

# 4

## Feelings of Knowing and Tip-of-the-Tongue States

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The first metacognitive judgment that was subjected to rigorous experimental scrutiny was the feeling-of-knowing (FOK) judgment. In 1965, a graduate student—Joseph Hart, at Stanford University—devised a method that he called the recall-judge-recognition paradigm, or RJR method for short. The experimental participants were individually given a number of general information questions to answer such as, “Who was the first person to set foot on the moon?” Questions that participants answered correctly were not considered further. However, for those questions to which participants gave an incorrect answer, or failed to produce an answer at all, they were then asked to make a FOK judgment that involved predicting whether they would choose the correct answer on a multiple-choice task. After making FOK judgments for all questions that were not answered correctly, a multiple-choice recognition task was administered, so that the accuracy of the judgments could be estimated. In summary, participants first attempted to *recall* answers, then they *judged* whether they would be able to recognize the correct answer to incorrectly recalled ones, and finally they tried to *recognize* the correct answers—hence, the recall-judge-recognize (RJR) method. The interesting and, at the time, surprising finding was that even though participants had just demonstrated that they were unable to come up with answers to many questions, their predictions concerning which answers they would later recognize were accurate. In particular, their recognition performance was higher when they predicted that they would later recognize the correct answer than when they predicted they would not.

What was so surprising was that people could accurately judge whether an answer was in memory even though they could not recall that answer. How we are able to do this posed a puzzle for the field that triggered a great deal of research on people's metacognitions—their ability to know what they know and what they do not know, which is a vital self-reflective process. In the remainder of this chapter, we discuss current theories about how people make FOK judgments, each of which also provides an answer to the question, Why do people's FOK judgments show above-chance levels of relative accuracy? (For a reminder on the meaning of “relative accuracy,” refer to Chapter 3.) We also explore a related phenomenon, called a tip-of-the-tongue state, which vexes people almost daily. We then discuss the brain systems that give rise to FOKs, and we close the chapter by considering the functions of FOKs in controlling strategy selection and memory retrieval.

## Theories About Feeling-of-Knowing Judgments

In the next two sections, we review scientists' best attempts to unravel the mystery of people's feelings of knowing; namely, how can we know that a memory is available in our minds when in fact we cannot recall that memory? We begin with the target-strength account, which was first posed by Joseph Hart, and then we move to more contemporary heuristic-based solutions to this intriguing mystery.

### Target Strength Account

According to Hart (1967), FOK judgments directly tap how strongly a target is activated in memory. If you cannot recall the (target) answer to the question, “Who produced the first commercially successful electric guitar?,” then your FOK is based directly on how strongly your neural representation of the target (in this case, “Fender”) was activated when you were asked the question. According to this account, people will judge that they know a target answer that they cannot recall when the strength of the target falls below their recall threshold but above a FOK threshold. If the strength of a target answer in memory falls below this FOK threshold, then they will judge that they would not recognize the target. Because FOKs directly tap the actual strength of a target in memory, they should often show high levels of relative accuracy.

Despite its historical significance, the target-strength account has not received definitive support in the literature. Connor, Balota, and Neely (1992) provided relevant evidence in the following manner (see also Jameson, Narens, Goldfarb, & Nelson, 1990). First, they replicated an intriguing finding by Yaniv and Meyer (1987). Participants were asked to provide the

sought-after target to definitions, for example, “What is a mythical figure, half-man, half-horse?” In this case, the target is “centaur.” They then made a FOK judgment for each target that they did not recall. After this retrieval-judgment phase, a lexical-decision task was conducted, where the correct responses to definitions (e.g., centaur) were mixed with nonwords (e.g., gantean). During the lexical-decision task, these letter strings appeared, and participants had to decide as quickly as possible as to whether each one was a word or a nonword. Just like Yaniv and Meyer (1987), Connor et al. (1992) found that *more* lexical-decision errors were made for nonrecalled targets that received low FOK judgments than for those that received high FOK judgments. On first blush, this outcome appears consistent with a target-strength (direct-access) account: Presenting the definitions (“What is a mythical figure, half-man, half-horse?”) is activating some targets in memory (but not others) and doing so increases the memory strength for the activated targets. This increased activation would then produce high FOKs for the targets and would also boost the accuracy of lexical decisions for them (Yaniv & Meyer, 1987).

A follow-up experiment by Connor et al. (1992), however, demonstrated that this interpretation was not appropriate. Participants first performed the lexical-decision task, and then a week later, they returned to the laboratory to answer the questions and make FOK judgments. In this case, because the lexical-decision task occurred *before* the questions were presented, priming would not occur for lexical decisions, so lexical decisions and FOKs should not be related. Surprisingly, they still found that more lexical-decision errors were made for nonrecalled targets that received low FOK than high FOK judgments. A target-strength account cannot explain these data, because the definitions are presented *after* the lexical-decision task and hence could not have enhanced the activation of targets with high FOK judgments. Connor et al. (1992) offered the following explanation: “The [FOK] estimate reflects the subject’s current assessment of the level of expertise he or she has in a topic, where the speeded lexical decision performance simply reflects speeded recognition of an item that falls into a category with which the subject is familiar” (p. 553). That is, FOK judgments do not tap the strength of a particular target directly, but instead are based on one’s expertise—or familiarity—with a topic domain. Their domain-familiarity hypothesis is currently a leading, heuristic-based account of FOK judgments, which we explore in detail in the next section.

## Heuristic-Based Accounts

In contrast to the direct-access accounts, heuristic-based accounts do not claim that people’s FOKs directly tap the activation of some underlying

target. Instead, a feeling of knowing arises because people *infer* the target's existence based on some relevant factor, such as familiarity with the cue for a question. Such a FOK judgment is said to be *heuristically based*, because using cue familiarity gives one a good and easy-to-use rule—or heuristic—about whether you will be able to recognize the correct answer. Let's consider two cues that could inform such a heuristic—cue familiarity and target accessibility—and how they could support accurate FOK judgments.

### *Cue Familiarity*

Much research has suggested that people base FOK judgments on their quick assessment of the familiarity of a retrieval cue. Consider two situations: one in which you cannot immediately retrieve the answer to a question, and the other where you do not retrieve a name of an acquaintance. In particular, you may be unable to answer the question, "Who wrote the book *Atlas Shrugged*?" Or you may be unable to retrieve a person's name when you see him on the street. In these cases, however, you may have an unmistakable feeling that you would recognize the author or the person's name. In the former case, the *cue* is the question itself ("Who wrote the book *Atlas Shrugged*?"), and in the latter case, the *cue* is the person's face. According to the cue-familiarity hypotheses, you have a feeling of knowing because the cue itself is highly familiar. That is, a high feeling of knowing is not based on retrieval of the sought-after target, but rather on either (a) familiarity with the domain of the cue (e.g., you read a lot of literature, and you are familiar with authors' names), or (b) perceptual or conceptual familiarity with the cue (e.g., the cue seems familiar because you recently were exposed to the words "atlas" or "shrugged," or you have seen this particular person a lot, but cannot recall his name).

Because such cue familiarity tends to be predictive of what people will later recognize, this heuristic would produce accurate FOK judgments. Concerning sheer familiarity with the cue, if a person senses that he is familiar with the words in a cue (or a person's face), it is likely that the person has past experience with the word (or the person). Of course, words in a question often occur with their answer (when you see the words "*Atlas Shrugged*," they often will appear with Ayn Rand), and a person's face often occurs with a name (when you saw the person in the past, you probably heard his name on more than one occasion). The idea here is that even when we cannot recall a sought-after target, the fact that we are familiar with the cue suggests that the actual target is lurking just below the surface of memory waiting to be retrieved. In these cases, high cue familiarity leads to high FOK judgments and a higher likelihood of correctly recognizing the target

than does low cue familiarity, which would lead to low FOK judgments and a lower likelihood of recognition.

Now consider domain familiarity. If unable to immediately retrieve the name of the capital of Turkey, the frequent traveler would probably give a higher feeling-of-knowing rating than someone who rarely travels. The former would also likely have a better chance than the latter of choosing the correct response from the alternatives: BURSA, RIYADH, ISTANBUL, ANKARA, ASHGABAT, JEDDAH, MECCA, TABRIZ, MANAMA, MUSCAT. But this frequent traveler might not be an art lover, and so when unable to retrieve the answer to, “Who painted *Two Tahitian Women?*,” she should by the cue-familiarity heuristic give a low feeling of knowing (and should also be unlikely to correctly choose the target when given the alternatives). The idea is that if people are familiar with the domain of a question, they will be able to eliminate wrong answers fairly easily, and they should know they are likely to be able to do so. If they are unfamiliar with the domain, they will have much less luck. That is, with a bit of metacognitive smarts, they should know that they will be worse on those unfamiliar domains and will do much better on familiar ones. Thus, using either familiarity with a cue or familiarity with the domain the cue comes from as a heuristic to make FOK judgments would often support accurate judgments.

Much evidence favors the cue-familiarity hypothesis. For instance, while initially trying to retrieve an answer to a question, people can make different kinds of error, such as errors of omission (recalling nothing) or errors of commission (i.e., recalling a wrong answer, such as recalling “Margaret Atwood” instead of “Ayn Rand”). In the RJR method, people are often asked to make a FOK judgment after both kinds of error, and before doing so, the experimenter tells them that in fact they had just made an error. Examination of how FOK judgments relate to these errors suggests that participants are basing their judgments on cue familiarity. In particular, Krinsky and Nelson (1985) found that FOKs given to commission errors were higher than those given to omission errors. Commission errors tend to occur in domains with which people are more familiar (Butterfield & Mangels, 2003; cf. Koriat, 1993), so even when people make a commission error, their domain familiarity may nevertheless suggest that they have a good chance at recognizing the correct answer. Of course, this evidence is indirect, and although other relevant evidence also suggests domain familiarity influences FOK judgments (e.g., Connor et al., 1992; Costermans, Lories, & Ansay, 1992; Marquié & Huet, 2000), *experimental* evidence (where an independent variable is manipulated) is not currently available, partly because domain familiarity is a pseudo-experimental variable. Thus, further experimental research is needed to more closely scrutinize the influence that domain familiarity has on FOK judgments.

Even more convincing evidence for the cue-familiarity hypothesis has been offered by Lynne Reder (1987, 1988), who was a leader in demonstrating the centrality of this cue in the FOK judgment process. She argued that if FOK judgments were based on explicitly retrieved information, then one might expect that the time needed to make these judgments would be at least as long (or longer) than the time needed to retrieve information. In contrast to this prediction, she and her colleagues found that judgment reaction times were shorter than retrieval latencies. Most relevant to the cue-familiarity hypothesis, Reder also experimentally manipulated familiarity with the cue in the following manner. Participants first read a long list of words (some of which appeared in pairs) and rated how often they encountered certain pairs of words together in real life, such as while reading or listening. These *primed* words then appeared in half of the general-knowledge questions during the subsequent recall-judgment phase. For instance, “grape” and “wine” may have been rated for co-occurrence and would subsequently occur in a general-information question such as, “What grape is dominant in wines produced in the French region of Tavel?” Priming these words presumably would increase the familiarity of the cue (in this case, the question) and hence should increase people’s FOK judgments. As expected, Reder (1987) found that FOK judgments were often higher for questions with primed pairs than for questions without them (see also Schwartz & Metcalfe, 1992).

Metcalfe, Schwartz, and Joaquim (1993) also used a paradigm in which they repeatedly presented the same cues across several trials (which did not improve retrieval of the target) or repeatedly presented the targets. More specifically, participants studied two lists of paired associates (e.g., pickle-lucky, where the first word, “pickle,” is the cue, and the second word, “lucky,” is the target). As shown in Table 4.1, the second list of paired associates was the same for all participants, and the first list differed depending on the group. The left-hand column refers to the general relationship of both lists, with AB, AB meaning that the same pairs appeared on both lists, and AD, AB meaning that the same cues (A) appeared on both lists, but they were paired with different targets on the two lists. Most important for now, note that the cues are repeated across both lists for the first two groups, but different cues are used on the two lists for the second group. Thus, when the cues (e.g., lucky-?) are presented for the FOK judgments, cue familiarity should be higher when the cues were repeated than when they were not. In this case, the prediction from the cue-familiarity hypothesis is that FOK magnitude should be higher for the AB, AB group and the AD, AB group than for the CD, AB group, which is exactly what was found (see the far-right column in Table 4.1).

**Table 4.1** Percentage Recall and Feeling-of-Knowing (FOK) Judgments for Pairs Presented on List 1

<i>Group</i>	<i>List 1</i>	<i>List 2</i>	<i>% Target Recall</i>	<i>FOK Magnitude</i>
AB, AB	pickle-lucky	pickle-lucky	39	48
	table-picture	table-picture		
	butter-psyche	butter-psyche		
AD, AB	pickle-carpet	pickle-lucky	17	49
	table-maple	table-picture		
	butter-sandal	butter-psyche		
CD, AB	single-carpet	pickle-lucky	19	38
	fragrant-maple	table-picture		
	marble-sandal	butter-psyche		

SOURCE: Adapted from Metcalfe, J., Schwartz, B. L., & Joaquim, S. G. (1993). The cue-familiarity heuristic in metacognition. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19, 851–861.

NOTE: FOK magnitude refers to the mean FOK judgment across pairs for a given group. FOK judgments were made on a 100-point scale, from 1 (no idea of correct response) to 100 (sure they would recognize the correct answer). The pattern of mean recognition performance was identical to recall performance.

In summary, much evidence indicates that people use their familiarity of a cue to make FOK judgments. This heuristic account provides one answer to our main question, *Why do FOK judgments show above-chance relative accuracy?* Namely, when we are familiar with a cue (and hence make a high FOK judgment), it's often because we have seen the cue and target in the past, so if the cue is familiar we likely have some lingering memory for the target as well and hence will recognize it on the criterion test. When we aren't familiar with a cue (and hence make a low FOK judgment), it's probably because we have rarely seen either the cue or target in the past, so we won't later recognize the correct target. Note, however, that even though relative accuracy is usually above chance (with judgment-recognition correlations being greater than zero), it also is often far from perfect, with correlations typically being below +.50. These mid-to-low levels of relative accuracy are also consistent with the application of a heuristic, because as explained by Metcalfe et al. (1993), "frequently our predictive ability is disappointing, as might well be expected given that we base these judgments on a heuristic rather than on some direct assessment of the . . . target itself" (p. 860).

### *Target Accessibility*

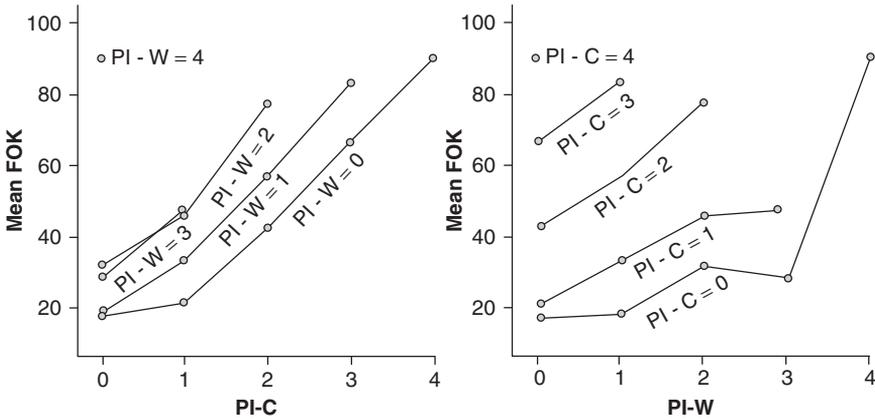
Another heuristic basis for FOK judgments involves retrieving (or accessing) information relevant to the sought-after target. The idea is that when making an FOK judgment, we continue to attempt to retrieve the sought-after target, and some information may be retrieved. According to this *accessibility* hypothesis, when making an FOK judgment, accessing more information about a target (and accessing the information more quickly) will increase your confidence that you will later recognize the correct response (Koriat, 1993, 1995). As argued by Asher Koriat (1993), “the computation of FOK is parasitic on the processes involved in attempting to retrieve the target, relying on the accessibility of pertinent information” (p. 609). That is, a FOK judgment arises as a by-product of the retrieval process aimed at discovering the sought-after target. For instance, when asked to make a FOK judgment for the question, “Who wrote *Atlas Shrugged?*,” you may readily retrieve that the author’s last name begins with an “R” and that the author was a woman. In contrast, for “Who produced the first commercially successful electric guitar?,” you may not retrieve anything when searching for the answer. According to this hypothesis, your FOK judgment will be higher for correctly recognizing the former target than for the latter one. Although the success of this retrieval process will rely on the strength of the target in memory, this view is not another version of the target-strength (direct-access) account. The target-strength account indicates that people have direct knowledge about target strength, whereas the accessibility hypothesis posits that people use the products of retrieval as a heuristic to *infer* target strength.

We have already described evidence relevant to this accessibility hypothesis. Reconsider data from Metcalfe et al. (1993), which is presented in Table 4.1. Participants who studied each paired associate twice (i.e., the AB, AB group) outperformed the others on the recall test (which preceded the FOK judgments). Accordingly, one could argue that overall, target access was greater for the AB, AB group, so a prediction is that this group should also have the highest FOK magnitude. In contrast to this prediction, FOK magnitude does not vary with target access but instead varies with cue familiarity, which indicates that at least in some circumstances cue familiarity is a dominant basis for people’s FOK judgments. It is important to note, however, that these two heuristic accounts for FOKs—cue familiarity and accessibility—are not mutually exclusive, so both heuristics can jointly influence people’s FOKs. And, as we’ll see, accessibility does appear to have an important influence on FOK judgments.

According to Koriat's (1993) accessibility hypothesis (see also Schacter & Worling, 1985), FOK judgments are based on the total amount of information retrieved about the target, regardless of whether that information is correct or not. As a person recalls more and more, her FOK will increase too, even if all the information retrieved is incorrect. The idea here is simply that people are not good at evaluating the quality of information that is quickly accessed prior to making an FOK judgment, so all the information produces an FOK en masse. Note that this explanation naturally accounts for the above-chance relative accuracy displayed by FOK judgments. In particular, given that people often retrieve partial information about a target that is correct, being able to access some correct information (versus not being able to do so) would mean that the correct target is available in memory but just can't be recalled.

Asher Koriat has reported a great deal of evidence that is consistent with this proposal (for an excellent overview, see Koriat, 1994). In one experiment, participants studied a series of tetragrams—four-letter strings that were unfamiliar, such as FKDR, RFSC, and so forth (Koriat, 1993, Experiment 1). A participant studied a tetragram (FKDR) for 1 second, performed a distracter task for about 19 seconds, and then was asked to recall the tetragram. They were told that on each trial they would gain 1 point for each correct letter recalled but that they would earn no points if they recalled even one letter incorrectly. After this recall attempt, a FOK judgment was made for that tetragram. After these recall-judgment trials, a recognition test was given so that the accuracy of the FOK judgments could be assessed.

Two main questions arise from the accessibility hypothesis. Does FOK magnitude increase with the number of letters accessed? And, as important, Does FOK magnitude increase with letters accessed regardless of whether those letters were correct or incorrect? The results from this experiment are presented in Figure 4.1, where FOK magnitude is plotted as a function of partial information (PI) accessed—that is, the number of letters recalled from a tetragram—that was either correct (C) or wrong (W). Examine the left panel first. The data point at the top left-hand corner is the mean FOK rating for items in which four letters were recalled and they were all incorrect (PI-W = 4). Now compare this value to the one in the far right-hand corner, which is when all the letters accessed were correct (PI-C = 4). Note that the FOK magnitude is high and nearly identical for these two conditions. This comparison and several others from this figure illustrate that people judged they knew an answer if four letters were



**Figure 4.1** FOK magnitude as a function of amount of information accessed and whether the information was correct (C) or wrong (W).

SOURCE: Koriat, A. (1993). How do we know that we know? The accessibility model of the feeling of knowing. *Psychological Review*, 100, 609–639.

recalled, regardless of whether those letters were correct or incorrect. Moreover, in both panels of this figure, it is evident that FOK magnitude generally increases as more letters are recalled. FOK increases with PI-C (and PI-W), from 0 to 4. As important, when participants largely accessed correct information (PI-C) prior to making FOK judgments, relative FOK accuracy was well above chance, whereas when incorrect information was accessed (PI-W), their FOK judgments were not accurate at all. This and other evidence from Koriat’s (1993, 1995) research provides support for the target-accessibility hypothesis.

At this point, you may be wondering: Which has a more potent effect on people’s FOK judgments—cue familiarity or accessibility? Although such a question is reasonable and motivated early research on FOK judgments (e.g., for competing opinions, see Koriat, 1994, and Miner & Reder, 1994), the question does not deal with the fact that people may monitor both factors—cue familiarity and accessibility—when making a FOK judgment. Thus, we propose a more cutting-edge question about how people make FOK judgments in Mystery Box 4.1, which should motivate exciting research in the future.

### **Mystery BOX 4.1** **Do People Monitor Multiple Cues** **When Making a Feeling-of-Knowing Judgment?**

Although we have focused on only three possible bases for people's FOK judgments, many others have been considered. In fact, Nelson, Gerler, and Narens (1984) compiled an extensive list of 12 factors that could influence people's FOK judgments, including those described in our text plus others, such as social desirability (i.e., saying one knows an answer so as to not be thought of as stupid) or actuarial information (i.e., saying one knows an answer because the question appears to be normatively easy). Certainly, it seems reasonable that any of these factors could in principle influence FOK judgments, which leads to a series of mysteries that future research must solve.

In particular, the steady growth of interest in how people make FOK judgments has typically rested on experiments that investigate either (a) the contribution of a given factor in isolation or (b) which of two factors (e.g., cue familiarity versus accessibility) has a larger influence under a given set of conditions. If more than one factor influences people's FOKs, however, it seems especially important to understand how people use multiple factors *jointly* in constructing FOK judgments. This venture is particularly critical if we want to understand exactly how people's FOK judgments reflect their monitoring of memory, which would require that we can isolate factors that do not reflect monitoring processes (e.g., social desirability). Many questions that remain without adequate answers today include: How exactly are two—or more—factors combined to make an FOK? If a given factor is available (e.g., target access), does it overshadow other factors that could increase the accuracy of FOKs (e.g., normative actuarial information)? And, when more than two factors influence FOK judgments, how can we estimate the separate influence of each factor on the judgments?

Almost no research has sought to answer these questions, with a notable exception. Koriat and Levy-Sadot (2001) investigated how two cues—cue familiarity and target accessibility—are combined (see also Benjamin, 2005). According to their interactive hypothesis, when a question is encountered (e.g., "What is the name of the largest kingfisher in the world?"), one first has an initial and quick preliminary feeling that is based on the familiarity of the cue (e.g., Miner & Reder, 1994). If the cue is not familiar, a search of memory will be brief if it occurs at all. In this case, because search for the target doesn't get started, the accessibility of the target will not influence FOKs. If the cue is immediately familiar, then a more thorough search for the sought-after target will occur. While searching, one may access information about the target, and in doing so, believe that the correct target could be recognized. Thus, only when the cue is familiar, and hence the search for the target persists, is target

accessibility expected to influence FOK judgments. Across three experiments, Koriat and Levy-Sadot (2001) provided preliminary evidence that supported this interactive hypothesis.

Koriat and Levy-Sadot's (2001) ideas and experiments highlight an intriguing new avenue for research on FOK judgments, because we know a lot about which individual factors influence FOKs but very little about how they jointly influence FOKs. As you will find when we review the literature on other basic metacognitive judgments in the next chapters, research focusing on the joint effects of various factors on these judgments is also nearly absent. Certainly, a new wave of research will be required to solve the mystery of how people attend to, select, and combine multiple factors when judging their memories.

## Tip-of-the-Tongue States

If you have played the game Trivial Pursuit—or some other game like it—then you are among many who love to challenge their memories about current and past events, trying to come up with answers to questions such as, “Who was the first man to set foot on the moon?” or “What team has won the most World Cup Championships?” Of course, for many of these questions, you may quickly retrieve the correct answer, yet for some others, you may struggle, feeling that you absolutely know the answer, if it would only bubble up to the top of your mind. Even if you have not played Trivial Pursuit, you probably have been frustrated by being almost but not quite able to recall something—for example, a person's name—that you are sure you know. Most of us actually have these *tip-of-the-tongue states* often; they arise when we are trying to recall someone's name, and they also arise more frequently as we grow older.

Given the ubiquity of such tip-of-the-tongue (TOT) states, and that they invoke emotional anguish in many of their victims, it perhaps is not too surprising that psychologists have been interested in understanding them for some time. In his classic textbook, *The Principles of Psychology* (1920), William James described TOT states in an often-quoted passage:

Suppose we try to recall a forgotten name. The state of our consciousness is peculiar. There is a gap therein; but no mere gap. It is a gap that is intensely active. A sort of wraith of the name is in it, beckoning us in a given direction, making us at moments tingle with the sense of our closeness, and then letting

us sink back without the longed-for term. If wrong names are proposed to us, this singularly definite gap acts immediately so as to negate them. They do not fit into its mould. (p. 251)

James's description is eloquent and emphasizes the disturbing nature of TOT states, which pose as a "wraith" that teases us into believing we can remember something that we cannot. And often another word—a blocker, or "ugly stepsister," as some researchers call it—persistently comes to mind to torment us further (see Box 4.2 for more on blockers). These frustrating experiences are common. In his review of the literature, A. S. Brown (1991) concluded from diary studies that TOTs naturally occur about 1 to 2 times a week for younger adults, whereas the rate of TOTs is almost doubled per week for older adults.

**BOX 4.2**  
**Do Blockers Really Block**  
**Our Access to Sought-After Memories?**

So, you're daydreaming about this absolutely gorgeous classmate who you have a crush on. And who should appear, all alone, as you're standing in line to pay for your coffee? You're about to kiss the ground she walks on, and are wildly thinking of ways to impress her, when... oh, no! Not now! You're in a TOT state—of course you know her name, but you just can't retrieve it. To make matters worse, it's a *blocked* TOT. All that comes to mind—tormenting you, and turning you into a blithering idiot—is "Angelina." But you know her name is not Angelina. But what is her name, right there sparkling on the end of your tongue? You remember the professor mentioning her name, and even worse, you repeated her name, whistling, as you strolled across campus yesterday. But today, you're blocked. She's getting closer. She's interested. She breathes your name (oh, worse luck) in the most adorable husky tones. And you say: "Oh, hi, ah... uh... uh... uh... sputter."

The deep intellectual question, here, is whether poor old Angelina is really to blame? Does having a blocker come to mind really interfere with resolving the tip-of-the-tongue state? The blocking hypothesis—that retrieving a blocker hurts—is so widely accepted that some authors use the terms TOT and blocker synonymously. Kornell and Metcalfe (2006) addressed this question of whether blockers really block, experimentally, by giving definitions of words that were likely to induce TOT states, and then asking people whether they were in an unblocked TOT state or whether they were in a blocked state. To make sure people were actually in a blocked state when they said they were, they also had to

state their blockers, and they had no difficulty in doing so. Moreover, people knew perfectly well that the blockers were wrong. They were annoyed by them and tried to get rid of them.

Smith and Blankenship (1989) had shown that giving people blockers that were made up by the experimenter, not self-generated, did interfere with people's ability to come up with the correct answer. But perhaps experimenter-provided interference and people's own, internal, blockers are different. Kornell and Metcalfe (2006) argued that if blockers really did block, then the way to get them to be less harmful would be to wait a while. Get them out of your mind, and then come back to the problem. This idea—to go away and do something else for a while, or, in other words, to incubate—is often evoked as a method to help people when they are stuck on solving insight problems. In this case, too, they're supposed to be blocked, and an incubation period away from the current dead-end (blocked) thinking is supposed to help.

To see whether waiting and allowing the blockers to be put out of mind would improve the resolution of blocked TOTs, Kornell and Metcalfe (2006) had a computer pick half of the blocked TOTs and half of the non-blocked TOTs to be thought about immediately. The other half of each category was separated out and presented later, and the person was given the same amount of time to work on them after the incubation period. If the blockers were really actively fighting off access to the target word, then waiting should have lifted the block (because the blockers were forgotten during the wait, and simply weren't there to block). The blocked TOTs should have benefited more from the incubation period than the originally nonblocked TOTs because the latter had nothing inhibiting their resolution in the first place. In contrast to this prediction, although the incubation period did help participants retrieve some of the sought-after targets, it helped such resolution by the same amount for the originally non-blocked TOTs *and* the blocked TOTs. The so-called blockers, apparently, were not blocking. So, although your blocked TOT dilemma, true to the observations of William James (1920), may have been frustrating, don't blame Angelina. In the meantime, if the classmate really likes you, why not just ask her what her name is—after all, asking someone for help is a great way to resolve TOT states.

Unfortunately, diary studies do not allow researchers to experimentally investigate the states in a manner that would lead to definitive answers to important questions such as, What causes a TOT state (but see Burke, MacKay, Worthley, & Wade, 1991)? To answer such questions, a laboratory analog for inducing TOT states was needed. Brown and McNeill (1966) developed the first one, which has been adapted numerous times to explore TOT phenomena. In particular, they presented a definition of a rare

word, and experimental participants were asked to recall the word. While searching for these rare words, participants were also asked to report when they were in a TOT state, which was described as being unable to retrieve a word but having the feeling that the word was known and would soon be recalled. This procedure successfully elicited hundreds of TOT states. Moreover, when participants were in a TOT state, they were able to accurately recall some of the letters of the sought-after word and sometimes the number of syllables of that word. This evidence demonstrated that TOT states were accurate in that when people believed they were on the verge of recalling a sought-after target, the target was likely available in memory but just not currently accessible.

Further evidence for the accuracy of TOTs was discussed by Schwartz (1999, 2002), who described experiments modeled after the RJR method to explore FOK accuracy. In these experiments, participants first reported whether they were in a TOT state or not in a TOT state when they could not recall a sought-after target. After these judgment trials, a test of recognition was administered so that TOT accuracy could be estimated. Across multiple experiments from various laboratories, recognition performance was higher when people were in a TOT state than when they were in a non-TOT state (for complete details, see Schwartz, 2002). Again, these outcomes further establish that when someone complains about being in a TOT state, the actual target is more likely available in memory than when they aren't in a TOT state. This brings us to two questions: (a) What causes these frustrating states? and (b) How do explanations of TOT phenomena account for their accuracy?

Many answers have arisen for these questions, and like hypotheses for how people make FOK judgments, these answers can largely be separated into two classes: those implying that TOTs arise from a person having direct access to the strength of the sought-after target in memory, and those indicating that TOTs are inferential in nature. Direct-access accounts readily explain TOT accuracy, because when in a TOT state, a person allegedly has direct access to target strength, such as if a person directly monitors the neural activation of the semantic representation (i.e., its meaning) when the sought-after target cannot be retrieved (e.g., Burke et al., 1991). Burke et al. argued that people may, at least some of the time when they are in the TOT state, have essentially complete access to the conceptual meaning of words, but still be unable to retrieve the word's sound or phonemic representation. More generally, lexical access is thought to entail two or more successive, or possibly interactive, levels of processing. In Stage 1, a semantically and syntactically specified representation is accessed. In Stage 2, a phonological representation is accessed. The notion here is that the feeling of being in a TOT state can occur because there is complete access to the first level, but that the

person may, nevertheless, be unable to produce the word because of an impairment, block, or problem at the second level. If this were so, then the person would be said to have complete semantic and syntactic access, but they might still be unable to recall the target. This model is thought to be most important in explaining the high rate of TOTs seen in older adults, but it may also apply to young participants in some instances.

To support the view that the problem in TOT states is phonological in nature, James and Burke (2000) preceded the definitions of words that commonly provoke TOT experiences by spoken primes that shared some of the phonology. For example, a TOT-provoking question would be “What word means to formally renounce a throne?” When one of the spoken-aloud primes given before the presentation of this question was the word “abstract,” people were much more likely to answer the question (correct answer: abdicate), and they were less likely to be thrown into a TOT state, suggesting that at least some TOTs are not semantic but rather result from a lack of access to the appropriate phonology. Miozzo and Caramazza (1997), using the fact that Italian words have male and female gender as part of their syntax, showed that Italian speakers could tell, with above-chance accuracy, the gender of the words when they were in a TOT state as compared to when they said that they did not know. Thus, the syntax may be accessed.

Further support of the idea that at least some TOT states entail virtually complete access to the semantics of the lexical item that is sought, but a disconnect between that conceptual level of processing and the phonemic output, come from a study by Funnell, Metcalfe, and Tsapkini (1996). They reported on a patient who had production anomia, and who seemed constantly to be in a tip-of-the tongue state. This patient, H.W., was tested for the names of 150 words (50 nouns, 50 adjectives, and 50 verbs) that were specifically designed so that there was only a single word answer. An example would be: “When a person brushes butter on a turkey while it is cooking they are said to \_\_\_\_\_ the turkey.” “Baste” is the only answer that works. H.W. was able to come up with only 1 of the 150 words. When he was given a recognition test for the words, however, he did better than college students from Dartmouth on choosing the correct alternatives. It would seem that this patient (and perhaps many people when in a TOT state) has essentially complete semantic access to the words when he is in a TOT state, yet he cannot access the appropriate phonology.

Thus, it would appear that there are cases in which people may be in a TOT state accompanied by complete semantic access to the target item. They may, however, also report being in a TOT state for other reasons,

basing their TOT judgments on heuristics, such as the familiarity of the cue or partial, but not complete, access to information about the target word. Metcalfe et al. (1993) evaluated whether being familiar with memory cues could give rise to TOT states. The method used to do so was described above: Experimental participants studied lists of paired associates on two study-test trials, and sometimes both stimulus and response were repeated across lists (AB, AB), sometimes only the stimulus was repeated (AD, AB), and sometimes no words were repeated across lists (CD, AB) (see Table 4.1 for a refresher). Just like with FOK judgments, they found that TOT states were not elevated when the correct targets were strengthened through repetition, which cannot easily be explained by target-strength accounts. In contrast, TOT states occurred most frequently when the cues were repeated (AB, AB; and AD, AB) than when they were not repeated (CD, AB). Thus, it appears that people's TOTs partly arise from using the cue-familiarity heuristic.

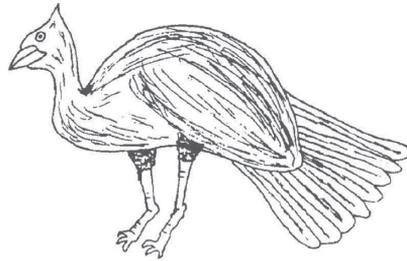
According to the accessibility hypothesis, a person infers the presence of a target when any information (even partial information) is retrieved as the search for the target proceeds. As one retrieves more and more information about the target, the chances a TOT state will occur increases. Thus, if you cannot recall the answer to the question, "Which singer was known as Ol' Blue Eyes?," you may remember that the singer was male, he starred in *Ocean's Eleven* (the original), he was part of the Rat Pack, and his first name began with "T." Accessing so much information (regardless of whether it is correct or incorrect) may lead to a state where you absolutely know that you know the answer. Note that these products of the retrieval attempt will usually signify that a correct answer is stored in memory, so a TOT will often accurately indicate that the correct target (in this case, Frank Sinatra) is lurking somewhere in memory waiting to be discovered (even though some of the information retrieved, such as that his name begins with "T," was incorrect).

To evaluate this accessibility account, Schwartz and Smith (1997) used naturalistic materials developed by Smith, Brown, and Balfour (1991), which were drawings of make-believe animals along with their names, sizes, countries of origin, and diets. Figure 4.2 includes some *TOTimals*, and the format for the various conditions used in this experiment. For some *TOTimals*, only the name and country were presented (called the *minimum-information* condition); for other *TOTimals*, the picture was also included (*medium-information* condition); and finally, in the *maximum-information* condition, the name and country were presented along with the picture of the *TOTimal*, and its diet and size. Participants studied twelve *TOTimals* for 15 seconds each. During the subsequent test, the country of each *TOTimal* was presented as a cue (none of them originated from the same country), and

participants were asked to recall the name of the corresponding TOTimal. If participants could not recall a TOTimal's name, they were asked to report if they were in a TOT state and also asked to report anything they could remember about the TOTimal. According to the accessibility hypothesis, participants were expected to report being in TOT states more often when they retrieved more information about the unrecalled target. Moreover, the maximum- and medium-information conditions were expected to lead to greater levels of access, so TOTs should arise more often in these conditions than for the minimal-information condition. The outcomes were consistent with these predictions (see Schwartz & Smith, 1997, Experiment 3).

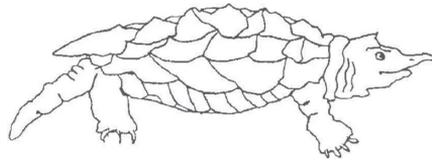
In summary, TOT states likely arise either when people can access the sought-after target but cannot articulate it, or when they cannot recall a sought-after target yet find (a) the cue for the target (e.g., the question itself) to be highly familiar (as per the cue-familiarity heuristic), or (b) when other information about the target readily comes to mind (as per the accessibility heuristic). Research efforts aimed at an even better understanding of why TOT states occur will undoubtedly continue. Another avenue for research concerns discovering techniques to help people resolve a TOT state—that is, to retrieve a sought-after target when it eludes you. For more on resolving pesky TOT states, see Box 4.3.

*Maximum-Information Condition*



Panama-Yelkey  
2  
Berries

*Medium-Information Condition*



France - Rittle

*Minimum-Information Condition*

India - Merling

**Figure 4.2** Examples of some TOTimals in all three information conditions used by Schwartz and Smith.

SOURCE: Schwartz, B. L., and Smith, S. M. (1997). The retrieval of related information influences tip-of-the-tongue states. *Journal of Memory and Language*, 36, 68–86.

### BOX 4.3 I'm in a TOT State. How Do I Cure It?

Everyone finds themselves in a TOT state from time to time. TOT states arise naturally and are universal. In fact, in his survey of languages, Bennett Schwartz had native speakers of 51 different languages provide the saying that matched what English speakers mean when they say, "It's on the tip of my tongue." Speakers of 45 different languages used a similar metaphor, including Irish and Serbians who use "on the top of the tongue" and some Koreans who use the colorful phrase, "sparkling at the end of the tongue" (for details, see Schwartz, 1999, 2002). Those who *speak* language use this phrase, as well as individuals who use American Sign Language, which Thompson, Emmorey, and Gollan (2005) refer to as the "tip-of-the-finger" state. Similarly, it appears that we can experience the same frustration when we fail to retrieve the name of an odor (Jönsson & Olsson, 2003), which has been dubbed the "tip-of-the-nose" phenomenon.

Given that TOTs appear to be a truly universal problem, frustrating people around the globe, some form of therapy or intervention seems in order. How can we resolve these TOT states? The research on TOT resolution is relatively sparse, and no one is currently conducting systematic research to develop a set of "no fail" tactics to retrieve frustratingly elusive memories. Nevertheless, a handful of studies do offer some suggestions on how to increase the chances of resolving a TOT state. One suggestion comes from Beattie and Coughlan (1999), who reported that people resolved more TOT states when their hands were free to gesture than when they were instructed to make sure their arms were folded (for explanations for why gestures may help, see Schwartz, 2002, p. 93). So be sure to pull your hands out of your pockets and let them do some talking when you're in a TOT state.

In experiments by Brennen, Baguley, Bright, and Bruce (1990), participants were asked general-information questions in which the answer could be a famous person's name. When in a TOT state, participants were shown either the person's picture or initials of the sought-after name. Presenting the initials increased the likelihood of retrieving the name, which suggests the strategy of walking through the alphabet in hopes of coming across the correct first letter of the word you're looking for will trigger retrieval of the entire word. No doubt many people already use such an alphabet strategy when searching memory in TOT states.

Of course, another excellent way to resolve a TOT state is simply to ask someone else to help you come up with your lost memory. Just recently, an author of this textbook couldn't remember the name of the singer who wrote, "Where Is My Mind?" After some frustration, he walked to the next office, asked a friend who immediately chimed in with "Frank Black of the Pixies." Thus, searching for

external aid—from a friend, from the World Wide Web, or from any other relevant source—is likely a worthwhile endeavor when you're in a pinch to relieve frustration and to find that lost memory.

Finally, remember not to get too frustrated when you are in a TOT state, because diary studies indicate that most TOT states are eventually resolved, partly through the use of some of the techniques described above. For instance, Burke et al. (1991) examined TOT resolution for three groups differing in chronological age. In a diary, participants reported when they were in a TOT state and whether they eventually found the sought-after memory. TOT states were often resolved, with the percentage rates of resolution being 92% for younger college-aged adults, 95% for middle-aged adults, and 97% for older adults. Other diary studies also leave room for optimism, showing that resolutions usually occur in 30 minutes or less (for an overview, see Schwartz, 2002). So when you do fall prey to a TOT state, don't worry or get too annoyed—you'll likely come up with that memory.

## Brain Bases of FOK Judgments

The nature of the neural circuitry underlying memory monitoring is unknown. Many researchers have suggested that metacognitive monitoring largely relies on the frontal lobes, but very few studies have shown the critical nature of this brain region for monitoring. We'll consider some of the seminal research here along with the most recent attempts to image the brain's functioning as people make FOK judgments.

In a classic article that used the RJR paradigm, Shimamura and Squire (1986) demonstrated that different kinds of amnesia differentially influence memory and memory monitoring (as tapped by FOK accuracy). Most amnesiacs, while showing profound memory deficits, also showed *normal* relative FOK accuracy—that is, they could make FOK judgments as accurately as you or me, even though their recall was extremely impaired. They also studied patients with Korsakoff syndrome, which is caused by alcohol abuse along with thiamine deficiencies. Korsakoff patients were not only memory impaired, but their FOKs also showed impaired relative accuracy.

In keeping with the hypothesis that metacognitive monitoring might be frontally controlled, the Korsakoff patients are thought by some researchers to have frontal lobe damage, while the other memory impaired patients had no frontal damage. The difficulty Korsakoff patients have with memory and memory monitoring was explained by Metcalfe (1993), who proposed

the first formal memory model (instantiated as computer simulations) that included memory monitoring and accounted for the accuracy of FOK judgments. In this model, when a particular memory cue was presented (e.g., “What is the capital of Australia?”), the familiarity of the cue was immediately computed, and the judgments were directly based on that familiarity. Thus, similar to Reder’s proposals (e.g., see Miner & Reder, 1994; Reder, 1987), Metcalfe (1993, 1994) argued that FOKs arose from a preliminary familiarity check in which the system monitored the novelty of the memory cue. If this cue highly matched other information stored in memory, a person had an immediate feeling of knowing the answer, but if the cue did not highly match other information in memory, a person would have a feeling of not knowing. Metcalfe (1993) demonstrated how this novelty monitoring device was critical for controlling a neural model of memory. Most relevant here, the deficits shown by Korsakoff patients can be simulated if one assumes that this syndrome selectively disrupts a person’s ability to monitor the familiarity—or novelty—of a memory probe (for details, see Metcalfe, 1993).

Unfortunately, with Korsakoff syndrome, reduced memory and impaired metamemory go hand in hand. That is, there is nearly always a connection between memory functioning and FOK accuracy, and hence we are unable to determine whether people’s relative FOK accuracy is poor because they have so little memorial information on which to base those judgments, or whether damage to the *judgment process* itself might be responsible. This problem was sidestepped by Janowsky et al. (1989), who investigated FOK accuracy for three groups of participants: patients with frontal lobe damage, patients with temporal lobe damage, and normal controls. Participants first studied sentences and then sometime later they were shown the sentences again but the final word of each one was missing. They were asked to recall the final word, and if they couldn’t, they made an FOK judgment. Janowsky et al. (1989) equated the groups on overall memory performance by manipulating the delay between when each group studied the sentences and when they were asked to make the FOK judgments (for why equating memory performance is crucial, see Box 3.1). Even though the groups were equated on memory, FOK accuracy was still impaired for the patients with frontal lobe damage. Thus, impairments in memory per se cannot explain some patients’ poor FOK accuracy. Instead, the current evidence on patient populations converges on the conclusion that frontal functioning is vital for metacognitive monitoring that underlies FOK judgments (for further evidence, see Souchay, Isingrini, & Espagnet, 2000).

Recently, a group of researchers (Schnyer et al., 2004) tested patients with specific frontal lobe lesions on a FOK task. The results are striking and implicate the frontal lobes as a key contributor to accurate FOK judgments.

They hypothesized that the prefrontal cortex plays a critical role in accurate FOK predictions of episodic memory performance. Fourteen patients with a broad spectrum of damage to the frontal cortex and matched control participants read sentences and later were tested for recall memory and made FOKs (as in Janowsky et al., 1989). Frontal patients were impaired at recall and recognition memory, and as a group, they were markedly impaired in FOK accuracy. Lesion analysis of frontal patients with the most profound impairment in FOK accuracy revealed an overlapping region of damage in the right medial prefrontal cortex.

These results are qualified by two functional Magnetic Resonance Imaging (fMRI) studies on normals. The first study (Maril, Simons, Mitchell, Schwartz, & Schacter, 2003) implicates the left midlateral prefrontal cortex as being crucial to people's feelings of knowing. The second study (Kikyo, Ohki, & Miyashita, 2002) also points to frontal areas, but more diffusely. Given that FOK and recall levels are often related, a strength of Kikyo et al.'s (2002) study is that they attempted to localize FOK functioning separate from memory functioning. Brain scans were taken while participants performed a version of the RJR method, and then Kikyo et al. decomposed the neural correlates of FOKs into those areas that did (and did not) overlap with neural areas that were activated during recall. As expected, this decomposition revealed substantial overlap in the neural correlates for FOK and recall, as shown in the middle three panels of Figure 4.3 (shown inside the front cover). Most important, it was apparent that the left inferior frontal gyrus and the right inferior frontal gyrus were not recruited for recall itself but were recruited when participants had a FOK (far-left panel). These areas may have a privileged role in metacognition processes as distinct from memory processes.

In summary, only a few studies are available that use state-of-the-art imaging techniques to investigate the neural bases of FOK mechanisms (for a review of the neural bases of TOT states, see Shimamura, 2008). Even though there is not consensus about the most specific brain areas that are involved in making FOK judgments, the imaging evidence converges on the same conclusion as the behavioral research in this field. Namely, echoing Pannu and Kaszniak's (2005) conclusion from their comprehensive review, results from "neurological populations are consistent with the conclusion that the frontal lobes play a central role in the production of accurate metamemory judgments" (p. 122).

## Functions of Feelings of Knowing

Imagine yourself reading a textbook and stumbling while reading the word *bucolic* because you do not immediately recall its meaning. What would you

do? If you immediately realize that you are not at all familiar with the word, you may look it up in a dictionary. In contrast, you may sense an initial feeling of familiarity with the word, so instead of cracking open your Webster's, you spend some time searching your memory for the definition. In these cases, initial familiarity with the cue for memory (in this case, the word "bucolic") is used to choose a strategy—dictionary look-up or memory search. Your FOK may influence how long you search memory for an answer as well. If you decide to search memory and you find yourself in a tip-of-the-tongue state or have a high feeling of knowing for the definition, you may continue the search. Alternatively, your feeling of knowing may wane and hence you may terminate your search.

In both these cases, feeling of knowing plays a functional role in the search for an answer to the question, "What does bucolic mean?" In the first scenario, an initial FOK informs strategy selection, whereas in the second scenario, an ongoing FOK informs termination of retrieval. In the next two sections, we review research that highlights these functions of people's FOKs.

## Strategy Selection

Lynne Reder and her colleagues have developed innovative methods to investigate whether a preliminary FOK drives strategy selection—much like in the example above (for a review, see Reder, 1988). The idea here is that when we are

asked a question, we have the experience of an immediate feeling of knowing (or not knowing) that occurs before we begin to search for the answer. It is this pre-retrieval FOK that is then used to make decision about whether to begin a full-blown search for the answer or to use some other strategy to come up with one.




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**Lynne M. Reder**  
Developed creative methods to systematically explore the bases of FOK judgments

In her earlier work, Reder (1987) developed a game-show paradigm in which participants were shown a question, but instead of answering it, they had to respond as quickly as possible as to whether they knew the answer to the question—just like a typical game show, such as *Jeopardy* or *Family Feud*. After they made this quick FOK judgment, they then had time to answer the question, so that the accuracy of their judgments could be estimated. Control participants were presented with the same questions but instead of making an FOK judgment, they had to answer the questions as quickly as possible. Several outcomes are noteworthy.

First, for anyone who has watched (or played along with) game shows, it is not surprising that it took less time to judge whether one could answer the questions than it took to answer them. Moreover, the initial FOK judgments were accurate in predicting whether or not the answer could actually be retrieved. Thus, an accurate FOK judgment could be made quickly and before any answer had been retrieved, which demonstrates the plausibility that a preliminary FOK could influence the decision about whether to search for an answer. Perhaps most impressive, the total time needed for participants to make this judgment and to answer the question was equivalent to the time taken to retrieve the answer by the control group. This outcome suggests that even members of the control group (who were not asked to *explicitly* make a FOK judgment) also had a preliminary FOK stage before answering the question.

An alternative possibility is that people's decisions are actually based on a very quick evaluation about whether the answer to a question is stored in memory. For instance, perhaps people quickly recall a part of the correct answer (as per the accessibility hypothesis), which then produces an initial FOK. Although possible, Reder and Ritter (1992) used a version of the game-show paradigm to rule out this possibility and to further establish the importance of a preliminary familiarity-based FOK in driving strategy choice. They had participants answer novel arithmetic problems, such as  $28 \times 16 = ?$ ). The procedure, which is illustrated in Figure 4.4, involves the game-show flare: A problem is presented on a computer screen, and then participants must quickly decide which of two strategies to use to arrive at the correct answer—they could either decide to retrieve it from memory or to calculate it. After they made this quick decision, then they either attempted to retrieve the answer or to calculate it.

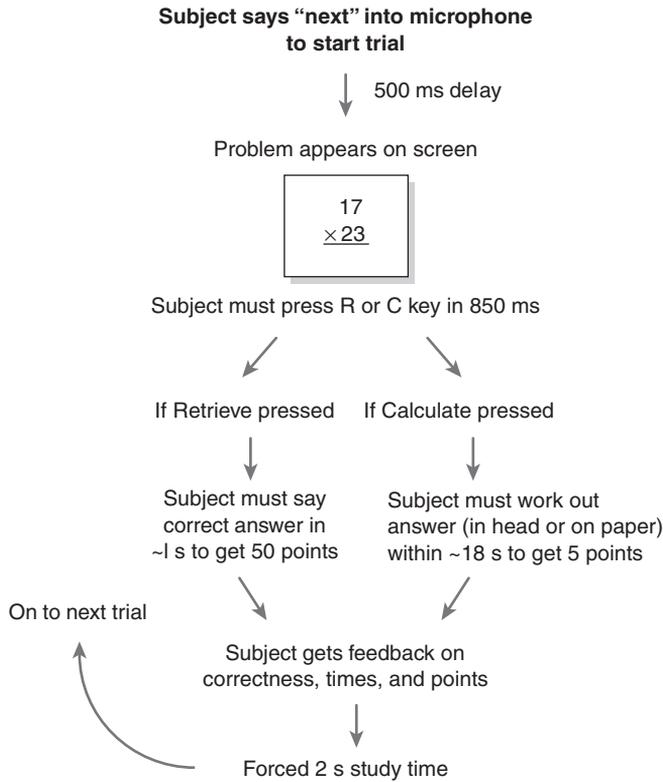
Of course, without any practice, participants would not know the correct answers and hence would have to choose the calculate strategy. Participants had hundreds of trials (Figure 4.4 illustrates only a single trial), and many problems were repeated across these trials. The issue is whether participants would switch to a retrieval strategy as they memorized some answers during practice trials. In particular, as participants became more familiar with a problem and learned the correct answer, they should shift from using the calculation strategy to a retrieval strategy. Some critical results are presented in Figure 4.5, which plots the percentage of times participants decided to use the retrieval strategy as a function of how often a problem was repeated. First, consider the curve with filled symbols ("copies of training problems"), which represents problems that were repeated in their identical form (so,  $28 \times 16 = ?$  was presented multiple times). Note that the percentage of trials that participants chose the retrieval strategy increased as the problems were presented more often.

Although this outcome was expected, as mentioned above, it can be explained by two different mechanisms: Either the initial decision to retrieve is based on a preliminary FOK that is triggered by familiarity with the problem (i.e., cue familiarity) or the decision to retrieve was based on a quick retrieval of the actual answer. To distinguish between these competing hypotheses, Reder and Ritter (1992) incorporated an innovative twist to the method. In particular, the final exposure of some problems was altered. For instance,  $32 + 14 = ?$  may have been presented 8 times during the initial trials. On its final trial, however, the operator was switched, so that instead of presenting it as an addition problem, the participants would see  $32 \times 14 = ?$  Such “switched operator” problems were entirely new—participants had never seen them before, so they did not know (and could not retrieve) the correct answer. Thus, if participants were making decisions based on an initial retrieval of an answer, because the answer was not known, they should choose to calculate the answer. In contrast, if participants were basing their decision on the overall familiarity of the cue, they might actually choose to retrieve the answer, because in fact the problem would look familiar. As shown in Figure 4.5, participants were more likely to choose to retrieve the answers to these switched-operator problems because the initial problem (e.g.,  $32 + 14 = ?$ ) had been presented more often before the switch. These outcomes provide strong evidence that the preliminary FOK that drives strategy choice is based on cue familiarity and not on access to the actual responses (for a review, see Miner & Reder, 1994).

## Termination of Retrieval

Do your best to answer the following questions, which pertain to information from the History chapter. “Who was the scientist that popularized the term ‘metacognition’ in psychological research?” “Who was the famous orator from antiquity who is given credit for developing the method of loci?” In both these cases, you may have failed to remember the correct answer, but in doing so, you may have also taken a lot of time trying to recall “Flavell” and very little time trying to recall “Simonides.”

What is responsible for how long someone searches for an answer that he or she cannot retrieve? One answer to this question, of course, is that one’s feeling of knowing for the correct answer is used to make decisions about how long to persist while trying to retrieve an answer. To illustrate, consider this intuitive rationale. For some questions, you may immediately be sure that you do not know the answer. For instance, I might ask you, “What is Britney Spears’ telephone number?” Because it’s implausible that you’ve ever

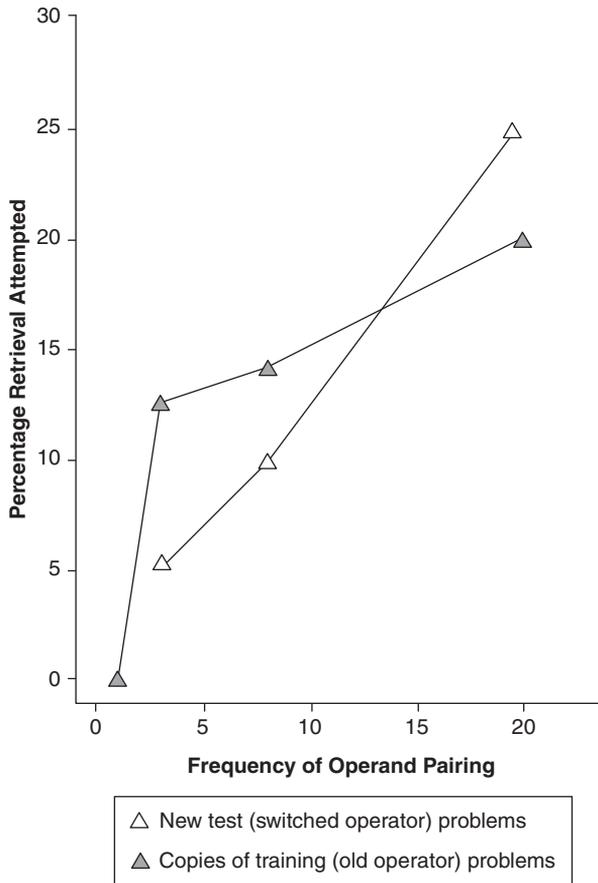


**Figure 4.4** Illustration of a single trial of the game-show paradigm used by Reder and Ritter. Note that participants received more time to calculate if it was a multiplication problem than if it was an addition problem.

SOURCE: Procedure from Reder, L. M., and Ritter, F. E. (1992). What determines initial feeling of knowing? Familiarity with question terms, not with the answer. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 435–451.

NOTE: s = second; ms = millisecond.

known her telephone number, you’d probably quickly say, “I don’t know,” without even searching your memory for the answer (Kolers & Palef, 1976). Thus, an immediate feeling of “not knowing” can lead to a quick termination of search. In contrast, if you were asked, “Who wrote *The Lord of the Rings*?” even if you can’t recall the answer immediately, you may feel you know it, if you’ve read the trilogy or seen the movies based on them.



**Figure 4.5** Percentage of trials in which participants attempted to retrieve an answer as a function of the frequency with which the problem was presented across trials.

SOURCE: Reder, L. M., and Ritter, F. E. (1992). What determines initial feeling of knowing? Familiarity with question terms, not with the answer. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 435–451.

Based on this example, we would then expect to find a positive relationship between FOK and the duration of search, with higher FOKs leading to more time being used to dig up an answer from memory. Although the relationship between FOK and search duration has not received a great deal of

attention in the field, the current evidence is consistent with the hypothesis that FOK affects how much time people use to search memory (e.g., Nelson et al., 1984; Reder, 1987). For instance, Nelson et al. (1984) used the RJR method in which participants first answered general information questions until they failed to answer 21 questions (Experiment 1) or 12 questions (Experiment 2). The latency of responding “I don’t know” was recorded, which was the measure of how long participants persisted in searching for an answer before they gave up. They then made FOK judgments for these questions; afterwards, a criterion test was administered (e.g., multiple-choice recognition). In both experiments, Nelson et al. (1984) correlated the latency of incorrect recall, that is, how long it took for participants to say, “I don’t know,” with a variety of other measures, such as criterion test performance and FOK judgments. An impressive outcome was that latency of recall was not related to objective measures of memory, such as performance on the criterion tests. In contrast, in both experiments, the mean across individual participants’ correlation between recall latency and FOK judgments exceeded  $+0.35$ . Thus, as concluded by Nelson et al. (1984), these findings “suggest that the amount of time that people search for nonrecalled answers is determined not by what they know but rather by what they feel that they know” (p. 292).

## Summary

Since Hart’s (1965) seminal work on FOK judgments, researchers have sought to answer a variety of core questions about people’s FOK experiences, including “Why do FOK judgments typically show above-chance relative accuracy?” and “What is the functional role of FOK in controlling human thought and action?” Concerning the first question, the original direct-access account proposed by Hart is no longer viewed as viable—people are not able to directly access the strength of items in memory. Instead, people appear to infer whether a nonrecallable memory is actually available in memory by using a variety of heuristics, such as cue familiarity or accessibility. As you’ll find in the following chapters, such heuristic-based accounts are prevalent and have been successful at explaining both the accuracy and biases of other metamemory judgments.

Feeling-of-knowing judgments also appear to play a functional role in guiding people’s strategy selection and retrieval. Concerning the former, a prominent view is that when people are presented with a problem to solve,

a rapid feeling of knowing based on familiarity with the problem drives a decision about whether to retrieve the solution from memory or to compute the solution. Concerning retrieval, people appear to persist longer in attempting to retrieve a sought-after memory that does not immediately come to mind. At the extreme, when people are faced with a memory on the tip of the tongue, they may spend quite a bit of time searching memory and even resort to using external aids—for example, the Web or friends—to get relief from this frustrating experience.

### DISCUSSION QUESTIONS

1. You find yourself with a friend in Hollywood, exploring some places where you think celebrities may be hanging out. After some deliberate searching with no luck, your friend tugs your shirtsleeve and quietly points across the way to a good-looking man in his 40s, who appears to be wearing an expensive outfit. She whispers, "I'm sure that guy over there is in the movies, but his name slips me. Do you know it?" In this scenario, describe all the metacognitive experiences (both monitoring and control) that your friend is having. Assuming that the gentleman in question is not a celebrity, why might she be having a strong feeling of knowing for his name?
2. Imagine a person who has a normal memory—this person's object-level memories are intact. Now imagine that this person also has no metacognitive experiences relevant to feeling of knowing. So, when she can't recall something, she never has any other experience than not being able to remember. How would this lack of metacognitive awareness influence her interactions with other people? Would she be great at games like *Trivial Pursuit* or *Jeopardy*? Why or why not? Even though her memory system is normal, would she appear to have normal memory? Do you think it would be more frustrating for her not to have an occasional TOT state than to have them like other people?

### CONCEPT REVIEW

For the following questions and exercises, we recommend you write down the answers on a separate sheet in as much detail as possible, and then check them against the relevant material in the chapter.

1. Describe how scientists collect FOK judgments and how relative FOK accuracy is computed.
2. Describe evidence that indicates FOK judgments are based on (a) cue familiarity and (b) target accessibility.

3. Which brain areas do scientists believe are responsible for FOK experiences? Are these separate from those areas that serve memory itself?
4. What are tip-of-the-tongue experiences and how do they arise? Name two strategies to remember something that is currently on the tip of your tongue.
5. Describe the functions of FOKs.