphors to explain linguistic expressions again. Non-linguistic evidence is clearly needed as well.<sup>2</sup>

The general hypothesis in this experiment is that, if a metaphor is a fixed cross-domain mapping and it is always automatically recruited, the activation of the source domain should prime the target. In relation to anger, this amounts to saying that, if the emotion is construed with conceptual information from the HOT FLUID IN A PRESSURIZED CONTAINER and NATURAL FORCES domains (among others), the activation of the latter should facilitate reasoning about anger.

In our experiment, pictures were chosen instead of words to prime the target domain. The decision to use this kind of prime was motivated by three reasons:

- (i) pictures have the same type of semantic representation as certain words (Pylyshyn, 1973; Anderson, 1976; Carr, McCauley, Sperber & Permelee, 1982);<sup>3</sup>
- (ii) pictures allow access to semantic information more rapidly than words, as the latter have to go through phonological processing first; only after a word-string has been recognized as a word will its semantic properties be accessed (Nelson, Reed and McEvoy, 1977; Potter and Faulconer, 1975; Glaser, 1992), and

(iii) by using pictures subjects can be induced to access conceptual representation while at the same time minimizing linguistic interference. Pictures have “faster and more automatic access to their meanings than to their names”, while “words have faster and more automatic access to their names than to their meanings” (Carr, McCauley, Sperber & Permelee, 1982: 757). In other words, while pictures access semantic memory directly, words are more likely to activate an anger-related linguistic expression in the speakers’ minds. In the second case, a speeded response could be taken to be a consequence of lexical memory rather than a (language-independent) conceptual association.

However, pictures can evoke a name too, for which reason images were chosen that had no direct anger-related linguistic realization in Spanish. For example, pictures of explosions were rejected, as there exists the expression *explotar* (‘explode’) that conventionally refers to anger in the language. Similarly, angry faces, aggressive attitudes or any other direct representation of the emotion were avoided.

To sum up, in order to minimize lexical interference and favor speeded access to conceptual representation, images instead of words were used as primes and only those were chosen that had no direct linguistic counterpart in Spanish.

As target stimuli, a number of words were selected with which subjects had to perform a cognitive task. The kind of task chosen is relevant too, as pictures do not seem to prime words in all cases. According to Bajo et al (1999), picture-word priming occurs only in tasks where semantic processing of the target words is explicitly required (cf. also Lupker and Katz, 1982). According to these researchers, the mere reading of a word does not necessarily activate its semantic representation (there are encoding and decoding operations that transform the visual characteristics of a word into a mental representation that forms the basis for word recognition). Consequently, word-naming or lexical-decision tasks can be insufficient (Lupker and Katz, 1982: 419). Semantic priming can only occur if semantic processing is required.

For this reason categorization tasks are particularly useful, as they guarantee that the subjects’ response involves semantic processing of the target word. Besides, categorization tasks are typical devices in the investigation of implicit memory.

In our study, the categorizing task consisted in deciding whether or not some item belonged to some suggested category. Subjects had to respond to the question “is X a Y?”, where Y was a category (EMOTION, TOOL, FRUIT or VEHICLE) and X could be a member of this domain or not (e.g., *anger*, *banana*, *hammer*, *train*). Some of the questions were primed with a category-related image (for ex-

ample, being shown a picture of a strawberry just before the question "is a banana a fruit?"), whereas some others were category-unrelated (for example, being shown a picture of a hammer before the question "is a banana a fruit?").

Unlike the rest of categories, in the case of anger the images were not literal representations of the emotion, but indirect representations of it, as they were related to the HOT FLUID IN A PRESSURIZED CONTAINER and NATURAL FORCES domains, which, in turn, are claimed to map onto the ANGER domain in Spanish (Barcelona, 1989, Soriano, 2005).

Subjects were expected to respond to the questions faster when primed with category-related images than in the mismatch condition. In the case of anger the same result was expected, even though the question was not primed by a literal pictorial representation of anger, but by a metaphorical reference to it. The reason is that, if metaphors are stable neural associations that get automatically called up, the picture should automatically activate the concept ANGER in the participants' minds and the response to the question "is anger an emotion?" should be faster than after seeing any other picture.

### **3.1 Material and method**

A total of forty-five psychology students of the University of Murcia (13 males, 32 females) participated in the study. They presented normal or corrected-to-normal vision and for their participation they received course credits.

#### **3.1.1 Participants**

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#### **3.1.2 Materials**

Sixteen pictures were chosen belonging to four different domains: tools, fruit, vehicles and anger (the pictures chosen can be seen in Appendix I). There were four possible combinations of primes and targets. These are illustrated in Table 1.

For each domain, the same structure was followed. In the first possible combination (rows #1 in Table 1) both target word and category belonged to the same domain as the priming picture (hence R-R in the structure column, for "related"). For example, people saw a pair of pliers and they were asked whether a hammer was a tool. The answer in these cases was always "yes".

1. pliers	Hammer	Tool	R-R-Yes
2. screw driver	Pliers	Fruit	R-U-No
3. hammer	Ship	Tool	U-R-No
4. adjustable spanner	Orange	Fruit	U-U-Yes
1. pineapple	Peach	Fruit	R-R-Yes
2. pear	Apricot	Emotion	R-U-No
3. banana	Rage	Fruit	U-R-No
4. strawberry	Anger	Emotion	U-U-Yes
1. lava	Wrath	Emotion	R-R-Yes
2. geyser	Irritation	Vehicle	R-U-No
3. bolt	Drill	Emotion	U-R-No
4. tornado	Bus	Vehicle	U-U-Yes
1. ship	Car	Vehicle	R-R-Yes
2. bike	Plane	Tool	R-U-No
3. train	Tangerine	Vehicle	U-R-No
4. motorbike	Saw	Tool	U-U-Yes

R = related U = unrelated

Table 1: Prime-target combinations in the categorization task.

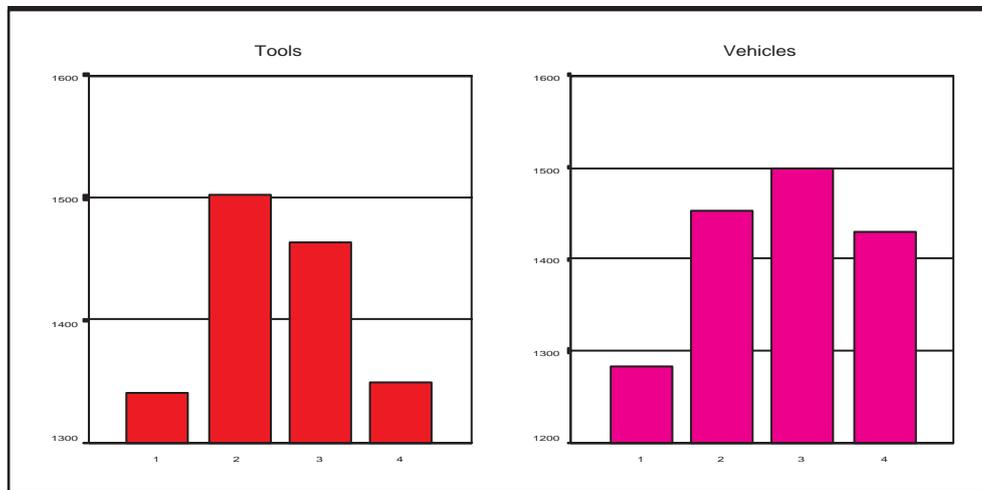
In the fourth combination set (rows #4, Table 1) the answer was still “yes” because the words belonged to the category suggested, but none of them was related to the priming picture (U-U, for “unrelated”). For example, people were asked if an orange is a fruit after seeing the picture of an adjustable spanner. In these cases the response was expected to take longer than in the first combination, as the picture did not prime either the target word or the category asked about.

There also were two intermediate combination sets in which only one of the two elements, either the target word or the category, were related to the picture (R-U and U-R respectively - rows #2 and #3). In these cases the answer was always “no”. These responses were expected to take longer too.

In sum, we expected to find the following pattern:  
R-R-YES (#1) < U-U-YES (#4) < R-U-NO (#2) or U-R-NO (#3)

### 3.1.3 Procedure

The instructions for the experiment were presented in written form and also explained orally at the beginning of the experiment. After these instructions, subjects proceeded to the task, which consisted of the following sequence of events: (a) a prime picture appeared in the center of the screen during 900 ms; (b) a question was asked, by which the subject was asked whether the target word was a member of a given category (e.g., is a hammer a tool?). The question remained on screen until the subject answered. If the answer was “yes”, subjects were asked to press



Figures 1 & 2: Results of VEHICLE and TOOL primes.

a key on their keyboard; if it was “no”, they had to press another key (the key for yes was ‘A’ and for no it was ‘L’). Pictures and questions were presented in random order for each participant; (c) after answering, subjects received feedback on the correctness of their response and the percentage of errors committed.

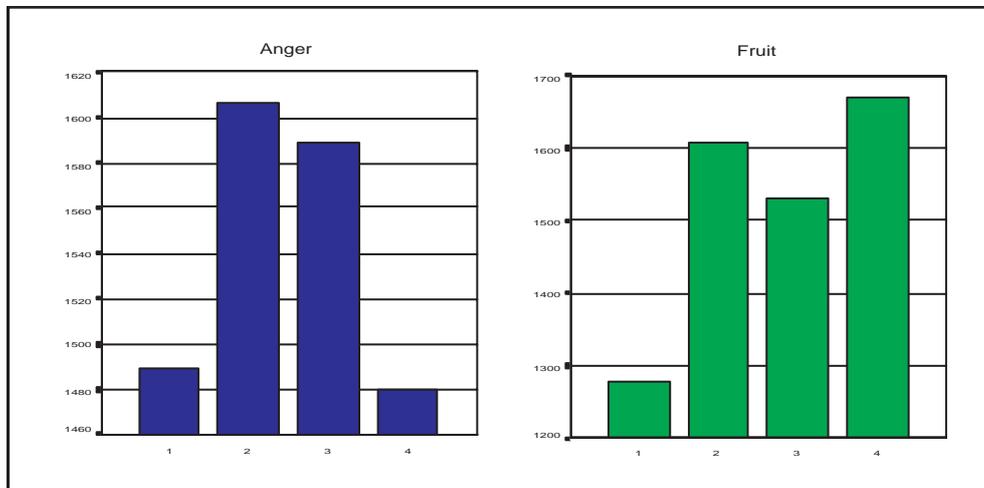
All the stimuli appeared in the centre of the screen of a personal computer. All the details of stimulus presentation were controlled through the E-Prime software program. Pictures were full coloured against a white background and covered a visual angle of approximately  $0.87^\circ$ . Participants were seated facing the computer at a distance of 60 cm from the screen, and were instructed to look at the centre of the screen and to answer the questions as fast and as accurately as possible.

### 3.2 Results and discussion

In general the predicted pattern was observed. R-R-YES (#1) took less time than U-U-YES (#4), and both of them were faster than the mixed mismatch conditions R-U-NO (#2) and U-R-NO (#3). Figs. 1 and 2 illustrate these results for the set of trials following images related to the VEHICLES and TOOLS domains.

Numbers on the vertical axis of each figure correspond to response times in milliseconds; the columns 1, 2, 3 and 4 correspond to the combinations presented above: R-R-YES, R-U-NO, U-R-NO and U-U-YES respectively. As can be seen, the results respond to the pattern  $\#1 < \#4 < \#2\text{--}\#3$ .

However, this pattern was not matched perfectly in all domains; in the case of two domains, Anger and Vehicles, combination #4 (U-U-YES) came either in first



Figures 3 & 4: Results of ANGER and FRUIT primes.

or in last position.

The first case was observed in the EMOTION domain. After seeing an anger-related picture (a tornado), subjects were asked whether a bus was a vehicle (column 4, Fig. 3). Responses were faster than in the primed condition, where people saw an anger-related image (lava coming out of a volcano) and were asked if wrath was an emotion (column 1, Fig. 3).

The second inconsistency appeared in the FRUIT domain, when subjects were asked if anger was an emotion after seeing the image of a strawberry (column 4, Fig. 4). Responses took longer than in any of the remaining mismatch combinations associated to the picture of a fruit (Fig. 4).

What these results reveal is that thinking about anger (an abstraction) is comparatively a more difficult task than thinking about a concrete object like a vehicle or a fruit. Thus, when dealing with the EMOTION domain (Fig. 3), after seeing an anger-related picture, people were asked four types of questions: the first three items involved were being asked about anger either as a word or as a category (e.g., is anger an emotion, is anger a fruit, is a train an emotion). However, in condition #4, they were asked about concrete entities instead ("is a bus a vehicle?"). In this case, their response then was much faster than in any of the previous ones.

For the same reason, when the FRUIT domain was involved, people looked at a series of pictures of fruit and there were asked four questions, three of them involving fruit, either as a word or a category (e.g., "is an orange a fruit", "is an apple a tool?", "is a ship a fruit?") while condition #4 involved a question with anger both as a word and as a category ("is anger an emotion?"). This proved more

difficult to process than the remaining three conditions in which they had been asked about fruits (all concrete objects).

Notice also, that in general, the fastest response times for all concrete domains are well below 1400 msec. On the contrary, the fastest response for anger is above 1480 msec.

Finally, as predicted, the question "is anger an emotion?" was answered faster when primed by an anger-related image (column 1, Fig. 3) than after an anger-unrelated one (column 4, Fig.4)

## **4 Conclusion**

The results indicate that, irrespective of being primed or not, there was a tendency for responses to be faster when there was a match between word and category. This suggests that class inclusion is easier to process than class-exclusion, perhaps because subjects have to exhaust their analysis of the semantic content of the target word before they can conclude that it does not belong to a given category.

Within the cases in which word and category matched, there was a clear facilitation when questions were primed with category-related images. This suggests that the presentation of an image activates the domain in the speakers' minds, which makes it easy to recognize a given element as belonging to the domain. This was the case for the anger-related questions too. Since anger had not been represented directly (i.e. through the image of an angry face or the pictorial representation of a common linguistic expression), but through metaphor (a picture of a source domain), the results, though tentative, suggest that the activation of the source domain can automatically activate the anger domain in the speakers' minds.

Further research in this direction is still needed, though. One obvious course of action would be to exclude the possibility that the effect observed was due to interference rather than facilitation. Response times would have to be measured without priming images to establish a base-line for comparison. If the responses to coherent primes coincided with the baseline, the observed difference in response time to target-related and target-unrelated words should be explained as a result of the interference of the target-unrelated in the categorization task, but no facilitation would have taken place. Conversely, the results would be evidence of facilitation if the baseline coincided with the prime-unrelated responses. A sufficient distance of the baseline to the response times under both conditions would evidence cases of both facilitation and interference.

Finally, our results show that people were slower thinking about abstractions than they did when engaged with concrete entities. This is further evidence of the

well-known cognitive principle CONCRETE OVER ABSTRACT, hypothesized by Kövecses and Radden (1998: 64) as a “natural path” in human cognition.

## Notes

1. “The system of conventional conceptual metaphors is mostly unconscious, automatic, and used with no noticeable effort” (Lakoff, 1993: 245).
2. Note also that cross-modal facilitation (picture-word, word-picture) renders a reasonably strong support for the sort of abstract conceptual memory postulated by the CTMM.
3. Note that we are interested in what people can access "unconsciously and automatically" (Lakoff, 1993), not so much in what they can deliberately retrieve from semantic memory when consciously reflecting on something.

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