CHAPTER TWO

Digging into Déjà Vu: Recent Research on Possible Mechanisms

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Contents

Abstract

The déjà vu experience has piqued the interest of philosophers and physicians for over 150 years, and has recently begun to connect to research on fundamental cognitive mechanisms. Following a brief description of the nature of this

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recognition anomaly, this chapter summarizes findings from several laboratories that are related to this memory phenomenon. In our labs, we have found support for three possible mechanisms that could trigger déjà vu. The first is split perception, which posits that a déjà vu is caused by a brief glance at an object or scene just prior to a fully aware look. Thus, the perception is split into two parts and appears to be eerily duplicated. A second mechanism is implicit memory, whereby a prior setting actually has been experienced before by the person but stored in such an indistinct manner that only the sense of familiarity is resurrected. Another example of an implicit memory effect involves a single part of a larger scene that is familiar but not identified as such, with the result that the strong sense of familiarity associated with this portion inappropriately bleeds over onto the entire scene. Others have found support for gestalt familiarity, that the framework of the present setting closely resembles something experienced before in outline but not in specifics. We also present physiological evidence from brain and cognitive dysfunctions that relate to our understanding of déjà vu. Finally, some important but unresolved issues in déjà vu research are noted, ones that should guide future research on the topic.

1. Introduction

> We have all some experience of a feeling that comes over us occasionally of what we are saying or doing having been done in a remote time—of our having been surrounded dim ages ago by the same faces, objects, and circumstances—of our knowing perfectly well what will be said next, as if we suddenly remembered it.
>
> *David Copperfield*, Charles Dickens (1849, p. 630)

Perhaps the most exciting insights into the nature of cognitive function happen when normal processes break down. Roediger (1996) notes that the field of perceptual psychology embraced, early on, the study of illusions as a conduit to better understand normal perceptual processes. Yet memory researchers have not been as enthusiastic about such an approach, perhaps because memory dysfunction (compared to perceptual dysfunction) is more closely associated with global mental and physical pathology (cf. Brown, 2004). While a few memory illusions have been extensively investigated, such as false recall (Roediger & McDermott, 1995) and conjunction errors (Jones & Atchley, 2006), déjà vu is perhaps the most interesting and dramatic of memory illusions because it involves a clash of two rational and routine cognitive evaluations—familiarity versus unfamiliarity. During déjà vu, one feels that a setting or event is strongly familiar, yet rationally "knows" that it is not.

Stepping back into the realm perceptual psychology, there are two different classes of illusions—those that *are not* attention grabbing (Müller-Lyer) and those that *are* (wagon wheel). With the Müller-Lyer illusion, one simply perceives the arrow-head capped line to be shorter than the one with the arrow heads, without surprise or awareness of one's error. In contrast, in the wagon wheel illusion, the spokes of the stagecoach appear to be turning backwards as in the old cowboy movie, jolting our awareness. We know that the wheels are not really turning in reverse direction, and that the movie frames are simply out of sync with the wheel spokes. Turning back to the realm of memory, there are also two categories of illusions: those that we are aware of, and those that we are not. When we fail to recognize an old friend in a crowd as they walk past us, we are unaware of it and it does not capture our attention. On the other hand, when we fly to Key West for the first time and our rented vacation condo feels strikingly familiar, we experience a realm of uncomfortable mental incongruity that grabs hold of us and elicits a déjà vu.

The literature on the déjà vu experience is extensive, going back 150 years (cf. Brown, 2004). Most early reports involve personal reflections in the form of literary descriptions and personal anecdotes. A few attempted to document a connection between the déjà vu and various medical (epilepsy) and psychological (schizophrenia) dysfunctions, but the application of scientific scrutiny to déjà vu has been slow to evolve. This sluggish involvement of systematic empirical investigation is perhaps a result of déjà vu's unfortunate association with things mysterious and unempirical, such as reincarnation and extra sensory perception (cf. Funkhouser, 1983). Another factor impeding research progress may be the rarity of the experience, typically occurring only once or twice a year even with those most prone (young adults) (Brown, 2003).

But perhaps the most important hindrance to research on déjà vu is the lack of a clear eliciting stimulus. In culling through personal descriptions, it is nearly impossible to find a clear or consistent trigger for déjà vu. Nearly all published descriptions focus on the nature of the cognitive disruption *or* one's personal reaction *or* what one feels during the experience. The quote by Dickens at the start of this chapter is typical of published descriptions. Thus, it is a serious challenge to identify stimuli that could reliably elicit a déjà vu in the lab.

Later in this chapter, we will describe ways in which current research has attempted to scientifically evaluate this phenomenon. Rather than attempting to recreate a full-blown déjà vu experience, most research approaches this topic indirectly: how can we *increase the probability* of a false positive familiarity illusion? Simply put, déjà vu is a recognition failure—an involuntary false alarm. Under normal circumstances, we experience familiarity for objects and situations that we have encountered before, and unfamiliarity for those that we have not. With déjà vu, we have a sense of

strong positive familiarity for items that we know to be novel: ''any subjectively inappropriate impression of familiarity of a present experience with an undefined past'' (Neppe, 1983, p. 3).

Given the rarity of déjà vu, most information has been gathered retrospectively through surveys. Such data reveal that déjà vu is experienced by two-thirds (67%) of respondents, with the incidence highest among those in their late teens and 20s, and dropping off steadily with increasing age (Brown, 2003, 2004). Among experients—those who report ever having the experience—it is reported much less frequently as one ages. The experience happens more often among more educated, more liberal (politically/religiously), and more traveled individuals, and is unrelated to gender or race. Déjà vu is typically associated with an entire setting, rather than with specifiable elements (objects, people, or sounds). It also accompanies the preseizure aura in a small percentage of temporal lobe epileptics. Apart from specific temporal lobe pathology (seizure; tumor), déjà vu has not been clearly connected with any physical or psychological pathology.

The vague nature of the experience provides a fertile ground for theoretical speculation, with few clear constraints. Over 50 explanations have been proposed, the most viable of which are subsumed under three different categories: perceptual, memory, and physiological (cf. Brown, 2004). All can connect to theories and findings that have emerged in research on cognition and neuroscience. In fact, we are at a propitious point in the evolution of our research designs/tools, where we can begin to conduct more precise tests of such theoretical speculation. This chapter is intended primarily to summarize research findings on déjà vu published since previous summaries (Brown, 2003, 2004) and to give a sense of where the field is heading.

2. Perceptual Explanation

Usually referred to as perceptual gap or split perception, a déjà vu may occur when a person processes the present sensory input twice, in rapid succession. The first input experience is brief, degraded, occluded, and/or while distracted. The second perception, immediately following, then seems strangely familiar because it connects to the immediately prior input (unbeknownst to us). As with each category of explanation, many variations exist that can be traced back over a century (Angell, 1908). This particular explanation is exceptional because it received formal attention by a pioneer of modern cognitive science:

> . . . you are about to cross a crowded street, and you take a hasty glance in both directions to make sure of a safe passage. Now your eye is caught, for a moment, by the contents of a shop window; and you pause, though only for a moment, to survey the window before you actually cross the street. . .the preliminary glance up and down, that ordinarily connects with the crossing in a single attentive experience, is disjointed from the crossing; the look at the window, casual as it was, has been able to disrupt the associative tendencies. As you cross, then, you think ''Why, I crossed this street just now''; your nervous system has severed two phases of a single experience, both of which are familiar, and the latter of which appears accordingly as a repetition of the earlier.
>
> (Titchener, 1928, pp. 187–188)

2.1. Jacoby and Whitehouse (1989)

Titchener's quote was a focal point for the first scientifically rigorous test of a possible mechanism underlying déjà vu. Jacoby and Whitehouse (1989) modeled Titchener's ''hasty glance'' through a brief visual exposure in a controlled laboratory setting. If this explanation is true, then a subthreshold glance at a word should create a heightened sense of familiarity for it when it is viewed in full, moments later. Jacoby and Whitehouse's design involved two stages: first, an input list of words; second, an old/new recognition test. The recognition test was one word at a time. Each test word was preceded by a briefly flashed stimulus consisting of (a) the word itself (identical), (b) a word different from the test word (different), or (c) no word (none). The key finding was that when the prior glance involved the test word itself (*identical*), this increased the likelihood of misidentifying this *new* word as having occurred on the prior list—relative to new words in the *different* or *none* prime conditions. This finding was replicated both within the Jacoby and Whitehouse article, and in subsequent research (Bernstein & Welch, 1991; Gellatly, Banton, & Woods, 1995; Joordens & Merikle, 1992; Klinger, 2001). This demonstration of a false positive familiarity illusion captured the imagination of many, as reflected in a phenomenal number of subsequent articles (over 200) that have cited the Jacoby and Whitehouse study.

This captured our attention as well. Rather than forcing subjects to stay mentally within the confines of a laboratory in making familiarity assessments, we wanted to know whether a false positive familiarity illusion could be pushed much further back into one's personal past, prior to the lab (Brown & Marsh, 2009). If so, this could move a step closer to modeling actual déjà vu experiences. Thus, our goal was to capture some sense of the amorphous temporal quality that typifies déjà vu—''this experience has happened sometime before in my life, but I don't know exactly when.'' Brown, Porter, and Nix (1994) confirmed that subjects have

difficulty identifying just when the prior experience supposedly happened: survey respondents were evenly distributed on whether the illusory prior encounter happened days, weeks, months, or years ago.

2.2. Split Perception: Study 1

We attempted to increase the verisimilitude of Jacoby and Whitehouse's design via two experimental design changes (Brown & Marsh, 2009). First, we eliminated the input list and used only a test list. This alteration would, we hoped, force our subjects to attribute any sense of enhanced familiarity to experiences prior to the current lab session: "have you had a pre-experimental encounter with this symbol?" The second issue involved stimulus materials. Asking about a pre-experimental encounter rules out the use of words, because practically all words have been seen prior to the experiment. Instead, we gathered a collection of relatively unfamiliar line drawings, and cataloged how unfamiliar such symbols were by using a pilot group of subjects to rate these 300 black and white line drawing figures. Based upon these ratings, we sorted symbols into three sets: novel, low familiarity, and high familiarity. A sample of each type is shown in Figure 1.

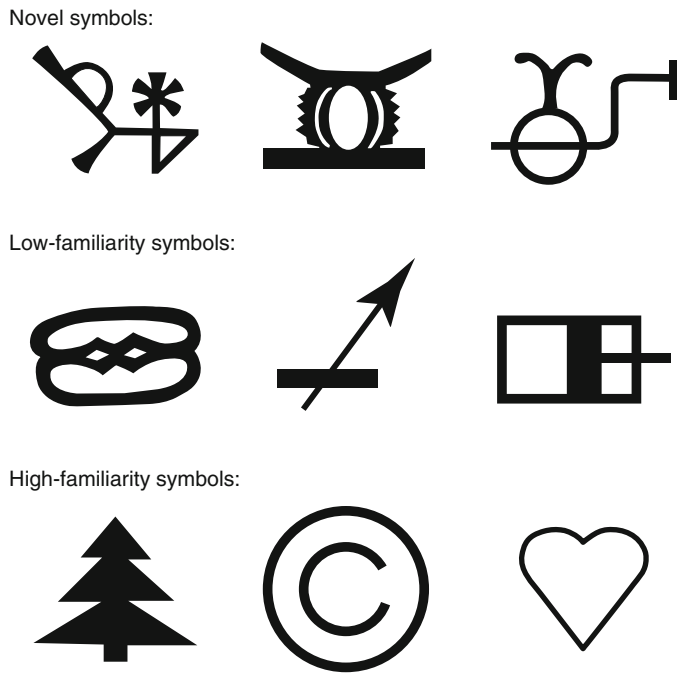

Figure 1 Novel, low-familiarity, and high-familiarity symbols from Brown and Marsh (2009).

To recap, we followed the Jacoby and Whitehouse (1989) procedure of preceding each figure with a brief flash of (a) the same stimulus (identical), (b) a different stimulus (different), or (c) nothing (none). As is obvious from the examples in Figure 1, we expected that high-familiarity stimuli (e.g., a heart) would have been seen prior to the study, but included them so that all subjects could respond "yes" on some trials. However, we were uninterested in analyzing these high-familiarity stimuli because their ratings should be at a ceiling, limiting the possibility of increasing judged familiarity.

Our primary finding replicated Jacoby and Whitehouse (1989): a brief glance at a figure just before judging its familiarity significantly increased a sense that it had been seen before. For *novel* figures, subjects were five times more likely to claim a pre-experimental encounter in the identical prime condition (15% rated as seen before) than in either the different (3%) or no prime (3%) conditions. The same significant effect also occurred with *low-familiarity* stimuli: an identical prime roughly doubled the probability of claiming a prestudy encounter (28%), compared to different (16%) or no prime (13%) conditions. Thus, we successfully created an illusion of a previous experience, by simply flashing the stimulus briefly ahead of itself. This again confirmed Jacoby and Whitehouse's finding that a "new" stimulus word (or symbol) can be misattributed as having been seen before. However, we showed that this effect can be induced for stimuli that the subject probably has never seen before (novel symbols), and demonstrated that this misattribution can extend to a time frame and place outside the laboratory.

Our intent was to test the split perception theory of déjà vu by pushing familiarity around, and we did not anticipate that our manipulation would be powerful enough to produce a full-blown déjà vu experience. Checking on this item by item would have been ill-advised from several perspectives. Not only would it have considerably slowed the procedure, we were concerned that it would create an expectation bias. But just to check on the possibility, we asked subjects after the procedure was over whether they had experienced a déjà vu at some point during the study. Surprisingly, 50% said that they had. There was no way to confirm that these experiences happened on an identical prime trial, rather than different or none prime trial. However, given that most of these same subjects (71%) reported that déjà vu occurred less frequently than once a month, this finding was intriguing.

2.3. Split Perception: Study 2

We conducted several follow-up investigations to Brown and Marsh (2009) that required a more complex evaluation of familiarity. Requiring that subjects assign any sense of increased familiarity *only* to pre-experimental

encounters may have been less sensitive to subtle changes in familiarity that might have occurred. What if the familiarity enhancement was modest and insufficiently intense for subjects to consider it as emanating from a prestudy exposure?

In the first follow-up, we used the same design as Brown and Marsh (2009), except that subjects rated symbols on a more general familiarity scale of "have you ever encountered this design before?" (1 = definitely no; 6 = definitely yes). Congruent with our published report, a brief exposure significantly increased familiarity ratings for both novel and low-familiarity symbols. For *novel* figures, mean familiarity for both the different (1.8) and none (2.1) prime conditions was significantly lower than that for identical prime (4.3). As in Study 1, this effect replicated with *low-familiarity* symbols. Compared to the different (2.5) or none (2.7) prime conditions, a brief exposure to itself (identical prime) significantly increased rated familiarity (4.8).

To gather more detail on the familiarity attribution, on each trial where a symbol was rated as familiar (ratings 4, 5, and 6), subjects also assessed the familiarity *source*: (1) prior exposure during the study, (2) prestudy encounter, or (3) unsure. In the identical prime condition, subjects attributed their sense of familiarity most often to in-study exposure (81%) rather than to prestudy (13%) or unsure (6%). For the different and no prime conditions, the positive familiarity attributions were more evenly distributed between in-study (43%) and prestudy (41%), with a few unsure (16%) responses.

This finding suggests that the familiarity enhancement generated by a quick glance will be primarily attributed to a recent within-experiment experience, if subjects are given this option. Thus, our published report may actually underestimate the impact of our manipulation. If one feels a strong feeling of already seeing this particular symbol, the predominant attribution may be to a recent exposure, earlier in the series of just-rated symbols. Perhaps subjects in Brown and Marsh (2009) were inclined to attribute the identity prime familiarity boost to a recent encounter—within the study—and thus less likely to attribute it to a prelab encounter. Such speculation aside, the most important finding in Study 2 is a replication of familiarity enhancement found in Study 1. Interestingly, a postexperiment inquiry again revealed that about half (46%) of the subjects experienced déjà vu during the procedure.

2.4. Split Perception: Study 3

In Study 2, both the prime and the target symbol were presented foveally, in the center of the computer screen. We wondered whether the effect would change if the prime symbol was processed off to one side, in the parafoveal area. One explanation of déjà vu is that it results from an initial peripheral perception of one object while focusing on something

else near it. You drive to a restaurant for the first time, and while you approach the front door an unusual flowering plant beside the entrance captures your attention. When you then look directly at the distinctive doorway, you are struck by an unsettling feeling of familiarity. It is possible that the visual information (doorway) was briefly preprocessed in the foveal area while you were looking at the plant, and when this impression matched the subsequent fully processed view, a déjà vu resulted.

> . . . it is very common for people to be in situations where there are many unattended stimuli outside their immediate focus of attention that are not consciously experienced. . .For this reason, the experimental conditions in studies in which unattended stimuli are presented at spatial locations removed from the current focus of attention more closely resemble the conditions under which visual stimuli are perceived in everyday situations. . . .
>
> (Merikle, Smilek, & Eastwood, 2001, p. 122)

Research on inattentional blindness provides credence to the potency of unattended, parafoveal stimuli (Mack, 2003; Mack & Rock, 1998). Participants perform a fairly simple visual task, such as judging which of the two arms of a briefly presented cross (vertical; horizontal) is longer. The procedure extends for many trials, and on a few of these trials another stimulus (a symbol, word, or letter) accompanies the cross, off to one side. Surprisingly, most participants fail to report seeing the additional item, although they show priming for this stimulus on a subsequent indirect memory test, indicating that it was processed without their awareness.

To evaluate the peripheral priming possibility for déjà vu, Study 3 modified the design used in Study 2. Rather than the identical or different symbol appearing in the same foveal location as the subsequently rated symbol, it appeared offset toward one of the four corners of the computer screen. The outcome essentially replicated Study 2. For *novel* symbols, the identical prime boosted the rated familiarity substantially (4.1) over the different (2.0) and none (1.8) prime conditions. For the *low-familiarity* symbols, identity prime symbols were again rated much more familiar (4.5) than those in either the different (2.4) or none (2.4) conditions.

Taken together, this series of studies supports the possibility that a perceptual double-take (i.e., a superficial glance followed by a close look) can elicit an exaggerated sense of familiarity for a stimulus. This enhancement is repeatedly shown to occur for both novel and low-familiarity symbols across three different studies. This boost in assessed familiarity was found with both an ambiguous (during vs. before experiment) source rating (Study 2 and 3), as well as a pre-experiment source rating (Study 1; Brown & Marsh, 2009), with the latter finding more directly supporting the concept of déjà vu.

2.5. Superficial Glance = Shallow Processing?

Given that the split perception explanation seems viable, what mechanism(s) might underlie this? In other words, what forces a subjective temporal separation between these two adjacent perceptual experiences? One possibility is that the initial glance involves shallow processing, where only superficial physical attributes are extracted from the stimulus. And perhaps stimuli that are processed in a shallow manner seem older to us, when contrasted to deeply processed stimuli.

We tested this by presenting a list of words, some of which were processed deeply (can you carry this?) and others shallowly (does it have an "e"?). After a short distractor task, subjects identified whether each word had appeared in the 1st, 2nd, or 3rd third of the input list. There was a general bias to guess "middle third" for both shallow and deep words, probably reflecting a middle-of-the-road response default when unsure. However, there was a clear difference between deep and shallow items on whether subjects believed that they had been presented in the first-third or last-third of the list (Figure 2).

Overall, 34% of deeply processed words were judged as more proximal (end of list; last 3rd), compared to 21% of shallow words. In contrast, distal (beginning of list; first 3rd) judgments related to level of processing in the opposite manner: 24% of deeply processed words seemed to have occurred *earlier* in the list (first 3rd) compared to 37% of the shallowly processed words. Remarkably, this bias remained consistent across items actually appearing in

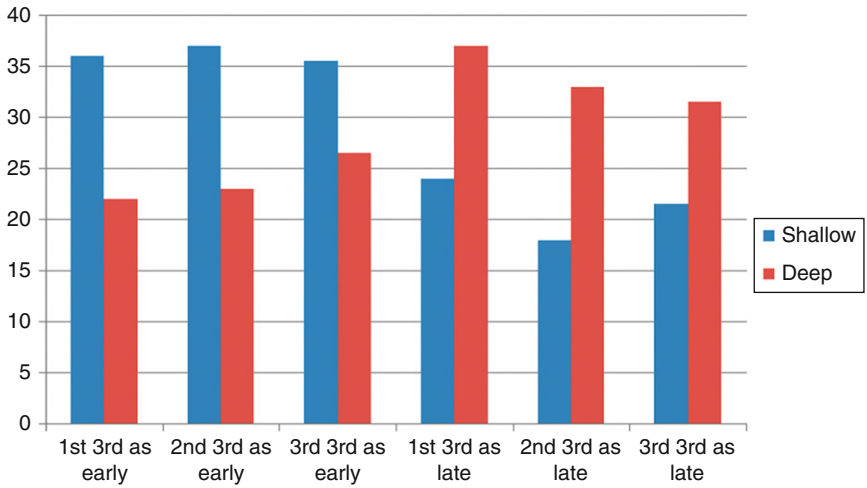

Figure 2 Mean percentage of items in each list third judged as early (appearing in first third) or late (appearing in last third), for shallowly and deeply processed words.

the 1st, 2nd, and 3rd thirds of the list. This outcome can potentially clarify why the split perception experience leads to a sense of déjà vu. The initial, shallowly processed impression gets temporally pushed back (older), while the subsequent deep look gets pulled forward (recent). This contrast in the moment, with two impressions duplicated in immediate succession drifting in opposing temporal directions, may exaggerate the actual time separation which then leads to a sense of déjà vu.

3. Implicit Memory Explanation

There are a number of different versions of the implicit memory interpretation of déjà vu. All are grounded in the assumption that a déjà vu occurs because some aspect of the current situation has actually been experienced before. When the present stimuli hook into previously stored memories which are lacking temporal or contextual tags to assist in the conscious identification of the source of "oldness," a sense of familiarity that is aroused cannot be explicitly identified. Several lines of research tie into this general explanation.

3.1. Episodic Experience

One of the most reasonable and straight-forward interpretations for déjà vu is that a person *actually has experienced* this situation or setting before, but has simply forgotten it. Given the enormous amount of information that we process, it seems likely that there are stored memories of many different types of outdoor scenes, palaces, verbal phrases, plot themes, social situations, hotel lobbies, and melodies, many of which may have lost their explicit memory tag. When a current stimulus connects with one of the episodically disconnected and orphaned memories, this unbeknownst resurrection of the stored representation could yield a vague and unsettling sense of prior experience. Because the objective data that we sort through in the moment are insufficient to support this familiarity, we interpret it as a discomfiting memory illusion.

A marvelous commercial by Hotels.com (Deja View) (http://www.elsevierdirect.com/companions/9780123809063/Supplemental/material/1) illustrates this scenario. A couple enters a hotel room, and against a background of spooky music, the moderately distressed man says "I've been in this room before!" His nonchalant woman partner replies "What?" to which he emphatically repeats "I've been *here* before!" The woman quickly solves his quandary by reminding him that "You took the virtual tour on Hotels.com." While this serves as a great relief to the man, it illustrates how

readily such information may become planted in our experiential memory at a shallow level, and then subsequently connected with the real situation that is playing out in front of us, causing momentary memorial distress.

3.1.1. Episodic Experience: Study 1

To model this possibility in the lab, we used our captive audience of undergraduate students to create a plausible memory dilemma (Brown & Marsh, 2008). Most college students visit numerous college campuses prior to their final selection, and we used this fact to help evoke a false sense of prior experience. Students signed up for a two-stage study. During the first, they saw a variety of different scenes: mountain ranges, courtyards, campus buildings, serene lakes, etc. Embedded in each was a small cross, and their task was to identify which quadrant of the picture this cross was located in. We pushed them along at a good clip, so that they would process the pictures in a relatively superficial manner. Mixed in among these pictures were some campus shots from a university that they were *not* attending. We did verify, postexperimentally, that the "other" campus had not been visited and excluded the handful of Duke students who had actually visited SMU, and those SMU students who had toured Duke.

Our main objective was to plant unfamiliar campus images in the students' memories, in a way that could subsequently evoke a false impression of an actual prior visit. To model déjà vu, it was important to ask not simply if the scene was *familiar*, but if the student had actually *been to* the location depicted in the photo. Both mundane and unique scenes from both campuses were included, because anecdotal reports suggest that déjà vu can occur in both ordinary circumstances (hanging out with friends, relaxing, watching TV) as well as unusual settings (Brown, 2004). This difference is illustrated by these two open-ended survey responses:

> I was sitting in this guy's apartment talking about something and I got little flashes like I had been there talking about the same thing and I know it never happened before.
>
> I was going to a rock concert in downtown Fort Worth. When we got to the parking lot, I looked up and noticed all the buildings around me. At that moment, I felt as if I had experienced that exact same scene before, although I had never been to downtown Fort Worth.

Examples of these unique (chapel; famous monument) and mundane (dorms; academic classrooms) campus settings are shown in Figure 3. Presentation frequency (once or twice) was varied during the initial cross-detection phase. This manipulation did not have a theoretical underpinning, but was included to see if memory strength might influence false visit attributions.

After completing the rapid cross-detection task, subjects returned one week later for session 2, during which they viewed scenes from their home campus and the unfamiliar campus. Home-campus shots did not appear in

Figure 3 Examples of unique and mundane campus locations used in Brown and Marsh (2008).

session 1, but were added at session 2 to assure that each subject could respond that they had actually visited some of the locations. Each photo was shown briefly (half a second) to limit analytical processing, and subjects were instructed to respond quickly based on first impression. After each photo was presented and removed, subjects evaluated whether they had actually been at that particular location using a four-point scale: no, might, probably, definitely.

Visit ratings for the critical (away) campus shots were significantly higher for those exposed before, in session 1, compared to those that had not. However, there was no difference between scenes viewed once versus twice in session 1. As expected, mundane shots were given higher visitation ratings than unique shots, because there were fewer clues available to discount a possible visit. But the boost in visit ratings from prior exposure was consistent across unique and mundane scenes.

3.1.2. Episodic Experience: Study 2

These results were essentially replicated in a second study (Brown & Marsh, 2008, Experiment 2). Presentation frequency was again manipulated (one or two exposures in session 1), in addition to retention interval between

sessions 1 and 2: one versus three weeks. Prior exposure in session 1 again boosted subsequent personal visit assessments, and presentation frequency and retention interval had no effect on the degree of this enhancement.

Similar to the split perception studies described earlier in this chapter (Sections 2.2–2.4) (Brown & Marsh, 2009), a postprocedural interview revealed that nearly half of the subjects admitted having a déjà vu sometime *during* the procedure: 46% in Experiment 1; 49% in Experiment 2. As explained earlier, we cannot determine which specific item(s) elicited déjà vu, as this would require an item by item query during the procedure. However, their general responses provide encouragement that this paradigm may model real-life déjà vu experiences. More specifically, déjà vu could occur when the present scene or setting duplicates one experienced before in the form of a magazine, movie, PowerPoint presentation, website, or newspaper.

3.2. Single-Element Familiarity Explanation

In the above experiments with campus scenes, we explored the possibility that déjà vu could stem from having seen an *entire scene* before. But another implicit-memory possibility is that déjà vu could be triggered when a small part of a scene is familiar. Imagine walking into a friend's living room for the first time and being struck by a feeling of eerie familiarity. It is only later that you realize this familiarity stems from a lamp on her end table that is identical to one in the basement recreation room of your best friend during high school. The source of this intense familiarity—triggered by that single element—is not immediately identified and over-generalizes to the entire scene. Consider another, related example: you walk across campus when two people approach you, talking with each other. You for sure recognize the person on the left, but then feel like you must know person with them but cannot figure out from where. Does your familiarity for person A affect your sense of familiarity for person B? Both of these examples involve the possible spill-over familiarity from one element, whether it affects the familiarity of an entire scene (example 1) or another element (example 2).

3.2.1. Single-Element Familiarity: Study 1

We began with a laboratory investigation of the second example by asking whether the familiarity of one single element can "bleed over" and influence the familiarity evaluation of a second item (Brown & Marsh, 2007; Marsh & Brown, 2010)? Would low-familiarity symbols, selected from our symbol pool from the split-perception studies (Brown & Marsh, 2009) increase or decrease in rated familiarity, depending on the familiarity level of the symbol that was shown with them? More specifically, could we bias subjects to give a higher rating if a high-familiarity symbol accompanied the target, and would subjects reduce a target symbol's rated familiarity

if accompanied by a novel symbol? Two factors were manipulated: how long the target appeared on the screen (100 vs. 1000 ms), and whether the target appeared (a) alone, (b) with a novel symbol, or (c) with a high-familiarity symbol.

The procedure for the first experiment is summarized in Figure 4. Subjects were told "your job is to decide how familiar the target symbol is. In other words, you are to judge how well you are acquainted with the target symbol in everyday life." On both two-symbol and one-symbol trials, the judgment was made *after* the symbol(s) disappeared and a question mark appeared in the location of the to-be-rated symbol. In sum, a ready prompt was followed the symbol(s), which were then briefly masked and replaced by a question mark indicating the target symbol.

On the scale of 0 (very unfamiliar) to 5 (very familiar), mean performance on filler trials indicated that subjects were using the scale properly: novel = 0.80; high familiarity = 4.23. More importantly, test context mattered. Mean judged familiarity for a low-familiarity symbol was *lower* when accompanied by a novel (1.55) compared to a high-familiarity (2.10) symbol, and intermediate when presented alone (1.81). This effect did not depend upon symbol presentation time.

3.2.2. Single-Element Familiarity: Study 2

Study 1 required subjects to remember which symbol had been presented where. A question mark appeared in the location where the target had been, but the symbol itself was not in view for the judgment. Thus, subjects may have occasionally judged the wrong symbol because they had forgotten where it had been shown. To address this, the second experiment modified the procedure (see Figure 4): following a "ready" prompt, the symbol(s) appeared for 2 s

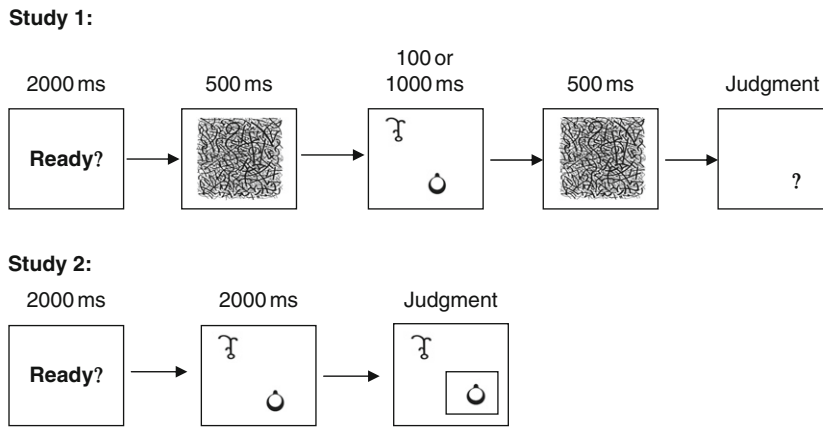

Figure 4 Experimental procedure used in single-element familiarity studies.

before a box appeared around the target. Replicating the first experiment, a low-familiarity symbol was judged to be more familiar (2.16) if paired with a high-familiarity symbol than if alone (1.97). However, the novel symbol no longer influenced familiarity judgments: the target (low-familiarity) symbol was equally familiar when tested alone (1.97) or with a novel symbol (2.00).

This outcome suggests that familiarity is easier to enhance than decrement, so in the remaining experiments in this series we focused on whether high-familiarity neighbors could pull target familiarity up. Our use of both more and less familiar neighbors in Study 1 was mainly for academic curiosity—to see if symmetrical effects exist. Déjà vu relates primarily to *increasing* familiarity through a familiar accompanying element. *Decrementing* familiarity ties in with jamais vu, a lesser known phenomenon which is related to déjà vu and described later in this chapter (Section 6.4). However, as in real life, our jamais vu model appears to be less reliable than déjà vu.

3.2.3. Single-Element Familiarity: Study 3

One simple, but reasonable, alternative explanation for the boost in familiarity rating described above is that familiarity increase when two symbols are shown on the screen compared to one (control condition), and not because of the presence of a high-familiarity neighbor. To address this, we compared the effects of a high-familiarity neighbor symbol with a low-familiarity neighbor. A low-familiarity symbol accompanied by another low-familiarity symbol received a similar familiarity rating (1.81) to when it appeared alone (1.82). In contrast, pairing a low- with a high-familiarity symbol ($M = 1.94$) increased its perceived familiarity. Thus the earlier effects were not simply due to seeing two symbols at one time. Rather, a more familiar neighboring symbol increases perceived familiarity of a less familiar target.

3.2.4. Single-Element Familiarity: Study 4

We also tested a perceptual explanation of the familiarity effect. Perhaps the high-familiarity symbol changed the interpretation of the target symbol. For example, does a random squiggly symbol look more like a nameable object when paired with a familiar handicap symbol? To test this, we changed our dependent measure from rating familiarity to identifying the meaning of the symbol. Participants were told that we were interested in their ability to identify symbols, and that some would be very easy to identify and for others they would have no idea of the meaning. They were warned against guessing, and instructed to type "I don't know" if they did not know the meaning of a symbol.

The same procedure was used, with only the evaluation measure changed. Following a "ready" prompt, the symbol(s) appeared for 2 s. Then, a text box appeared and subjects answered the question "What does the target drawing mean to you?" We scored the data in two ways. First, we computed the proportion of symbols that subjects could label,

regardless of the nature of the label. Second, in the pair condition, we examined whether the label given to a target symbol was related to the meaning of the accompanying high-familiarity symbol.

Overall, subjects were good at identifying the meaning of high-familiarity filler symbols, being correct 87% of the time. As expected, they were much less likely to ascribe meanings to low-familiarity targets, labeling just 33%. This also indicates that they followed the instruction not to guess or make up meanings. Critically, seeing meaning in low-familiarity target symbols was not influenced by pairing with a high-familiarity symbol. Subjects generated interpretations for 32% of alone targets and 33% of paired targets. Furthermore, when subjects did assign meaning to the target, it was rarely related to the high-familiarity neighbor (3%). These results suggest that the effects of the high-familiarity flanker were not due to influencing the interpretation of the target symbol.

In short, having memory for part of a scene—the high-familiarity symbol, in our paradigm—can influence one's feeling of familiarity for other elements of the scene. Less clear is how much this is under conscious control. If subjects are told not to let the familiarity of one object affect their judgment of another, can they avoid its influence? We are currently collecting these data, and our hunch is that subjects will be unable to control the influence of the familiar symbol, in the same way that people are unable to avoid attributing their emotions from one stimulus to another neutral one (Payne, Cheng, Govorun, & Stewart, 2005).

3.3. Gestalt Familiarity Explanation

In addition to seeing an entire scene before (episodic experience) or a piece of a scene (single-element familiarity), another type of implicit-memory explanation for the déjà vu experience is that the *general framework* of the current circumstance or setting resembles one experienced before. Assume that you are a college student making a trip to a new campus to see a high school buddy. During the drive through the main drag on campus, you are struck by an eerie sense of having been here before. What may be familiar is a general layout: a central quadrangle, surrounded by a white chapel on the left and a fountain in the middle and a two brick classroom buildings on the right. Although no specific feature is identical to one with which you are familiar, the general layout follows a well-etched mental template. As with other déjà vu interpretations, this one also reaches back over a century (Sander, 1874), and Dashiell (1937) includes a great street-scene visual illustration of how this could work (cf. Brown, 2004).

3.3.1. Familiarity without Identification Research

Cleary, Ryals, and Nomi (2009) designed a clever study to evaluate this gestalt model of déjà vu. But before describing this study, some background on Cleary's (2004, 2008) research would help. In her study of familiarity

based recognition, or *recognition without identification* (Cleary, 2008), a general sense of familiarity appears to guide recognition decisions, even when we do not have access to the specific prior experience which elicits this feeling. To illustrate this, if subjects first study a list of celebrity names, and then provide celebrity names to face cues, subjects can discriminate between the celebrity names which did, versus did not, appear in the initial name list, *even when they cannot produce the celebrity's name in phase two* (Cleary & Specker, 2007). It is as if the familiarity spread from the person's name to their face, so that it received implicit activation. This activation was sufficient to support the recognition that it was connected with a prior experience, but insufficient to facilitate name retrieval.

Recognition without identification also has been demonstrated with famous scenes. Similar to Cleary and Specker (2007), Cleary and Reyes (2009) had subjects first study names of famous landmarks and locations (Stonehenge, Taj Mahal), and then provide the names for pictures of such places. Among pictures that remained unnamed, subjects could discriminate those whose name had, versus had not, appeared on the prior list. This again illustrates that a sense of prior experience can be triggered by a face or edifice cue, even when the prior experience and specific studied name cannot be recalled.

3.3.2. Gestalt Familiarity Study

Cleary et al. (2009) constructed a direct test of the gestalt theory of déjà vu, using her recognition without identification paradigm. Black-and-white line drawing stimuli depicting various scenes were constructed in pairs, resembling each other in overall configuration. A sample configural pair in Figure 5 depict an arbor (left) and castle drawbridge (right).

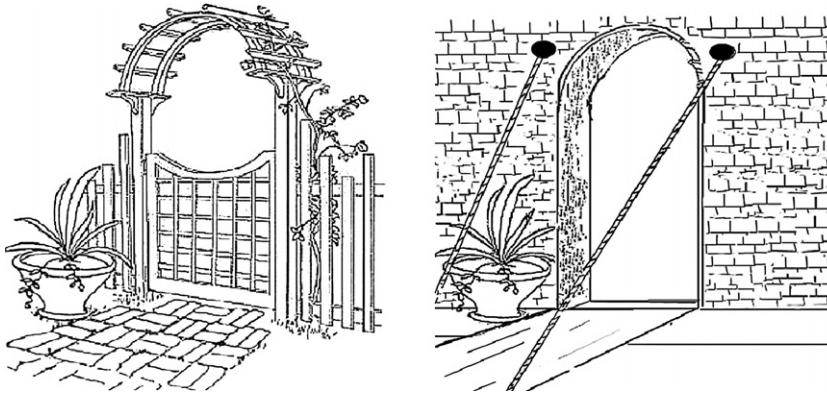

Figure 5 Configurally familiar scene pair from Cleary et al. (2009).

Subjects were asked to remember each study scene and the accompanying verbal description of it (arbor). At test, none of the original scenes were shown. Rather, half of the test scenes (castle drawbridge) configurally resembled one of the studied scenes and half did not. The configurally similar scene served as the memory cue, and subjects' attempt to identify (provide the label for) the input list picture that it resembled. As before, when subjects were unable to recall a corresponding input scene they still showed evidence of recognition without identification. Familiarity ratings were higher for tests scenes that resembled input scenes, compared to those that did not. After each familiarity decision, subjects were asked if they had experienced déjà vu, and these reports mirrored familiarity assessments: déjà vu occurred more often for test scenes resembling input scenes, compared to those with no resemblance. Given that these two ratings were always done in the same order—familiarity, then déjà vu—the familiarity rating may have biased the déjà vu rating. In Experiment 2a, Clear et al. (2009) had subjects report *only* déjà vu experiences (no familiarity rating). As before, déjà vu was more likely with configurally related test scenes, compared to unrelated ones.

Cleary et al. (2009) argue that their findings suggest that a single process underlies both déjà vu and familiarity. They base this speculation on two lines of evidence. First, configural resemblance produces similar effects for both déjà vu and familiarity. Second, a questionnaire study revealed that 79% of respondents define déjà vu as logical familiarity—re-experiencing something old that you know is old. Only 7% defined déjà vu as illogical familiarity—something new that feels old. This survey outcome should serve as a general caution about assuming that subjects doing déjà vu ratings actually understand the accurate or technical definition of the term.

3.4. Hypnosis

Banister and Zangwill (1941a, 1941b) attempted to elicit déjà vu experiences in the laboratory, to model the implicit memory explanation that déjà vu occurs because this particular experience has happened before but has been forgotten (Brown & Marsh, 2008). They presented pictures (Banister & Zangwill, 1941a) or odors (Banister & Zangwill, 1941b) to hypnotized subjects, followed by a posthypnotic suggestion to forget the encounter. One day later, in a normal waking state, subjects were tested about their recollection (and familiarity) for these same pictures or odors. While this approach holds promise, serious problems exist with this particular application (Brown, 2004). Recently, O'Connor, Barnier, and Cox (2008) conducted an investigation improving on this hypnosis design, using a unique puzzle task as the memory target. All subjects attempted to solve the puzzle while hypnotized. Some were given the posthypnotic suggestion to be amnesic about the puzzle, while others were told that the puzzle would later feel familiar. Later, during a nonhypnotized session, five of six

subjects in the familiarity group experienced a strong sense of déjà vu when encountering this puzzle, whereas none of six subjects in the amnesia group felt strong déjà vu.

This study raises the tantalizing possibility that the sense of déjà vu can be recreated in a laboratory setting with the right parameters and procedures (hypnotic suggestion). Cleary (2008; Cleary et al., 2009) has echoed O'Connor et al.'s (2008) optimism, suggesting that given how much familiarity without recollection resembles déjà vu, we may eventually be able to reliably elicit déjà vu using laboratory manipulations which are proven to successfully affect familiarity ratings.

4. Physiological Explanation

Turning to the third class of explanations, one of the earliest interpretations of déjà vu is that it reflects an alteration in the normal brain functions that utilize multiple pathways of information transmission. Osborn (1884) speculated that the sensory signals transmitted from the eyes to the occipital area separate and follow different tracks to the right and left hemispheres. This information then merges together at the occipital lobe to produce one unified perceptual impression. On occasion, the messages become slightly asynchronous, producing a sensation of déjà vu. The slight temporal delay in one track results in two visual impressions rather than one as they arrive successively (rather than together) at their destination. The trailing sensation seems to be a duplication of the first. These transmissions become slightly dysphasic due to a neurological event, such as a slight synaptic deficiency at some point on one of the two pathways. The brain misinterprets this slight separation as reflecting temporally distinct experiences, and the logical interpretation is that the present experience duplicates one from an earlier time and place (Brown, 2004).

4.1. Neural Transmission Asynchrony

Current technology allows an experimental test of this pathway asynchrony. Bogdan Kostic at Colorado State University used brief visual presentations of a common stimulus (words; faces), sent separately to both the right and left hemispheres. An asynchronous presentation of an identical image to both the right (left visual field) and left (right visual field) hemispheres, offset slightly (20 ms apart), should result in an enhanced sense of familiarity. Kostic did find partial support for such familiarity enhancement with presentation asynchrony, but the results were not straight-forward. A word presented in the right before the left visual field was judged to be significantly more familiar than

the reverse—left before right. Simultaneous presentation resulted in a familiarity rating intermediate between the two asynchronous conditions.

Kostic speculates that the right-first asynchrony enhances familiarity, relative to left-first, due to the left hemisphere advantage in language processing. If this explanation is true, then *nonverbal* stimuli should result in left-first familiarity enhancement, compared to a right-first presentation. Unfortunately, face stimuli did not result in a left-first advantage, with no familiarity rating difference between asynchronous and simultaneous presentation. These findings are very intriguing, but Kostic points out that the length of the delay between presentations that he used (20 ms) may be too long, and that endogenous delays in the nervous system that produce this outcome may be much shorter.

4.2. Surgical Elimination of Déjà Vu

The earliest scientific research on déjà vu was based on the assumption that it indicates brain pathology—seizure activity currently exists or is likely to develop. This speculation originated from the observation that some individuals with temporal lobe epilepsy (TLE) experience déjà vu in their preseizure aura (Brown, 2003, 2004), but the accumulated data do not support a stronger conclusion of brain pathology. Despite this erroneous early assumption, research on TLEs has continued to provide useful evidence about the nature of recognition processes involved with false familiarity.

Bowles, Crupi, Mirsattari, Pigott, Parrent, et al. (2007) describe a young woman who developed TLE in her preteen years, and her preseizure auras routinely included déjà vu. These seizures could not be managed by medication, and surgical correction was required. The surgery removed a brain tumor and surrounding tissue, which included the amygdala, entorhinal cortex, and perirhinal cortex. Both her seizures and déjà vu experiences were eliminated. But an interesting result of surgery is that her ability to assess familiarity was eliminated, while recollection was preserved. Using experimental tests involving list learning procedures with the remember/know task (Gardiner, Ramponi, & Richardson-Klavehn, 1998), the patient performed better than a control group on recollection (do you recall the item's presentation?) while showing a pathological absence of familiarity (does the item seem familiar?). This was confirmed across four cognitive tasks using a variety of different encoding and response manipulations. The clear implication of Bowles et al. (2007) is that déjà vu is associated with a separate cognitive system that governs familiarity, apart from brain structures involved with contextually guided recognition evaluations.

4.3. Surgical Elicitation of Déjà Vu

A second study dovetails nicely with Bowles et al. (2007). Prior to surgically removing tissue in epileptics, surgeons often implant depth electrodes in various areas of the brain that appear to be the origin sites of seizure activity.

These electrodes can both stimulate and record electrical activity. While procedural sophistication has evolved over recent years, the accumulated findings have not provided a reasonably precise or replicable picture concerning where déjà vu experiences may originate (Brown, 2004). While déjà vu can be created through stimulation of electrodes planted in and around the temporal area, inconsistent results and procedural problems (e.g., spread of stimulation) cloud these findings.

A recent study is notable for the reliability with which it was able to elicit déjà vu in TLEs. Bartolomei, Barbeau, Gavaret, Guye, McGonigal, et al. (2004) found that déjà vu experiences could be triggered via stimulation of the rhinal cortex in seven (of 24) patients, and that repeated stimulation produced the same déjà vu response. Replicable electrical elicitation of déjà vu was a first, but they were also able to differentiate between the perirhinal and entorhinal cortices. Recall that Bowles et al. (2007) (above) discovered that removal of both perirhinal and entorhinal cortices eliminated déjà vu (and familiarity) in their patient. Bartolomei et al. were able to differentiate between these two structures by finding that the entorhinal cortex is the key: 3% of perirhinal stimulations resulted in déjà vu, whereas 17% of entorhinal stimulations elicited déjà vu.

A second investigation implicates other areas that may be involved in déjà vu, or at least capable of creating the sensation through indirect pathways via spillover activation. Kovacs, Auer, Balas, Zambo, Klivenyi, et al. (2009) present a case study where déjà vu was repeatedly elicited through stimulating the globus pallidum. Remarkably, this woman had never previously experienced a déjà vu. However, there are several qualifications on this report. Déjà vu only occurred with a relatively high-level of electrical stimulation, raising the possibility that the experience resulted from indirect activation of neighboring brain regions. Furthermore, the illusions only happened with her eyes open, and were reported only in response to a direct query. She would not volunteer reports of déjà vu—but only acknowledged it if asked. Data from this particular patient must also be qualified by an early brain injury that altered her normal hemispheric language lateralization. Thus, this patient provides additional evidence that déjà vu can be reliably elicited through stimulation of a single brain location, but the specific role of the globus pallidum needs further verification.

5. Reports in Anomalous Individuals

5.1. Blindness

Déjà vu research has primarily emphasized the visual dimension in anecdotal reports, theoretical speculation, and empirical demonstrations (Brown, 2004; Brown et al., 1994; Neppe, 1983). However, many reports involve an auditory component, particularly where a conversation seems eerily familiar:

> . . . an impression that we have previously been in the place where we are at the moment, or a conviction that we have previously said the words we are now saying, while as a matter of fact we know that we cannot possibly have been in a given situation, nor have spoken the words.
>
> Angell (1908, p. 235)

The visual bias in déjà vu may stem from the fact that most cognitive research involves visual rather than auditory processing, thus naturally pulling theoretical speculation in this direction.

With this context in mind, O'Connor and Moulin (2008) document déjà vu in a male who has been blind since birth, and reports that "hearing and touch and smell often seem to intermingle in the déjà vu experiences" (p. 247). It would be very useful for our understanding of déjà vu if our current theoretical interpretations could be applied to, or tested in, other sensory modes. For example, could the split-perception paradigm that has been successful with visual materials (Brown & Marsh, 2009) extend to auditory identity priming? Would a brief and barely audible (at threshold) presentation of a word, just prior to a clear presentation, result in enhanced familiarity? Perhaps the single-element familiarity (Brown & Marsh, 2007) research with visual symbols could be modeled by presenting an auditory fragment ("bah") preceding the full spoken version ("bottle"). And full spoken phrases, sentences, or short paragraphs might be a viable extension of the visual implicit memory demonstration of déjà vu (Brown & Marsh, 2008).

5.2. Chronic Déjà Vu

Two recent case studies report chronic déjà vu in four individuals who experience the sensation on essentially a daily basis. Given that déjà vu happens only a few times a year even in those most prone (Brown, 2004), a daily rate is extraordinary. This is even more exceptional because all persons in these reports are all middle aged or older, an age range where déjà vu experiences are rare.

In one report, O'Connor and Moulin (2008) document a 39-year-old TLE patient who experiences déjà vu up to three times per day, always associated with the preseizure aura. This annoyance motivated the patient to try active strategies to terminate the sensation—turning his attention to something else; looking away from what he judged to be the eliciting visual stimulus. These efforts were to no avail, as déjà vu "follows my line of vision and hearing" (p. 145). O'Connor and Moulin (2008) suggest that this argues against a data-driven (bottom-up) etiology of déjà vu. They reason that if déjà vu was caused by visual sensations, then altering such stimulation should end déjà vu. Although a reasonable position, evidence against an external perceptual trigger does not prove that it can *never* occur through this route—only that it is not the exclusive triggering stimulus for a déjà vu.

A second report of chronic déjà vu describes three elderly subjects, all 65 or older (Thompson, Moulin, Conway, & Jones, 2004), whose frequent

déjà vu experiences made everyday living problematic. They discontinued routine daily activities like watching TV, reading the newspaper, or listening to the radio because it felt as if they have seen or heard these before. Similar to O'Connor and Moulin (2008), Thompson et al. suggest that such cases demonstrate that déjà vu is a central nervous system dysfunction, unrelated to specific external perceptual triggers. Incidentally, each of these subjects had some brain pathology (atrophy; hemorrhage), and it is unclear how this might relate to the chronicity of the memory illusion. As a segue to the following section, Thompson et al. propose that their clinical observations suggest that déjà vu increases as one ages, a position counter to a large body of evidence (Brown, 2003, 2004). They further suggest that the prevalence of déjà vu is underreported because it gets lost in the higher incidence of many other more serious memory problems that pop up as one ages.

6. Continuing Issues

6.1. Aging

One of the biggest empirical puzzles about déjà vu is its decline with age. This systematic decrease is reflected in the percentage of individuals who admit to ever having a déjà vu experience (Chapman & Mensh, 1951), and for individuals who do have déjà vu the incidence of the experience declines across their life (Brown, 2003, 2004). Superficially, these findings appear contrary to general findings regarding aging and memory. Familiarity assessment seems to remain relatively stable with age, whereas the capacity to recollect specific temporal and contextual details about experiences decreases (Mantyla, 1993). Déjà vu represents a strong sense of subjective familiarity in the absence of any objective evidence, and these two functions should show greater divergence as we grow older. Thus, déjà vu should increase rather than decrease with age.

What are some possible reasons? It may be a measurement issue, involving age-related changes in *recall* (déjà vu is more apt to be forgotten), *response bias* (older adults are more reticent to admit to déjà vu), or *cohort* (older adults are less aware of the concept) (Brown, 2004). However, it is also possible that older adults learn to rely more on familiarity than recollection, given that the former memory function is more stable. Thus, they are more likely to dismiss a discrepancy between familiarity and the absence of recollection (Cleary, 2008). Also, older adults may be less attentive to details of their surroundings that could possibly trigger a déjà vu, and they may also visit fewer places on a regular basis (and thus experience fewer possible triggers). Finally, in the face of an overall increase in memory difficulties, subtle issues like déjà vu may not be as noticeable. Incidentally, Thompson et al. (2004)

propose that déjà vecu, a variant of déjà vu where the present experience seems to have been lived through before, increases with age. They base this upon their impression of older adults who come to their memory clinic, and further propose that the experience is underreported by older adults (see above).

6.2. Dreams

Following the appearance of an article on déjà vu research in a major national newspaper, over 500 e-mails poured in. Most were diligently answered, even though the sender's desire for a definitive explanation could not be provided. The most curious dimension of these reactions from the general public is that most felt that the "prior experience" had occurred in a dream. Survey data show that one in five college students agree with this dream-origin interpretation. This dream impression needs to be logically explained, in order to remove déjà vu from the realm of the occult (cf. Brown, 2004). Our best hunch is that the surreal impression created by a déjà vu fits with the cognitive texture of a dream, rather than a real experience, and finding ways to specify this more empirically would be helpful in the development of research on déjà vu.

6.3. Single versus Multiple Causes

Several published reports openly challenge the notion that déjà vu is initiated by external stimuli, and suggest that it is only triggered by a biological dysfunction (O'Connor & Moulin, 2006, 2008; Thompson et al., 2004). All cognitive interpretations discussed earlier—split perception, implicit memory, single-element, gestalt—are predicated on the assumption that déjà vu is initiated by an external perceptual experience. The difference is whether that stimulus connects with itself from a few moments ago (split perception), the same scene experienced weeks or years ago (implicit memory), a piece of a prior real experience (single-element), or a familiar format (gestalt).

The alternative is that déjà vu is all in the brain. Support for this alternative position is drawn from individuals where the déjà vu experience: (a) occurs with extraordinary frequency, (b) is not tied to the physical setting, and (c) cannot be ended or altered by willfully changing the perceptual input (O'Connor & Moulin, 2008; Thompson et al., 2004). We believe that there are multiple possible causes for déjà vu. Just as a stomach ache can have different causes (e.g., over consumption, flu, food poisoning, medications, stress), the same is true of déjà vu (Brown, 2003, 2004). If a déjà vu experience can be identified as a likely result of one possible mechanism, this does not necessarily rule out others (cf. Cleary et al., 2009). Similarly, forgetting where you put your car keys could be

traced to biological (fatigue, stress, low blood sugar) as well as psychological (distraction, multitasking) circumstances. Proving one cause for a particular incident does not rule out other possibilities.

There is a considerable amount of accumulating evidence supporting déjà vu as caused through data-driven procedures: split perception (Bernstein & Welch, 1991; Brown & Marsh, 2009; Jacoby & Whitehouse, 1989), implicit memory (Brown & Marsh, 2008), single-element familiarity (Brown & Marsh, 2007), and gestalt resemblance (Cleary et al., 2009). No theory of déjà vu should be eliminated as precondition of accepting another. We are in an early phase in the exploration of this experience, and different interpretations can provide a rich source of ideas that may yield important findings to cognitive phenomena apart from déjà vu.

6.4. Jamais Vu

Normally, we experience a perfect alignment between objective and subjective recognition: things that we know feel familiar and settings/people that have not been experienced feel unfamiliar. Déjà vu is a mismatch between the two, with positive subjective recognition in the face of negative objective recognition. Jamais vu is the opposite—negative subjective recognition contrasted with positive objective recognition. For example, you walk into the dining room in the home that you grew up in, and it appears momentarily unfamiliar as if you are seeing it for the first time. Jamais vu is much rarer than déjà vu, and research on the subject is scant with only a few published reports on its nature or incidence (cf. Brown, 2004).

Jamais vu was briefly noted in Jacoby and Whitehouse (1989) but their speculation did not get traction in subsequent research. The most captivating aspect of their study (discussed earlier) was that a brief presentation of a prime identical to the immediately succeeding target word enhanced its perceived familiarity. Another finding, however, caught the attention of Jacoby and Whitehouse. In their different prime condition, where the preceding prime word differed from the target, the likelihood of a false alarm *decreased* relative to the control (no word) condition. Jacoby and Whitehouse suggest that:

> the processing of a test word is disrupted when its presentation is preceded by a nonmatching context word, and this reduction in fluency gives rise to a lack of familiarity, a feeling of strangeness. (p. 134)

Although found in their Experiment 1, this difference disappeared in Experiment 2. Nonetheless, if fluency enhancement can artificially enhance false positive recognition, why should not the opposite happen? This would provide a tidy symmetry to déjà and jamais vu, but such does not seem to be the case.

The lifetime incidence of jamais vu is much lower than déjà vu among college students. Whereas it is difficult to find an undergraduate who has not experienced déjà vu, barely a third of students admit to having experienced jamais vu (Brown, 2004). However, there is a more common experience that resembles jamais vu—word blindness. A survey at SMU revealed that most (60%) ($N = 167$) college students have experienced a familiar word suddenly looking unrecognizable, so that it momentarily appears to be a nonword. Females report this more than males (56% vs. 38%) and older students (junior/senior) more than younger students (freshman/sophomore) (58% vs. 35%). Of those who admit to word blindness, most have it at least every few months.

Words that respondents report becoming "blind" to are surprisingly simple, such as "were, through, is, of, mine, grow, from, actual." A few were longer ("preservation, statutory"), and most are abstract nouns or function words. Also related to jamais vu is semantic satiation, where the meaning of a word dissolves after repeated oral presentations or pronunciations. However, this is a poorer model because meaning dissolves only after forced repetition. Jamais vu, on the other hand, seems to occur without apparent repetition.

Jamais vu may be more common than reported, but is not noticed as readily as is déjà vu. Perhaps when subjective unfamiliarity contrasts with objective familiarity, it is not as attention-grabbing as déjà vu or it can be dismissed more easily. Current evidence has not provided a clear link between the two phenomena (Brown, 2004), but this would be a fruitful avenue to pursue to help clarify the mechanisms underlying déjà vu.

7. Concluding Remarks

The déjà vu illusion has received considerable attention over the past century and has stimulated over 40 different interpretations (Brown, 2004). Recent empirical evaluation of some of these theoretical positions has recently appeared in published literature. This chapter summarized tentative support for déjà vu as possibly caused by: two perceptions that occur in rapid succession, a momentarily inaccessible prior experience of the present scene, an overly generalized familiarity emanating from one portion of a scene, and a general-form match between the present and a past experience. Evidence from brain pathology and stimulation suggests that we may be close to identifying specific brain structures involved in this illusion of false positive recognition. Examining a subtle cognitive dysfunction like déjà vu among cognitively disturbed or medicated patients will always be difficult (Brown, 2004), but findings relating déjà vu to milder forms of cognitive dysfunction (e.g., dissociation; Adachi, Akanu, Adachi, Adachi, Ikeda,

et al., 2008) and medication side effects (Kalra, Chancellor, & Zeman, 2007) may elucidate biological and cognitive dimensions of the experience. In closing, the accumulating body of intriguing research on déjà vu will hopefully encourage us to spend more effort delving into memory illusions as a means of understanding normal memory function (cf. Roediger, 1996). These obtuse messages from the brain are potentially packed with fascinating secrets about cognitive function.

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