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What Do We Know When We Forget?

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The tip-of-the-tongue (TOT) state has attracted special attention because it combines two seemingly inconsistent features: we are unable to retrieve the solicited word or name but are convinced that we know it and feel that its recall is imminent. Several researchers have stressed the emotional and motivational distress that accompanies the TOT. The frustration from the memory blockage is particularly strong when we are able to retrieve partial clues about the elusive memory target although we fail to retrieve the target in full.

BLOCKED MEMORY FOR NAMES

In the lion's share of the studies, the TOT has been elicited by providing participants with word definitions and asking them to retrieve the corresponding word (A. Brown, 2012, table 3.2). Several questions about the TOT have been investigated using this procedure. The present chapter focuses on one question that has received some empirical evidence: What kind of partial fragments of information can participants report when they are stuck in a memory blockage state? In their pioneering study, R. Brown and McNeill (1966) asked participants in a TOT to make several guesses about the elusive memory target. They demonstrated that, while in the TOT and prior to recall, participants were successful in guessing some of the letters in the elusive word, the number of syllables in it, and the location of the primary stress. Other studies also showed that participants in a TOT have access

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to information about the length of the word, its frequency of occurrence, number of syllables, first letter, final letter, ending sound, and beginning sound (Brown & Burrows, 2009; Caramazza & Miozzo, 1997; Ecke, 2004; Koriat & Lieblich, 1974, 1975; Lovelace, 1987; Yarmey, 1973). These findings laid the ground for a general model of how words are stored in the mental lexicon and retrieved from it. The general conclusion was that "the lexical network is organized along lines of phonemic (and to some degree orthographic) similarity" (Collins & Loftus, 1975, p. 413).

The thesis advanced in this chapter is that an understanding of the TOT can benefit from an analysis of memory blockage states within the perspective of goal-oriented behavior. We propose that the kind of partial information that participants are most likely to access during memory blockage depends largely on the goal that was active when memory was blocked. According to goal-systems theory (Kruglanski et al., 2002), when a certain goal is pursued, various goal-related constructs are activated, such as the means for achieving that goal. Indeed, research indicates that the accessibility of a goal results in the activation of goal-related knowledge (Aarts, Dijksterhuis, & De Vries, 2001; Balcetis & Dunning, 2006; Fishbach & Ferguson, 2007; Förster, Liberman, & Higgins, 2005; Moskowitz, 2002). For example, Aarts and colleagues (2001) have shown that thirsty participants (those asked by the experimenter to consume salty snacks) responded faster to beverages or to items associated with drinking (e.g., soda, juice, bottle) as compared to control words and compared with non-thirsty participants.

In the case of the TOT, memory search is cued by a definition that specifies the meaning of the solicited word. The person's goal is to name the word that fits that definition. The intention to retrieve the word narrows the memory search (see Koriat & Lieblich, 1974), activating fragmentary phonemic information that is part of the program of retrieving the complete word. In the terminology used in discussions of word production (Levelt, 1989; Roelofs, Meyer, & Levelt, 1998), the TOT represents a failure in the transition from *lemma* to *lexeme*. *Lemma* refers to the abstract semantic and conceptual representation of the word, whereas *lexeme* refers to a representation that specifies the phonological form. When the retrieval of the lexeme is thwarted, the person can still provide information about some of the phonemic attributes that are activated (see Gollan & Acenas, 2004), which constitutes the next step toward the completion of the goal – producing the word. Thus, the TOT, as defined by R. Brown and McNeill (1966), represents what we shall term a *Blocked Memory for Name* (BMfN) state. As several authors have noted (e.g., Dale & McGlaughlin, 1971; Norman, 1969; Yarmey, 1973), because TOT are precipitated by word definitions, and

the corresponding word is solicited, participants tend to generate primarily acoustically related words.

BLOCKED MEMORY FOR MEANING

Consider the following situation: When reading a text, you encounter a rare word whose meaning is not immediately clear to you (Durso & Shore, 1991; Shore & Durso, 1990). Several associations come to mind as you search for the meaning. In this situation, the word is given and your goal is to retrieve the meaning of the word relying on these associations. Retrieval failure in this case may be said to represent *Blocked Memory for Meaning* (BMfM). Therefore, when complete retrieval fails, the partial information accessed is likely to concern semantic and associative features that constitute the next stepping stone toward the retrieval of the meaning of the word. Indeed, this is what happened in several studies in which memory was cued by the word itself. For example, in the study of Koriat, Levy-Sadot, Edry, and De Marcas (2003), participants studied the Hebrew translations of pseudo-Somali words and were tested by having to recall the Hebrew word in response to the Somali cue. When they failed, they were asked to judge the word's meaning with respect to one of the three dimensions of the semantic differential (Osgood, 1952) – evaluation (good-bad), potency (strong-weak), and activity (active-passive). Participants' judgments about the attributes of the irretrievable word were significantly accurate for each of the three dimensions. For example, participants who could not recall the translations of Somali words that signified "pleasure," "feather," or "boredom" could still judge the connotation of the word as good, weak, and passive, respectively. Access to the semantic attributes of the irretrievable word is also suggested by the observation that when participants made commission errors, the Hebrew word that they reported had the same polarity on the respective dimension as the correct word (e.g., responding "happy" instead of "health"). Such a tendency for consistent polarities between commission errors and targets was observed for all three dimensions. Similar results supporting access to the connotative attributes of words whose full meaning could not be retrieved was also reported by Yavuz and Bousfield (1959), Schacter and Worling (1985), and Koriat (1993).

It is interesting to note that in Koriat and colleagues (2003), partial recall exhibited a slower rate of forgetting than complete recall. Also, whereas complete recalls were predominantly associated with *remember* responses, attribute judgments were predominantly associated with *know* and *guess* responses. These observations were taken to suggest that access to partial

information is based, in part, on implicit memory (Durso & Shore, 1991), and that source monitoring is more difficult for partial recall than for complete recall. Indeed, several studies indicated that participants are accurate in making semantic judgments about a rare word even when they deny any knowledge of that word (Durso & Shore, 1991; Eysenck, 1979; Shore & Durso, 1990).

Several studies that used memory pointers other than word definitions also indicated that participants experiencing memory blockage could provide accurate information about semantic and associative features of the solicited target. For example, Yarmey (1973) presented participants with photographs of celebrities. When they failed to retrieve the person's name but felt sure that they knew it and that it was on the verge of coming back, they were able not only to guess correctly phonemic features of the name, but were also accurate in guessing the person's profession, and where he had been most often seen (newspapers, television, movies, etc.). Thus, when participants are specifically requested to report information about non-acoustic features (e.g., profession), they are generally accurate in providing generic information. Caramazza and Miozzo (1997) provide evidence showing that during TOTs, Italian speakers correctly guessed the gender of the searched-for words. Lovelace (1987) asked participants questions that required the recall of a name. Participants in a TOT could provide some structural attributes of the name, but also the country or language associated with the name, descriptive attributes, and situational attributes. Riefer, Kevari, and Kramer (1995) presented their participants with theme songs of TV shows and asked them to identify the show. While in TOTs participants recalled a character from the show, a leading actor's name, or plot outline.

BLOCKED MEMORY FOR ACTION

Consider next a third kind of memory blockage that is characterized by a different goal. This will be referred to as *Blocked Memory for Action* (BMfA): You walk into the kitchen to do something. You are stuck in the middle of the kitchen not knowing what you came for. What kind of partial information can you access in this situation?

In such BMfA states, the original intention is to reach a certain end by executing a series of behavioral acts. The goal representation typically activates behavioral programs designed to reach (or move closer to reaching) a desired end state. BMfA states are often characterized by *intention loss* (Reason, 1984): during the course of executing a goal-directed behavior,

one discovers that the intention or some aspects of it have suddenly been forgotten. Subjectively, this type of memory lapse is characterized by a feeling of "What am I doing here?" (see Reason, 1984). The person is aware of the fact that the goal of one's actions was known a while ago but was somehow lost. Loss of intention can also occur before any intention-related action has been initiated ("I meant to do something, what was it?"). What do people know when intention is lost? Over the years, the senior author has collected reports of BMfA states from students in memory classes. The students were asked to keep a record of BMfA states when they occurred. In particular, they were asked to note all the information that they could access immediately when in a BMfA state, and before the blockage was resolved. When the blocked memory was resolved, they were asked to describe what they could remember. Despite the limitations of this procedure (Reason & Lucas, 1984), the reports seem to converge in providing some insights.

Here is one example for which we had a verbatim report:

> I was doing something just before my wife and I were about to leave home. It suddenly occurred to me that I had to lock the back door of the apartment. I stopped what I was doing and went to lock the door. Then I realized that there was something that I had been doing before I went to lock the door but I could not remember what it was. The only thing I could recall was that I had to "insert something into something" and, in fact, I felt the movement in my own hand. I recalled what it was when I saw a dossier on my desk and a bill next to it. What I had intended to do was to file the bill in the dossier by inserting it into an envelope within the dossier.

The reports suggest that in a BMfA state, participants are most likely to retrieve partial information about the intended action. Sometimes participants can mimic aspects of the intended actions with their hands. Two specific aspects are sometimes notable: location and size. For example, when a person walks into a room to obtain something, he may point in the general direction where the object lies in relation to the body (e.g., above or below). Possibly, location reflects the general direction where one should be heading. Also, sometimes participants can tell that the object is small, and can even shape their hands or palms to suggest the kind of movement needed to grab or hold the object. Sometimes people could convey semantic or associative information. For example, some people recalled that the lost intention had to do with food or eating, or with a telephone call that they had just received. Such semantic or associative information was generally accessed as people tried to retrieve the lost intention by attempting to reconstruct the events that had given rise to the intention (e.g., feeling hungry).

Another situation that is somewhat similar to the BMfA state just described involves a prospective memory in which some information about a to-be-performed task is lost. For example, while in the supermarket you may remember that there was some additional item that you wanted to buy but cannot remember what it was. Here the abstract retention is retrieved but not its specifics. In an unpublished study on prospective memory, we left the keys to the room on the table and told participants to do something with them (e.g., put them in a drawer) when they have completed a certain task. Some participants remembered that they had to do something with the keys but could not remember what.

Studies on the tip-of-the-finger (TOF) phenomenon also indicate access to gestural rather than oral or written word production. In a study by Thompson, Emmorey, and Gollan (2005), deaf participants were presented with a list of written English words and were asked to translate them into their corresponding American Sign Language signs. When participants reported experiencing a TOF, they were asked if they could recall any properties of the sign. In most cases, participants were able to correctly retrieve some structural features of the hand sign such as hand shape, hand location, hand orientation, and hand movement.

Similarly, in the tip-of-the-pen (TOP) phenomenon, Chinese writers who lose momentarily the visual representation of a Chinese character depicting a certain concept are able to provide orthographic information about the inaccessible character (structural features such as the number of strokes and radicals), and they do so more than during a non-TOP situation (Sun, Vinson, & Vigliocco, 1998). In a somewhat related phenomenon – the slip of the pen (SOP, see Brown, 1991) – participants inadvertently substitute the intended word with another word in written word production. High levels of correspondence are found between the SOP and the intended target, especially for their first and final letters (Hotopf, 1980; Wing & Baddeley, 1980).

A GOAL-DIRECTED PERSPECTIVE ON MEMORY BLOCKAGE STATES

Several features of the TOT, emphasized by many writers, are consistent with our analysis of memory blockage states within a goal-directed framework. First, the TOT is often accompanied by frustration with not being able to retrieve the elusive target (Schwartz, 2001a), and by the experience of relief when the sought-for target is retrieved. The frustration is particularly intense when the person succeeds in accessing partial fragments of the solicited target. It was proposed that the memory pointer (e.g., word

definition) initially activates a large number of candidates that satisfy the retrieval description only grossly (Koriat & Lieblich, 1977). The activations emanating from these candidates exert two conflicting effects: They interfere with accessing the correct target but at the same time enhance the subjective feeling that the target is about to emerge into consciousness. These conflicting effects contribute to the feelings of frustration accompanying TOTs (Koriat, 1994, 1998; Schwartz & Smith, 1997; Smith, 1994). Several researchers proposed that the difficulty in retrieving the solicited target in the TOT results precisely from the interfering effects of "interlopers" or "blockers" and that these compelling but wrong candidates must be first suppressed before the correct target can be retrieved (see A. Brown, 1991; Jones, 1989; Reason & Lucas, 1984).

The second feature of the TOT that supports its analysis within a goal-driven perspective lies in the motivation to bring that state to an end by retrieving the sought-for target (A. Brown, 2012). Schwartz (2001b) proposed that TOTs have both monitoring and control functions. The monitoring function is reflected in the strong feeling of knowing associated with a TOT, whereas the control function is reflected in the greater motivation for an extended memory search during TOTs than during non-TOT states.

The motivational function of the TOT is supported by findings indicating longer retrieval latencies of the target during a TOT (Gruneberg, Smith, & Winfrow, 1973; Schwartz, 2001b). It is also supported by the observation of Litman, Hutchins, and Russon (2005) that participants were more likely to open an envelope containing the target word during a TOT compared to a don't know (DK) state. It was also proposed that the extended search for the elusive target during a TOT diminishes cognitive resources, as suggested by the poorer performance on a secondary task of participants in a TOT compared to that of participants in a non-TOT state (Ryan, Petty, & Wenzlaff, 1982; see Schwartz, 2002).

The TOT has the qualities of an interrupted task, as discussed by Kurt Lewin (1935). Lewin proposed that the intention to perform a task creates a tension system (a "quasi need") that presses toward task completion. Completion of the task results in the discharge of the tension system associated with the quasi-need. When the activities used to fulfill the intention are interrupted, the unreleased tension can have cognitive and behavioral consequences. In particular, this tension can result in a strong tendency to resume the task, and in a better memory for the unfinished task (the so called Zeigarnik effect, see Van Bergen, 1968).

The TOT can be seen to involve a kind of interrupted or unfinished task (see Yaniv & Meyer, 1987). The intention to retrieve a memory target creates

a driving force toward accomplishment, which remains active and perhaps intensifies when retrieval is blocked. Intention-related constructs remain cognitively active, and relief from the tension is reached only when retrieval is successful. Indeed, using both a lexical decision task and a recognition task, Yaniv and Meyer (1987) found that target words that participants were unable to retrieve remained more accessible than control words for up to 30 minutes, and that this was particularly true when the pointers elicited strong feelings of knowing. Other studies indicated that the accessibility of goal-related constructs is reduced after goal fulfillment (see Marsh, Hicks, & Bink, 1998; Marsh, Hicks, & Brian, 1999).

In a naturalistic study of the TOT phenomenon, Reason and Lucas (1984) noted that during TOTs, sometimes incorrect intermediates keep suggesting themselves as possible resolutions of the TOT experience. They suggest that these incorrect responses are comparable to slips of action in which an unintended action that is more habitual under the prevailing circumstances than the one demanded by the current goal plan is executed. Their analysis is compatible with the goal-directed perspective on TOT advocated in this chapter.

In sum, several observations support the analysis of TOTs as an interrupted goal situation. Among these is the annoying frustration that accompanies a TOT, the motivational drive toward task completion, the lingering activation of goal-related constructs, the relief experienced when TOT is finally resolved, and the diminished activation of goal-related constructs after goal accomplishment. Consistent with the goal-directed framework are also the conditions and pointers that precipitate strong TOTs, which seem to involve activations that side track the memory search away from the solicited target (Jones, 1989; Koriat & Lieblich, 1977).

WHAT CAN BE LEARNED FROM THE TYPE OF PARTIAL INFORMATION ACCESSED DURING MEMORY BLOCKAGE?

As noted earlier, some discussions took the results obtained with the TOT to have implications for the organization of the mental lexicon along phonemic features. What should be clear from our analysis, however, is that these implications are specific to the intention activated when memory is blocked. Thus, some of the implications drawn by R. Brown and McNeill (1966) are specific to a BMfN situation in which the intention is to produce a word given its definition. In contrast, when the intention is to retrieve the meaning of a word, the pertinent memory organization is semantic and associative in nature. For example, in Koriat and colleagues' study, the hypothesis was examined that in a BMfM situation, access to the emotional-

evaluative dimension of a word is superior to that of other dimensions, consistent with the claimed primacy of emotion (Zajonc, 1984). The results, however, indicated equal access to all three dimensions of the semantic differential – evaluation, potency, and activity – of the word's meaning. The observations pertaining to BMfA situations, in turn, highlight a different organization of memory that is pertinent to intended actions.

Presumably, memory allows for different organizations, each of which becomes activated and shaped by the current intention. The study of the types of partial information that participants access when memory is blocked can shed light on the multiple organizations permitted by memory and the flexibility with which the pertinent organization is adaptively highlighted depending on one's current goals.

ACCESSING DIFFERENT TYPES OF PARTIAL INFORMATION DURING MEMORY SEARCH

So far we classified memory blockage states in terms of the current goal of the person, assuming that that goal determines the type of partial information accessed. However, participants normally access more than one type of information during a memory blockage state. For example, in Yarmey's (1973) study, participants provided both phonemic and semantic partial information. However, in most studies of memory blockage states, participants provided only one type of information. In these studies, two features of the experimental procedure tended to constrain the type of partial information reported, the type of memory pointer used, and the information solicited. For example, in R. Brown and McNeill's (1966) study, like in many other studies, the pointer used to cue memory was the definition of the word, so that there was no point for participants to report semantic information. In addition, in many studies, specific partial information was solicited (first letters, profession, etc.).

To capture the richness of information that is accessed when memory is blocked, it is important to use memory pointers that are less constraining, and also to allow participants to report any information that comes to mind (like in the BMfA study described earlier). In an unpublished exploratory experiment by the senior author, participants were shown a target street on a map, and additional details were provided to make sure that the participants knew which street was the target street. The task was to recall the name of the street, and when unable to retrieve the name, to report any information that came to mind. Participants sometimes reported semantic partial information (e.g., "it is a name of a woman") and sometimes structural or

phonological information ("it consists of two words"). Interestingly, the majority of the reports included semantic rather than phonological partial information. What is important to stress is that participants sometimes provided both semantic and phonological information ("it is the name of a person related to Jewish history. It ends with *vitch*"). When pressed, participants could report quite rich partial information that was largely correct.

However, when probed to report all the information that comes to mind, the information reported clearly does not pertain only to the next step toward reaching the retrieval goal. When people experience difficulty retrieving a solicited piece of information, they often probe their memory by deliberately generating a variety of cues that may bring them closer to the desired target information (see Koriat, 2000). For example, in Williams and Hollan's (1981) study, participants were asked to retrieve the names of their high school classmates, and did so for several days. The recall protocols revealed an enormous amount of information that was completely incidental to the task of recalling the names themselves. That information was presumably intended to provide clues that can assist the retrieval of the names. Williams and Hollan (1981) proposed that the retrieval of information from the distant past involves a reconstruction from a variety of bits and pieces of information, and partial retrieval represents a central tool that constraints the reconstructive retrieval process. This is probably true of many everyday memory blockage situations. A personal episode recounted by Nickerson (1981) about the attempt to recall the name of a street discloses the intricacies of the processes that take place when memory is blocked.

To conclude, in this chapter, we proposed a framework for the analysis of blocked memory states in general, and for the TOT, in particular, with a focus on the type of partial information that participants can relay about the elusive target. The goal-directed framework puts an emphasis on the intention of the person when memory retrieval is thwarted. This intention is assumed to constrain the type of partial information that participants can spontaneously access and/or report when complete retrieval is blocked. The study of partial recall can shed light on the memory organizations that are activated and utilized depending on one's current goals and intentions.

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