A Review of the Déjà Vu Experience

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For more than a century, the déjà vu experience has been examined through retrospective surveys, prospective surveys, and case studies. About 60% of the population has experienced déjà vu, and its frequency decreases with age. Déjà vu appears to be associated with stress and fatigue, and it shows a positive relationship with socioeconomic level and education. Scientific explanations of déjà vu fall into 4 categories: dual processing (2 cognitive processes momentarily out of synchrony), neurological (seizure, disruption in neuronal transmission), memory (implicit familiarity of unrecognized stimuli), and attentional (unattended perception followed by attended perception). Systematic research is needed on the prevalence and etiology of this culturally familiar cognitive experience, and several laboratory models may help clarify this illusion of recognition.

This article constitutes a summary of the empirical findings and scientific speculation concerning the déjà vu experience. The review is divided into four sections: (a) techniques used to study the déjà vu experience, (b) summary of empirical findings, (c) possible scientific explanations from cognitive and neuropsychological perspectives, and (d) directions for future research. Although the déjà vu phenomenon is widely experienced by the general public and is oft-cited in the popular literature (Sno, Linszen, & de Jonghe, 1992), the déjà vu experience has been relatively neglected by memory researchers. The déjà vu experience lacks any clearly identifiable eliciting stimulus or verifiable behavioral response, and these lacunae have presented impediments to systematic research efforts. Much of the published literature on déjà vu is from the psychodynamic or parapsychological perspectives, and although psychodynamic interpretations may have some explanatory value, these remain generally complex and cumbersome in light of possibly simpler scientific explanations. Recently, a number of cognitive researchers have begun to relate empirical work to the déjà vu phenomenon in an effort to elucidate the mechanisms underlying the experience (Hoffman, 1997; Jacoby, 1988; Jacoby, Allan, Collins, & Larwill, 1988; Jacoby & Whitehouse, 1989; Roediger, 1996; Schacter, 1996; Seamon, Brody, & Kauff, 1983). A goal of the present review is to provide sufficient information on the phenomenon to stimulate constructive ideas from researchers in the clinical, neuropsychological, and cognitive areas and to bring clarity and focus to an extensive but fragmented literature. Although much of the prior research on the déjà vu experience has been published in journals and books that do not connect with mainstream scientific research, there is sufficient data and speculation available to formulate a nascent picture of the déjà vu experience.

Defining the Déjà Vu Experience

It took nearly a century to settle on a common term for the déjà vu experience. From the mid-1800s to the mid-1900s, researchers used a variety of words and phrases in different languages to describe the phenomenon. Berrios (1995) and Findler (1998) suggested that the term *déjà vu* was first used in a statement by Arnaud (1896), whereas Cutting and Silzer (1990) pointed to the first use by Hughlings-Jackson (1888). Sno (1994), Neppe (1983a, 1983e) and Funkhouser (1983) claimed that Boirac (1876) first used the term *déjà vu* ("la sensation du déjà vu") in a letter to the editor. Although the term *déjà vu* was clearly introduced in the late 1800s, it did not come into common usage until many decades later. Sno and Linszen (1990) provided a list of 17 different terms (from three languages) that have previously been used to describe the déjà vu phenomenon (from *paramnesia* to *illusion of the already seen* to *sentiment of pre-existence*), and Neppe (1983e) gave a chronology of the use of these terms.

Table 1 presents passages from textbooks published by prominent psychologists (Angell, 1908; James, 1890; Titchener, 1928; Woodworth, 1940) that illustrate the diversity of early references to the experience, even into the mid-twentieth century. These descriptions show that earlier experimental psychologists evaluated the déjà vu experience as relatively common and tended to classify it as a disorder, illusion, or hallucination of memory. The following definition proposed by Neppe (1983e) has recently become the standard in research on déjà vu: "any subjectively inappropriate impression of familiarity of a present experience with an undefined past" (p. 3; see also Neppe, 1983b).

Methods of Investigation

A variety of different techniques have been used to evaluate the nature of the déjà vu experience, as detailed below.

Retrospective Reports

Much of the research on déjà vu has been conducted with retrospective evaluations of two varieties: short surveys designed to assess its incidence and longer questionnaires aimed at evalu-

Table 1
Quotes From Psychology Textbooks Concerning the Déjà Vu Experience

Author	Quote
James (1890)	There is a curious experience which everyone seems to have had—the feeling that the present moment in its completeness has been experienced before—we were saying just this thing, in just this place, to just these people, etc. (p. 675)
Angell (1908)	Another curious disturbance of memory, with which most of us are familiar, is found in the experience of 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. (p. 235)
Titchener (1928)	Most of us, probably, have an occasional acquaintance with what is called paramnesia or wrong recognition: a definite "feeling that all this has happened before," . . . in spite of the fact and the knowledge that the experience is novel. (p. 187)
Woodworth (1940)	A weird feeling that one has been through all this before, as if time had slipped a cog and were now repeating itself. Perhaps 50 percent of young people can remember having had this queer experience, and some few individuals suffer from it a great deal. It may be called the "illusion of having been there before." (p. 357)

ating different aspects of the déjà vu state. Although short surveys involve one or two questions (e.g., Have you ever had a déjà vu experience?; How often do you have a déjà vu experience?), retrospective questionnaires are aimed at clarifying more complex physical and psychological circumstances surrounding the déjà vu experience. Neppe (1983e) developed both a quantitative (frequency, duration) and a qualitative (emotional intensity, clarity of experience) questionnaire to be administered in an interview format, and Sno, Schalken, de Jonghe, and Koeter (1994) later refined and extended Neppe's (1983e) questionnaires. Both instruments focus on defining the content (setting, the respondent's actions, words spoken), frequency (how often, first experience), personal circumstances (where, when, doing what), physical state (fatigued, angry, intoxicated), and psychological reactions (emotions, time sense, body awareness) related to the déjà vu experience, as well as auxiliary psychological dimensions (dream memory) and personal habits (travel frequency).

The research evaluating the déjà vu experience has been plagued with a number of problems. First, there is often a failure to report some of the basic details of the research, such as the actual survey question used (Buck, 1970; Buck & Geers, 1967; M. A. Harper, 1969; Myers & Grant, 1972) or the incidence rate found through this query (J. C. Dixon, 1963; Osborn, 1884). For example, for one of the more thorough déjà vu questionnaires, Sno et al. (1994) provided considerable detail on the test–retest and interitem reliability, as well as on face and construct validity, but failed to publish the actual questionnaire or any descriptive statistics from four groups of individuals (people with schizophrenia, people with depression, those prone to complex seizures, and controls).

Unrepresentative samples are frequently used in déjà vu research. In many instances, a sample of convenience is used. Leeds (1944) queried individuals in a shop where he worked, Zuger (1966) surveyed patients undergoing therapy from him, and Kohr (1980) polled members of the Association for Research and Enlightenment, which studies paranormal experiences and of which he was also a member. Osborn (1884) distributed his survey "at Princeton and elsewhere" (p. 478) without further clarification, and several studies used hospital patients as representative controls to compare with psychiatric subgroups (Chapman & Mensh, 1951; Richardson & Winokur, 1967). M. A. Harper (1969) sampled

workers in a public health department, but to his credit he stated that "no attempt was made to make this a representative sample of the normal population" (p. 69). Finally, Gaynard (1992) surveyed students attending a university where he taught a popular course called "Aspects of the Paranormal," with many students aware of his positive bias toward this subject.

This problem of an inadequate and restricted sample is particularly disappointing in Neppe's (1983e) book, one of the most extensively documented survey projects on déjà vu. Although he included five groups—people with schizophrenia, people with temporal lobe epilepsy (TLEs), people with non-temporal lobe epilepsy, paranormal experients (people who believe in the paranormal), and controls—his control group consisted of 10 people who did not believe in paranormal phenomena (i.e., paranormal nonexperients). Only 5 of these 10 controls had ever had a déjà vu experience; thus, an extensive series of descriptive statistics and analyses was based on 5 persons. Though Neppe (1983e) admitted that data from this control group were not generalizable, it is unfortunate that such a great effort was expended on presenting the results from so few individuals.

Another bias is created by the context of the déjà vu question, which is often embedded among items evaluating paranormal phenomena such as out-of-body experiences, belief in poltergeists, psychokinesis, channeling, spirit possession, thought control, telekinesis, hauntings, past-life experiences, lucid dreams, ESP, and hallucinations (Gaynard, 1992; Green, 1966; Greyson, 1977; Kohr, 1980; McClenon, 1988; Palmer, 1979; Ross & Joshi, 1992). Note, however, that Ross and Joshi (1992) removed the déjà vu question from their analysis of 15 other questions on the paranormal because the reported déjà vu incidence was too high to be considered paranormal. A particularly unfortunate example of this bias is in the General Social Survey by the National Opinion Research Center (NORC) at the University of Chicago. The NORC uses exceptional sampling procedures in their surveys, yet accompany the déjà vu question with four others evaluating parapsychological phenomena, namely ESP, clairvoyance, contact with the dead, and out-of-body experiences. Similarly, a Gallup poll (Gallup & Newport, 1991) positioned the déjà vu item in a set of questions about belief in the following realms of the paranormal: ESP, astrology, ghosts, clairvoyance, witches, and devils. Although Gallup and

Newport (1991) acknowledged that most psychologists do not consider déjà vu to be a psychic or paranormal phenomenon, they clearly implied this to their survey participants.

A final issue with the survey research is the potential unreliability of the self-report data on this particular topic. M. A. Harper (1969) suggested that the incidence of déjà vu may simply be "an artefact of the interview situation and measures only the willingness of an individual to admit to an experience which may be universal" (p. 70; cf. Chapman & Mensh, 1951). As an experimental caution, M. A. Harper (1969) compared oral and written administrations of the same déjà vu questions to the same respondents and discovered only a 78% correspondence between whether the individual claimed to have experienced a déjà vu through written versus oral queries (written response yielded a lower incidence).

Prospective Reports

The infrequency of déjà vu experiences presents problems for remembering the specific physical and psychological details surrounding the déjà vu. This difficulty can be addressed by prospective survey, but only Heymans (1904, 1906) has used this methodology. In two separate studies, originally written in Dutch and translated into English by Sno and Draaisma (1993), college students recorded the details of each déjà vu they experienced during an academic year. In the first investigation, 6 of 42 students (14%) had a total of 13 déjà vu experiences during the 9-month period. The incidence of déjà vu in the second study is not available because déjà vu and depersonalization experiences were reported in combination: 31 of 88 respondents (35%) reported one or both experiences during the academic year.

This combined reporting of déjà vu and depersonalization experiences highlights a consistent theme in earlier investigations of déjà vu. Many researchers assumed that déjà vu was a symptom of a mood or personality disorder, rather than a routine cognitive dysfunction, and were primarily interested in documenting the relationship between déjà vu and other moderate to severe psychological disturbances (e.g., depersonalization), psychopathology (e.g., schizophrenia), and ongoing personal dispositions (e.g., mood fluctuations, working rhythms, emotional sensitivity; cf. Heymans, 1904, 1906).

Leeds (1944) also used a prospective procedure in evaluating the intensity and duration of 144 of his personal déjà vu experiences spanning a 12-month period. (An average of one every 2.5 days!) This extraordinary frequency motivated his self-analysis, and although Leeds provided summary information on his déjà vu experiences, this is not included in the present review because of the anomalous frequency of his episodes.

Case Reports

Two groups of individuals traditionally have been identified as having an atypically high incidence of déjà vu experiences: TLEs and people with schizophrenia. In the case of schizophrenia, attempts have been made to link the déjà vu experience to psychopathology (Cutting & Silzer, 1990; Sno, Schalken, & de Jonghe, 1992), but it is difficult to determine whether the experience of people in this subgroup is similar to that of individuals lacking such pathology. Neppe (1983e) suggested that déjà vu among

people with schizophrenia may be of much longer duration (hours, not seconds) and associated with intense depersonalization, making it qualitatively different from that experienced by nonclinical individuals.

With respect to TLEs, déjà vu is part of the aura preceding the seizure in some, and this phenomenon has been studied with retrospective anecdotal reports (Cole & Zangwill, 1963; Gloor, 1990; M. Harper & Roth, 1962; Krijgers Janzen, 1958; Neppe, 1980), personal experiential reports (Hughlings-Jackson, 1888; Leeds, 1944; Wohlgemuth, 1924), and brain stimulation (Adachi et al., 1999; Bancaud, Brunet-Bourgin, Chauvel, & Halgren, 1994; Gupta, Jeavons, Hughes, & Covanis, 1983; Weinand et al., 1994).

When seizure activity cannot be controlled through medication, surgical removal of brain tissue may be required, and prior to this procedure, efforts are made to identify the tissue that is focal to the seizure. As a by-product of this exploration, a déjà vu experience is occasionally elicited. With surface stimulation of the cortex, Mullan and Penfield (1959) elicited déjà vu experiences in 10 out of 217 TLEs. Recent procedures involving deep electrode brain implantation (Bancaud et al., 1994; Gloor, 1990; Gloor, Olivier, Quesney, Andermann, & Horowitz, 1982; Halgren, Walter, Cherlow, & Crandall, 1978) have shown that a déjà vu similar to one that occurs in the aura can be elicited with stimulation of the amygdala and hippocampus. Although these experiences were not reported in detail, the déjà vu generally consisted of a sudden feeling of unfamiliarity in the hospital environment (Bancaud et al., 1994; Gloor et al., 1982) and was often accompanied by epigastric phenomena and fear (Halgren et al., 1978). The elicitation of déjà vu through electrical stimulation may not be reliable. Halgren et al. (1978) stimulated several dozen brain locations in a group of TLEs on two different occasions (2 weeks apart) and found that a number of sites that elicited a déjà vu on one session did not do so on the other. Déjà vu experiences also resulted from stimulating the nondiseased hemisphere, suggesting that the experience is not necessarily specific to the tissue in which the seizure originates.

Although it is interesting that déjà vu experiences are produced through electrical stimulation of cortical and deeper structures of the brain, is this specific to TLEs or can such experiences be elicited in all individuals? There is also the broader question of whether a déjà vu experienced by TLEs is comparable with that experienced by individuals who do not have epilepsy (cf. M. A. Harper, 1969). Neppe (1983e) suggested that the experience in TLEs lasted longer than in people without epilepsy (minutes rather than seconds), was often duplicated (same déjà vu on repeated occasions), and may have been accompanied by substantial changes in thinking and emotions (compared with the brief and transient changes in the groups of participants without epilepsy), as well as a heightened sense of awareness of body and environment. Complicating this evaluation is that fact that the déjà vu experienced immediately prior to the epileptic seizure "is often dulled by slight clouding of consciousness, impaired by apprehension and recalled only with difficulty on close questioning" (M. A. Harper, 1969, p. 70).

Findings

Although there are methodological shortcomings in research on déjà vu, some consistent findings have emerged across these

investigations. In fact, one should have a high degree of confidence in outcomes reliable across such a diverse set of methodologies.

Lifetime Incidence

The percentage of individuals experiencing at least one déjà vu in their lifetime across 41 surveys is provided in Table 2, with surveys separated by the authors' use of clinical and nonclinical samples and listed in decreasing order of déjà vu incidence within each set. Over all outcomes, the mean incidence was 67%, and the median incidence was 66%. For the 32 nonclinical outcomes, the mean incidence was 68%, and median incidence was 70%; for the 9 clinical outcomes, the mean was 55%, and the median incidence was 65%. Thus, it appears that about two thirds of individuals have experienced at least one déjà vu in their life.

Table 2
Lifetime Incidence of Déjà Vu Experience Across 41 Surveys

Source	Incidence (%)	Sample size	Nature of sample
Nonclinical individuals			
Irwin (1996)	100	106	College students
Buck (1970)	98	49	College students
Brown et al. (1994)	97	353	College students
Buck & Geers (1967)	96	91	College students
Neppe (1979)	96	84	Upper-middle class women; members of a cultural society
Leeds (1944)	92	100	Factory workers and friends
Ardila et al. (1993)	91	2,500	College students
Palmer (1979)	88	268	College students
Kohr (1980)	83	406	Members of a paranormal society
Green (1966)	82	112	University students
Myers & Grant (1972)	80	66	College students (with depersonalization)
Adachi et al. (2001)	77	73	Citizens of Japan
McKellar & Simpson (1954)	71	110	College students
McKellar (1957)	69	182	College students
Neppe (1981)	68	28	Unknown
NORC (1984)	68	1,439	General Social Survey; random sample
NORC (1988)	68	1,456	General Social Survey; random sample
Palmer (1979)	68	354	Townspeople (Charlottesville, VA)
NORC (1989)	65	990	General Social Survey; random sample
McClenon (1988)	64	314	College students (China)
M. A. Harper (1969)	63	91	Public health department employees
Heymans (1906)	63	88	College students
McCready & Greeley (1976)	59	1,467	NORC data from 1973
Gallup & Newport (1991)	57	1,236	Random sample by telephone interview
Ross & Joshi (1992)	55	502	Random sample from Winnipeg, Canada
Myers & Grant (1972)	51	109	College students; no depersonalization experience
Neppe (1983e)	50	10	People with no paranormal experiences
Osborn (1884)	50[a]	Unknown	University students and faculty
Gaynard (1992)	48	340	College students
Heymans (1904)	40	42	College students
Emmons & Sobal (1981)	31	1,553	Gallup poll (1978)
Lalande (1893) cited in (Berrios, 1995)	30	100	Unknown
Clinical individuals			
Brauer et al. (1970)	92	84	People with schizophrenia or personality disorder or who were depressed
Zuger (1966)	66	58	Patients undergoing therapy from author
Greyson (1977)	65	20	Psychiatric hospital admits with schizophrenia
Neppe (1983e)	65	20	People with schizophrenia
Greyson (1977)	51	68	Psychiatric hospital admits, nonschizophrenic
Richardson & Winokur (1967)	44	301	Psychiatric patients
Richardson & Winokur (1967)	41	161	Neurosurgery patients
M. Harper & Roth (1962)	40	30	Phobic anxiety depersonalization patients
Chapman & Mensh (1951)	33	220	White hospital inpatients

Note.   VA = Virginia; NORC = National Opinion Research Center.
[a] Déjà vu experience was claimed by "about one-half" of those surveyed.

It is interesting that many behavioral scientists writing informally about the déjà vu experience describe it as common and universal (Angell, 1908; Carrington, 1931; Chapman & Mensh, 1951; Conklin, 1935; Critchley, 1989; M. A. Harper, 1969; James, 1890; MacCurdy, 1925; Maudsley, 1889; Murphy, 1951; Titchener, 1928; Wilson, 1929). Most of these writers are well educated, and the evidence (presented later) suggests that the experience is more common among this subgroup of individuals.

Frequency and Recency of Déjà Vu

The frequency-of-occurrence statistics provided in this section were calculated using those individuals who have experienced a déjà vu, or experients, as a base. Thus, if 60% of respondents have experienced a déjà vu and 20% reported déjà vu once a month, this is reported as a monthly rate of 33% (20%/60%) among experients.

Frequency of déjà vu has been measured in three different ways. The absolute measure is how many total déjà vu experiences the respondent has had. Kohr (1980) found that 14% had one or two lifetime experiences, 19% had three or four, 23% had five to eight, and 44% had nine or more. Though the highest percentage of experients had nine or more déjà vu experiences, this sample consisted of members of a paranormal club. Using a rougher cut, Palmer (1979) found that 98% of those who had déjà vu have had more than one experience. Both investigations suggest that if one has experienced déjà vu, it is highly likely that one has had multiple experiences.

Déjà vu frequency has also been evaluated by the following relative categories: seldom or rare, occasional, and often or frequent. The General Social Survey (NORC, 1984, 1988, 1989) revealed that most respondents fell in the seldom (44%) and occasional (44%) categories, with fewer claiming frequent (12%) déjà vu. These percentages are close to the those found by Leeds (1944; 44% seldom, 39% occasional, 18% frequent) and by McCready and Greeley (1976; 49% seldom, 41% occasional, 10% frequent). Both Green (1966) and Brauer, Harrow, and Tucker (1970) discovered that 16% of respondents claimed frequent déjà vu, a percentage close to that found in the other three studies.

Finally, a temporal evaluation can be made of either one's last déjà vu experience (past week? past month?) or how often one experiences a déjà vu (every week? every month?). For the present analysis, these two questions were considered comparable; if an individual's last déjà vu was in the past week, it was assumed that his or her incidence was weekly. Among investigations with a wide age range, there was moderate consistency in percentages of experients claiming monthly déjà vu: 10% in Chapman and Mensh (1951), 10% in M. A. Harper (1969), and 19% in Neppe (1979). This percentage was considerably higher (54%) for Brown, Porter, and Nix (1994), but this was probably due to their young age sample (see *Age Differences* section). The percentage of respondents claiming déjà vu at least every year was more variable across studies: 14% in Heymans (1904), 21% in M. A. Harper (1969), 40% in Richardson and Winokur (1967, sample of neurosurgery patients), 71% in Chapman and Mensh (1951), 84% in Neppe (1983e), and 94% in Brown et al. (1994).

Nature of the Déjà Vu Experience

There are surprisingly scant data on the precise nature of the déjà vu experience. Most surveys only ask about incidence, and

among those probing the various dimensions of the experience, the data are either unavailable (Sno et al., 1994) or based on very small samples (Neppe, 1983e). Brown et al. (1994) and Neppe (1983e) both found that the déjà vu experience was primarily triggered by the visual scene and lasted for only a few seconds. Neppe (1983e) discovered that the experience was associated with mild stress or anxiety and was not accompanied by substantial changes in thinking or emotion. Brown et al. (1994) also noted that the primary psychological reaction was surprise and that participants' time sense seemed to slow down.

There are obvious limitations in deriving such information from retrospective designs. Aside from the difficulty of remembering the personal details of a brief experience that may have happened months or years ago, one's memory of the déjà vu is most likely dominated by the perceptual experience which seems to be duplicated rather than details of one's physical state and psychological reaction. In prospective research (Heymans, 1904, 1906), most déjà vu experiences occurred in the evening, in the company of others, while listening, in a state of fatigue, and following unpleasant or confusing mental activity or physical exertion or excessive alcohol consumption. However, no descriptive summary statistics were provided on the contextual and behavioral correlates (cf. Sno & Draaisma, 1993).

Age Differences

The most consistent finding in the déjà vu literature is that the incidence with which it is experienced decreases with age (Bernhard-Leroy, 1898; Brauer et al., 1970; Chapman & Mensh, 1951; J. C. Dixon, 1963; Dugas, 1894; Gallup & Newport, 1991; M. A. Harper, 1969; Kohr, 1980; Kraepelin, 1887; Krijgers Janzen, 1958; Levin, 1993; MacCurdy, 1925; McCready & Greeley, 1976; Oberndorf, 1941; Palmer, 1979; Richardson & Winokur, 1967; Sander, 1874; Sno et al., 1994; Stanford, 1982; Zuger, 1966; although M. A. Harper, 1969; Lalande, 1893; and Neppe, 1983d, found no age difference). Whereas many evaluations were based on personal observations, there have been several convincing empirical demonstrations of this trend.

Three studies extensively evaluated changes in lifetime déjà vu experience across a broad age range. Chapman and Mensh (1951) assessed déjà vu incidence in 11 different 5-year age spans (from 15–19 through 65–69). As shown in Figure 1, they discovered a systematic decline in the lifetime déjà vu incidence with increasing age. The only anomaly in this trend is the lower rate found with teenagers. Richardson and Winokur (1967) modeled their research after Chapman and Mensh, and queried patients admitted to a hospital for neurosurgical and psychiatric treatment. The age trends for both of their groups were similar to that found by Chapman and Mensh (see Figure 1): a systematic decline in déjà vu lifetime incidence across the adult age span, with the exception of a lower incidence for teenagers.

The third extensive evaluation of age-related data comes from the combined results of three surveys by the NORC (1984, 1988, 1989), including 3,885 individuals across ages 18–89 with an average sample size of 274 for each age block (range = 70 to 488). The NORC incidence stayed steady at around 75% to 80% from the teen years to the early 40s, but declined systematically from there (see Figure 1). Palmer (1979) discovered that the lifetime
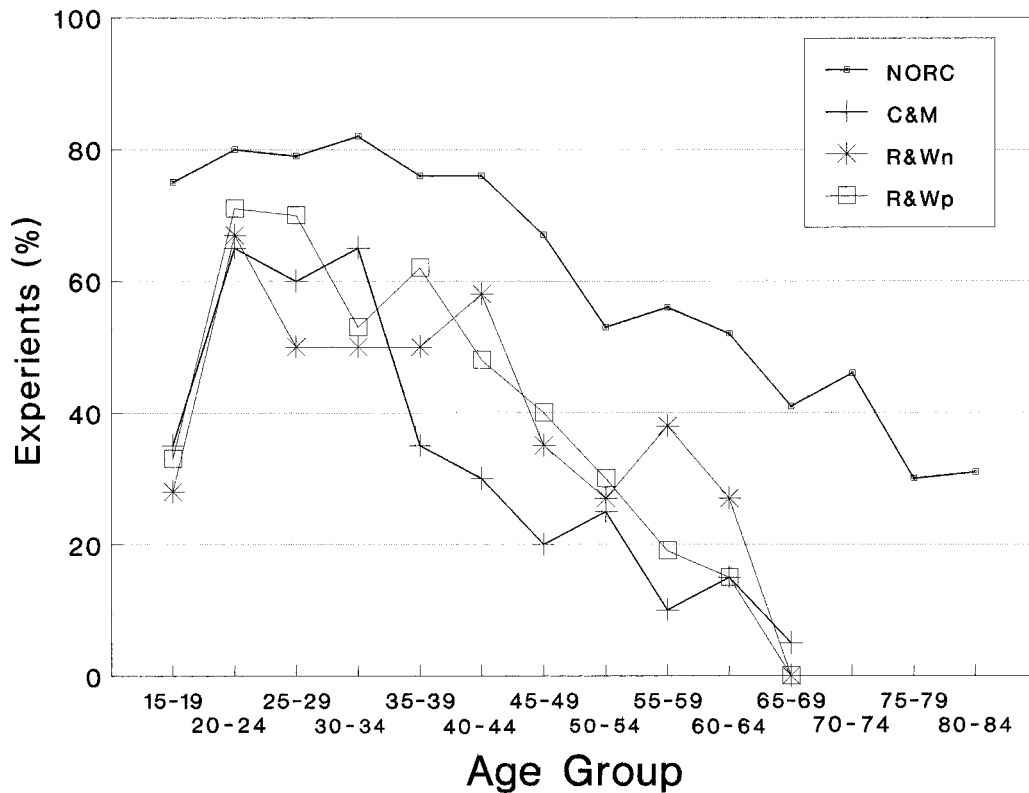
Figure 1. Age-related data for lifetime incidence for déjà vu experience in three studies. Data for the National Opinion Research Center (NORC) are the combined results of three surveys (1984, 1988, 1989). C & M = Chapman and Mensh (1951); R & Wn = patients admitted to a hospital for neurosurgical treatment who were surveyed by Richardson and Winokur (1967); R & Wp = patients admitted to a hospital for psychiatric treatment who were surveyed by Richardson and Winokur (1967).

Data for C & M are from "Déjà Vu Experience and Conscious Fantasy in Adults," by A. H. Chapman and I. N. Mensh, 1951, *Psychiatric Quarterly Supplement, 25,* pp. 168–169. Copyright 1951 by Kluwer Academic/ Plenum Publishers. Reprinted with permission. Data for R & Wn and R & Wp are from "Déjà Vu in Psychiatric and Neurosurgical Patients," by T. F. Richardson and G. Winokur, 1967, *Archives of General Psychiatry, 17,* p. 623. Copyright 1967 by the American Medical Association. Reprinted with permission.

incidence of déjà vu was 83% for those under age 30 but dropped to 52% for those over 50, whereas Zuger (1966) found that the incidence dropped from 72% in those aged 25 years and under to 61% in individuals older than 25. Finally, Sno et al. (1994), Chapman and Mensh (1951), and Kohr (1980) all found similar negative correlations between age and déjà vu incidence (–.22, –.23, and –.32, respectively).

Chapman and Mensh (1951) presented age-related data on mean number of déjà vu experiences per year. These data, plotted in Figure 2, show a sharp decline with age and indicate that teenage experients showed a comparable déjà vu frequency to those in their 20s but that the percentage of experients was simply lower among teenagers. Richardson and Winokur (1967) compared younger (< 45 years) and older (45+ years) patients and found a distinct age-related drop in the incidence of déjà vu in the past year in both the neurosurgery (younger = 44%; older = 16%) and the psychiatric (younger = 42%; older = 13%) groups. Finally, the age-related decline in déjà vu found by the NORC surveys (1984, 1988, 1989) was similar within each frequency category (once or

twice, several times, often). Apparently, the number of déjà vu experiences per year drops off across the adult age span more sharply than the number of individuals who claim to have had an incidence of déjà vu in their lifetime.

All analyses presented above suggest that the age composition of samples used in déjà vu survey research can dramatically affect estimates of déjà vu incidence. Aside from this measurement issue, there are two logical paradoxes in these data. First, teenage samples have the greatest number of déjà vu experiences per experient, yet appear to have a lower percentage of experients than samples of those in their 20s. Does this indicate that one has to reach a certain developmental level before experiencing déjà vu? Although no survey research has addressed the question of when a person first experiences déjà vu, several have suggested the cognitive maturation necessary for déjà vu is not fully in place until 8 or 9 years old (Crichton-Browne, 1895; Kohn, 1979; Neppe, 1983e). Furthermore, one may notice a déjà vu only after hearing or reading about it, and this awareness may not happen until the mid-teen years.
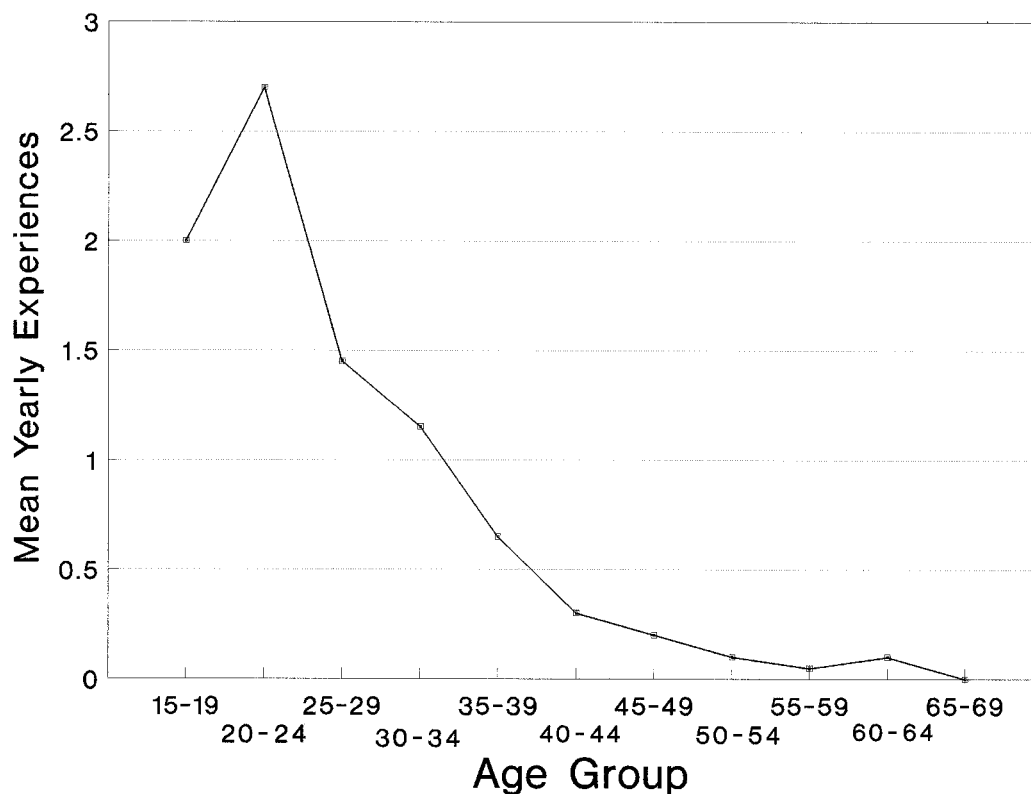
Figure 2. Yearly incidence of déjà vu among experiments from "Déjà Vu Experience and Conscious Fantasy in Adults," by A. H. Chapman and I. N. Mensh, 1951, *Psychiatric Quarterly Supplement, 25,* p. 169. Copyright 1951 by Kluwer Academic/Plenum Publishers. Reprinted with permission.

The second logical issue is that the lifetime incidence of déjà vu drops off dramatically in older adults. It is important to separate this issue from the frequency of déjà vu, which also drops off with age (see Figure 2). Individuals in their 60s were once in their 20s; therefore, it is logically inconsistent that fewer 60-year-olds than 20-year-olds report ever having had a déjà vu. The function plotting whether one has ever experienced a déjà vu should either increase or remain flat with increasing age, but it certainly should not decrease. Is there a memory problem: Do these experiences occur only during youth and then are forgotten over time? Is there a response bias: Do older adults feel less comfortable admitting to having a déjà vu experience? Is there a cohort effect: Has societal awareness and acceptance of déjà vu increased across the past 50 years?

Two sets of outcomes suggest that belief in, or acceptance of, the déjà vu experience has increased across recent decades. Gallup and Newport (1991) found that from 1978 to 1990, the amount of people who believed in the déjà vu experience nearly doubled from 30% to 55%. In addition, the General Social Survey showed an increase in the reported lifetime incidence of déjà vu from 59% in the 1970s (McCready & Greeley, 1976) to 68% in the 1980s (NORC, 1984, 1988, 1989). This societal increase in the belief in, and reporting of, déjà vu experiences may account for the decrease in reported déjà vu incidence with age. To be more specific, older cohorts matured during an era in which belief in déjà vu was not as accepted as it is today.

Aside from the anomalous decrease in lifetime incidence of déjà vu with age, there is also an age-related decline in the frequency of déjà vu among experients (see Figure 2). A gradual increase in the cultural awareness of, and comfort with, déjà vu may contribute to this age trend, and future surveys should require participants to define the term, as well as evaluate the personal and cultural acceptability of déjà vu. Another possible reason why older adults experience fewer incidents of déjà vu is that they may be less sensitive to the qualities of their own cognitive experiences. That is, older adults are less accurate in identifying the sources of information (Brown, Jones, & Davis, 1995) and less likely to spontaneously use source information in making memory evaluations (Multhaup, 1995), thus making them less aware of the type of source memory mismatch that spontaneously leads to déjà vu. Finally, older adults tend to be more settled in their routine physical surroundings, making them less likely to encounter those new settings that could elicit déjà vu experiences.

Gender

Many investigations have compared déjà vu incidence in male and female participants, but no consistent gender difference has emerged. Some have found a higher incidence among women and girls (Gaynard, 1992; Myers & Grant, 1972), others have reported a higher incidence among men and boys (Green, 1966; NORC, 1984, 1988, 1989; Richardson & Winokur, 1967, sample of neu-

rosurgery patients), and some have found no gender difference (Bernhard-Leroy, 1898; Chapman & Mensh, 1951; M. A. Harper, 1969; Kohr, 1980; Leeds, 1944; Palmer, 1979; Richardson & Winokur, 1967, sample of psychiatric patients; Sno et al., 1994). Thus, déjà vu is not clearly gender related in any obvious way.

Education and Socioeconomic Class

A positive relationship between the déjà vu experience and both education level and socioeconomic class has been noted in both anecdotal and empirical evaluations (Chapman & Mensh, 1951; Crichton-Browne, 1895; Gallup & Newport, 1991; M. A. Harper, 1969; Kohr, 1980; MacCurdy, 1925; Neppe, 1979, 1983e; Palmer, 1979; Richardson & Winokur, 1967, 1968). Chapman and Mensh (1951) compared six different "occupation" groups and declared that better educated persons (their definition; professional = 45%, student = 42%, clerical = 41%) had a higher déjà vu incidence than less educated individuals (skilled = 33%, housewife = 31%, unskilled = 28%). Richardson and Winokur (1967) used similar classifications and found a higher incidence of déjà vu in the "clerical, professional, and student groups (47% to 73%)" compared with the "unemployed (retired), unskilled, housewife and skilled groups (25% to 43%)" (p. 624). Comparing a number of different occupational levels, Palmer (1979) found the highest incidence of déjà vu among professionals (80%) and the lowest incidence among blue collar workers (50%).

With respect to education level, Chapman and Mensh (1951) found a systematic increase in déjà vu incidence across years of education (education years: < 9 = 20%, 9–12 = 44%, 13+ = 50%). Richardson and Winokur (1967) found a similar relationship between years of education and déjà vu incidence in both neurosurgery (education years: < 9 = 12%, 9–12 = 42%, 13+ = 68%) and psychiatric (education years: < 9 = 23%, 9–12 = 46%, 13+ = 56%) patients. Comparing five levels of educational achievement, Palmer (1979) noted the lowest incidence of déjà vu (48%) at the bottom rung (grade school only) and the highest incidence of déjà vu (81%) among those with a graduate degree. In addition, both Chapman and Mensh and Kohr (1980) found positive correlations (.16 and .10, respectively) between education and déjà vu. Thus, all investigations show a direct relationship between déjà vu incidence and years of schooling. Of course, education and socioeconomic class are highly related, and no one has separated the independent contributions of each variable.

Travel Frequency

Logically, those individuals who travel should have more opportunities to experience a déjà vu because they encounter objectively new physical locations more often than those who do not travel. Several investigations support this speculation. Chapman and Mensh (1951) discovered that people who did not travel had an 11% incidence of déjà vu, whereas those who made one to four trips a year had a 31% incidence, and people who took five or more trips per year had a 32% incidence of déjà vu. Richardson and Winokur (1967) found a similar relationship with both neurosurgery (11% incidence for nontravelers, 41% among those making one to four trips a year, and 44% for those taking five or more trips per year) and psychiatric patients (33% for nontravelers, 48% among those making one to four trips, and 45% for those taking

five or more trips per year). Thus, those who travel have more déjà vu experiences than those who do not, but the amount of travel seems to make little difference. This association of déjà vu with travel is probably interrelated with educational and socioeconomic differences, in that those in the upper class and with more education are more likely to travel (see *Education and Socioeconomic Class* section).

Stress, Fatigue, Anxiety, and Illness

Earlier anecdotal reports linked déjà vu with physical or psychological distress, suggesting that "it occurs most frequently after periods of emotional stress, or in the state of extreme mental fatigue" (Titchener, 1924, p. 187) or "when one is in a let-down state, and far from alert and keen" (Woodworth, 1940, p. 357). This speculation has received considerable support (Anjel, 1886; Arlow, 1959; Conklin, 1935; de Nayer, 1979; Groh, 1968; Heymans, 1904, 1906; Krijgers Janzen, 1958; Leeds, 1944; MacCurdy, 1925; Murphy, 1951; Oberndorf, 1941; Osborn, 1884; Richardson & Winokur, 1967, 1968; Schneck, 1962; Siomopoulos, 1972; Smith, 1913; West, 1948; Yager, 1989). In prospective research, Leeds (1944) found that his own déjà vu experiences were more likely when fatigued, and Heymans (1904, 1906) noted that fatigue was associated with the majority of déjà vu episodes reported by his students. A further point of interest is Linn's (1954) assertion that déjà vu was frequently experienced by soldiers going into battle. Indeed, marching through new terrain under the heightened stress of anticipating combat may present an ideal set of circumstances for eliciting déjà vu experiences. This may also relate to the higher incidence of déjà vu in travelers (see *Travel Frequency* section), as trips are often moderately to highly stressful experiences.

Dreams

Some individuals report that their déjà vu experiences appear to duplicate a prior dream, and it is possible that dreams provide the fragmentary memories later duplicated during the déjà vu (cf. Baldwin, 1889). When Zuger (1966) asked his respondents whether they (a) experienced déjà vu and (b) remembered their dreams, a striking relationship emerged: All 10 respondents who reported no dream memory also reported no déjà vu experiences, and all 36 respondents who reported déjà vu also reported remembering their dreams (9 reported dream recall but no déjà vu). Thus, there appears to be a strong relationship between remembering dreams and experiencing déjà vu. Palmer (1979) discovered a significant correlation between déjà vu and dream frequency among older adults but not among college students. However, the lack of correlation among students may be due to restriction of range because the college group reported a high number of both experiences. Hence, although Zuger speculated that the déjà vu experience is actually a dream state intruding into waking consciousness, it is also likely that dream memory fragments may trigger a déjà vu when similar situations are reencountered while awake.

Psychopathology

Some suggest that the incidence of déjà vu is more common among people with schizophrenia than among the population in

general (Cutting & Silzer, 1990; Kirshner, 1973; Neppe, 1983e; Richardson & Winokur, 1967, 1968). However, it is difficult to determine whether their déjà vu experience is similar to that of nonschizophrenic individuals because schizophrenia involves a variety of cognitive distortions (M. A. Harper, 1969). Sno, Schalken, and de Jonghe (1992) suggested that there is a continuum of déjà vu, ranging from brief and fleeting in those without to chronic and prolonged in those with schizophrenia. Taking a more general look at déjà vu and psychopathology, M. A. Harper (1969) did not find any general relationship between déjà vu frequency and neurotic traits (and phobias) or psychiatric health. In fact, déjà vu appeared to be less common in neurotic individuals. Richardson and Winokur (1968) examined the incidence of déjà vu across 10 subtypes of psychopathology (depression, schizophrenia, personality disorder, etc.) and found a higher déjà vu incidence only for individuals with personality disorder and situational reaction. They concluded that déjà vu might be diagnostic of personality disorder, but the high variability in sample size across subtypes and the problematic sampling procedures make this conclusion suspect.

In a comparison of seven subtypes of neuropathology (brain, meninges, cerebral vessels, spinal cord, etc.), Richardson and Winokur (1968) found no difference in the incidence of déjà vu. However, déjà vu has been found to be more common in those who have suffered head injury with loss of consciousness (M. A. Harper, 1969) in addition to being associated with amphetamine psychosis (Ellinwood, 1968), influenza medications (amantadine and phenylpropanolamine; Taiminen & Jääskeläinen, 2001), abuse of toluene-based solvents (Takaoka, Ikawa, & Niwa, 2001), withdrawal from medications prescribed for bipolar disorder (carbamazepine, clonazepam; Garbutt & Gillette, 1988), and herpes simplex encephalitis (Yamashita, Yoshida, Yoneda, Mori, & Yamadori, 1994).

Related Phenomena

Several other recognition dysfunctions have been related to the déjà vu experience. Jamais vu can be considered the opposite of déjà vu in that it involves encountering an objectively familiar stimulus that momentarily feels unfamiliar (Burnham, 1903; Conklin, 1935; Critchley, 1989; Cutting & Silzer, 1990; Hughlings-Jackson, 1888; Neppe, 1983e; Reed, 1974; Sno, 2000). Jamais vu is related to both word alienation, when an ordinary word suddenly looks unfamiliar (Heymans, 1904, 1906; Sno & Draaisma, 1993), and semantic satiation (Amster, 1964; Kounios, Kotz, & Holcomb, 2000), when the repeated (massed) presentation causes a word to momentarily lose its connotative meaning. Jamais vu is much rarer than déjà vu (Findler, 1998; Reed, 1974; Sno, 2000), but Heymans (1904, 1906) presented data suggesting that the two recognition dysfunctions of déjà vu and jamais vu may be related.

Also related to déjà vu is the Capgras syndrome (Capgras & Réboul-Lachaux, 1923), a condition in which an individual believes that someone familiar (friend, relative) has been replaced by an imposter. This most studied of the delusional misidentification syndromes does not occur in neurologically and psychiatrically healthy adults but is associated with either schizophrenia or organic brain damage (Critchley, 1989) involving the right hemisphere (Förstl, Almeida, Owen, Burns, & Howard, 1991). Déjà vu may also be related to reduplicative paramnesia, whereby an individual believes that the present situation is one that has been duplicated from the past (Hakim, Verma, & Greiffenstein, 1988; Langdon & Coltheart, 2000). The typical episode of reduplicative paramnesia involves a hospitalized patient mistakenly convinced that the present hospital is the same one that he or she had been in earlier (in a different geographical location). As with the Capgras syndrome, this recognition dysfunction is confined to individuals with (delusional) psychopathology usually associated with brain injury involving the frontal lobe (Benson & Stuss, 1990) and is unaltered by providing patients with clear evidence to the contrary (Langdon & Coltheart, 2000). Two other rare misidentification syndromes, Frégoli syndrome (Courbon & Fail, 1927) and intermetamorphosis (Courbon & Tusques, 1932), have also been connected with déjà vu by Berrios (1995). Both involve the belief that a familiar (intermetamorphosis) or unfamiliar (Frégoli syndrome) individual has been replaced by a familiar friend or relative.

Explanations of Déjà Vu

For more than a century, researchers have proposed a variety of explanations for the déjà vu experience. Many are framed within the psychodynamic and parapsychological perspectives, and the interested reader should consult Neppe (1983e) or Sno and Linszen (1990) for further details on these explanations. Scientific interpretations of the déjà vu experience fall into four categories: dual processing, neurological, memory, and attentional. The dual-processing explanations assume that two cognitive processes that normally operate in synchrony become momentarily uncoordinated or out of phase. Neurological explanations suggest that déjà vu represents a brief dysfunction in the nervous system involving either a small seizure or alteration in the normal time course of neuronal transmission. Memory interpretations assume that some aspect of the present setting is objectively familiar but that the source of familiarity has been forgotten. Finally, attentional interpretations posit that an initial perception under distraction is followed immediately by a second perception under full attention.

With respect to ultimately explaining the déjà vu experience, the dual-processing and neurological positions are less useful than the attentional and memory explanations. The dual-processing interpretations have deep historical roots, but they are less clearly and precisely formulated and are grounded more in the theoretical–philosophical than in the empirical realm. The neurological positions are more logically compelling and molecular, but a laboratory test of these explanations may be problematic with today's technology. The attentional and memory interpretations of déjà vu make clear connections with current cognitive findings, and a number of possible empirical tests emanates from these two perspectives.

Dual-Processing Explanations

The first category of déjà vu explanations is based on a disruption in the normal operation of two separate but interactive cognitive processes. At the core of each speculation, two mnemonic processes that generally operate in concert occasionally become asynchronous, or one process becomes activated in the absence of the other.

Familiarity and retrieval. Gloor (1990) proposed that retrieval and familiarity are independent cognitive functions that usually operate in a coordinated manner, with recall accompanied by a sense of familiarity concerning the information retrieved. However, these two processes occasionally operate independently of each other. Thus, retrieval can be activated in the absence of familiarity, which causes an ostensibly familiar setting to become momentarily unfamiliar (jamais vu). Conversely, a familiarity response may become activated in the absence of retrieval (déjà vu). This issue is also related to a large literature concerning the possible independence of recall and familiarity (Gardiner & Parkin, 1990; Tulving, 1985) and the process dissociation procedure (Jacoby, 1991).

Encoding and retrieval. De Nayer (1979) proposed a tape recorder metaphor for déjà vu. Under normal conditions, memory encoding and retrieval operate in a manner similar to the record and play heads (respectively) on a tape recorder: Either the record (encode) or play (retrieve) head can be on but not both at once. On rare occasions, the tape machine in a person's memory has both the record and play heads active simultaneously during a new experience, creating a false sense of familiarity for the newly encoded experience. Though this interpretation is intriguing, it is not well developed and remains at the nascent metaphoric level. Most cognitive psychologists would assume that retrieval of information (from semantic memory) is an important component of successful encoding. In addition, it appears to be at odds with Pashler's (1994) research on the bottleneck model of attention, in which a single, central processor is required for memory encoding, memory retrieval, and response selection. From this perspective, encoding and retrieval can never occur in parallel. Furthermore, other models suggest that memory is the outcome of whatever processing occurred during input (Johnson, 1983; Kolers & Roediger, 1984) rather than being attributed to specific encoding or retrieval operations.

Perception and memory. Another dual-process interpretation, proposed by Bergson, is that perception and memory are simultaneous events and that "memory is never posterior to the formation of perception; it is contemporaneous with it. Step by step, as perception is created, the memory of it is projected beside it, as the shadow falls beside the body" (as cited in Carrington, 1931, p. 303; cf. Tulving, 1968). People's cognitive resources are generally focused on the perception of an ongoing event, but distraction, inattention, or fatigue can lead to memory and perception momentarily enfolding in on each other. Bergson likened this to two soldiers marching in tight formation: If the first one pauses for a moment, the two will bump into each other. Thus, if storage of information occasionally occurs the moment it is perceived, it could give rise to inappropriate recognition or déjà vu.

Dual consciousness. Hughlings-Jackson (1888) suggested that people have two varieties of consciousness: normal, which processes information from the outside world, and parasitic, which monitors the thoughts and reflections of the inner, mental world. When the activity of the normal consciousness is diminished by distraction, fatigue, or seizure (in TLEs), evaluating the familiarity of incoming sensory experiences must depend on the more primitive internal consciousness, which operates from mentally generated images. The result is a momentary misreading of a new experience as old, leading to déjà vu. Rather than dominant and recessive states of consciousness, Wigan (1844) proposed two more equal and coordinated states. Only one is usually operational at any given moment, and it is the occasional activation of the second system simultaneous with the first that results in a déjà vu experience.

> Only one brain has been used in the immediate preceding part of the scene—the other brain has been asleep, or in an analogous state nearly approaching it. When the attention of both brains is roused to the topic, there is the same vague consciousness that the ideas have passed through the mind before. . . . We have no means of knowing the length of time that had elapsed between the faint impression received by the single brain, and the distinct impression received by the double brain. It may seem to have been many years. (Wigan, 1844, pp. 84–85)

Neurological Explanations

A number of researchers have suggested that a déjà vu experience results from a neurological dysfunction involving seizure or a change in the speed of normal neural transmission.

Seizure. Because déjà vu is part of the preseizure aura in some TLEs, a logical extension is that déjà vu in nonepileptic individuals results from a small temporal lobe seizure (Penfield, 1955; Stevens, 1990). In earlier research, Hughlings-Jackson (1888) attempted to determine whether déjà vu was diagnostic of seizure activity, epilepsy, and brain pathology, and Maudsley (1889) suggested that those most susceptible to déjà vu have a higher likelihood of developing epilepsy. Such speculation is supported by the fact that stimulation of the amygdala and hippocampus in TLEs can cause a déjà vu experience (Bancaud et al., 1994; Gloor et al., 1982; Halgren et al., 1978).

However, the weight of evidence argues against déjà vu being more common in people with epilepsy or being diagnostic of seizure pathology (M. A. Harper, 1969; Neppe, 1983e; Richardson & Winokur, 1967). In fact, estimates of the percentage of TLEs with déjà vu as part of their aura is generally quite low (< 1% to 6%; Gupta et al., 1983; Lennox & Cobb, 1933; Mullan & Penfield, 1959; Sengoku, Toichi, & Murai, 1997; Weinand et al., 1994), and studies reporting a higher incidence (11% to 86%) usually include TLEs with intractable seizures undergoing medical procedures to correct this problem (Cole & Zangwill, 1963; Gloor et al., 1982; Halgren et al., 1978; M. Harper & Roth, 1962; Neppe,1983c). A variant of this position is that a more general, right hemisphere dysfunction results in déjà vu, a conclusion stemming from the consistent observation that TLEs with déjà vu have a higher probability of seizure activity originating in the right hemisphere (Cole & Zangwill, 1963; Cutting & Silzer, 1990; Gupta et al., 1983; Jackson, 1880; Mullan & Penfield, 1959; Weinand et al., 1994).

Halgren et al. (1978) used brain stimulation procedures to duplicate a number of components of the preseizure aura in TLEs, among them the déjà vu experience. They speculated that during a typical seizure, a similar type of increased electrical "outflow" from the hippocampal gyrus, an area so intimately involved in encoding and retrieval, may be misinterpreted as a sensation of familiarity. Bancaud et al. (1994) supported such speculation and added that because the lateral temporal lobe receives major inputs from the visual and auditory cortices the nonspecific seizure activity in the temporal lobe combined with current sensory input results in an inappropriate feeling of familiarity.

Neural transmission delay. Another class of neurological interpretations assumes that the déjà vu experience results from a

momentary delay in neuronal transmission from the perceptual organ to the higher order processing centers of the brain. In one version, there is a slight increase in the normal time taken to transmit the message, due to a synaptic dysfunction, and this slight slowing in the routine processing time (several milliseconds) is misinterpreted as representing that the information is old (Grasset, 1904). Anjel (1896) noted that the fatigued state often accompanying déjà vu may underlie this neural slowing, temporarily elongating the time between sensation and perception. The logic behind this position is vague and unspecified, and it seems at odds with research on perceptual fluency. More specifically, individuals interpret faster (easier) processing of information as indicating that the item has been experienced before (Jacoby, 1988; Jacoby et al., 1988). Thus, slower processing should imply that the information is new, not old.

Another version of this transmission delay interpretation involves two neuronal pathways rather than one and has more logical explanatory appeal than the single-pathway version. In the visual system, sensory information traverses multiple pathways between the sensory organ and the higher cortical centers (Goodale & Milner, 1992; Milner & Goodale, 1995; Schneider, 1969). In most instances, the information is first received cortically from the primary and then from the secondary pathway (Weizkrantz, 1986). When the normally brief difference in processing time between the two tracks becomes lengthened, the usually seamless integration of the two messages into a single perception becomes disrupted and is experienced as two separate messages (Comfort, 1977). The brain interprets the second version, through the slowed secondary track, as a separate perceptual experience, and thus the inappropriate feeling of oldness derives from the match with the first input processed moments earlier.

Another version of this dual-pathway speculation assumes that the primary perceptual pathway goes directly to the dominant hemisphere while the secondary pathway routes first through the nondominant and then to the dominant hemisphere (Ephron, 1963; Humphrey, 1923). When the delay of information from the nondominant to the dominant hemisphere is slightly extended, a déjà vu results (Maudsley, 1889; Osborn, 1884; Weinand et al., 1994). A simpler version of this position is that the two hemispheres normally receive the same information simultaneously, but a slight delay of information to one hemisphere results in a déjà vu (Humphrey, 1923; Wigan, 1844). Weinand et al. (1994) and Ephron (1963) proposed that the preseizure electrical disturbance confined to one hemisphere may cause the slight temporal delay in the secondary pathway, resulting in déjà vu. Ephron also speculated that a lesion in the nondominant hemisphere could occasionally slow information transmission from the nondominant to the dominant hemispheres, an interpretation he suggested could be tested during neurosurgical procedures through local anesthesia of the corpus callosum.

A final neurological interpretation of déjà vu, also involving two perceptual pathways, assumes that the primary rather than the secondary pathway is delayed, causing the information from the secondary pathway to arrive slightly before that received from the primary pathway. Information from the primary pathway is routinely interpreted by the individual as the initial perception, so when this information arrives after the secondary pathway information it feels familiar because a "memory" match already exists, only milliseconds old (Comfort, 1977; Ephron, 1963).

Memory Explanations

An extensive literature documents that an individual's response to a particular stimulus can be altered by a prior encounter in the absence of explicit (episodic) recollection of this previous experience (cf. Roediger & McDermott, 1993; Schacter, 1987). Speculation concerning implicit familiarity as a foundation for a déjà vu was originally proposed more than a century ago by Osborn (1884), who suggested that individuals process a considerable amount of information without paying full conscious attention to it and that the subsequent reprocessing of this information may occasionally give rise to a sensation of subjective familiarity in the absence of recollection. What sets the déjà vu experience apart from other implicit memory responses is an inordinately strong impression of familiarity in the absence of explicit recollection. Not all models in this section provide a clear explanation of what causes this intense familiarity, but they do present reasonable frameworks within which the déjà vu experience can be interpreted.

Conflict in source monitoring processes. According to the source monitoring framework (SMF; Johnson, Hashtroudi, & Lindsay, 1993; Mitchell & Johnson, 2000), as events are experienced, various features are encoded (perceptual, spatial, emotional, semantic details, temporal information, ongoing cognitive operations), depending on the processing that occurs. Remembering is a mental activity in which current mental experiences are attributed to past events on the basis of their qualitative characteristics and on the individual's general knowledge and beliefs. Although déjà vu has not been specifically interpreted within the SMF, it is relatively straightforward to do so. For example, suppose that you are excited about a first trip to Seattle, enter the airport terminal on your arrival, and have a strong déjà vu experience. You know that you never have been in Seattle, but the terminal seems incredibly familiar. According to the SMF, a déjà vu experience could arise from the conflict in two types of source monitoring processes. That is, your attribution based on your general knowledge (of never having been in Seattle) is in conflict with the heuristic attribution that is most natural as based on qualities of the mental experience, which imply it is familiar from past perception. Such familiarity could arise from a number of different types of past events encoded in memory. Perhaps you have seen this airport setting in a movie, television documentary, or picture in a magazine, but your current mental experience does not include this additional information that would allow you to identify the source of the familiarity. If you had a sense of familiarity but could identify its source (e.g., a magazine article on the plane), you would not have a déjà vu experience. If you could not identify the source of the familiarity but also thought it was likely that you might have been in Seattle before after all, you also might not have a déjà vu experience.

Duplication of processing. Osborn (1884) suggested that it may not be the content of the memory that is duplicated in a déjà vu but rather the particular cognitive processing that occurred on a prior occasion:

> If at any time in our past lives we passed in actual experience or in imagination over a mental track, say a b c d e, and if to-day [sic] this track is again traversed, although the former experience itself may have been long forgotten, we have a sense that it has been through the mind before. . . . If the mind passes over only part of the former track,

say b c d, we sometimes, in the dim recognition which arises, believe we have been over the whole before. (pp. 480–481)

This interpretation can account for why the strong familiarity essential to déjà vu can occur in a completely novel setting. Osborn's position is similar to the theory of transfer appropriate processing (Kolers, 1973; Kolers & Roediger, 1984; Morris, Bransford, & Franks, 1977; Roediger, Weldon, & Challis, 1989), in which retrieval success depends on the correspondence between the way the information is processed during input and retrieval. If similar mental procedures occur on both occasions, then recollection probability is high. If the processes are dissimilar, the likelihood of remembering the information is low. Thus, if the processing of the new information duplicates the mental procedures that occurred with a prior but unrelated experience, an unexpected sense of familiarity and déjà vu may result, even though the stimulus elements in both situations are different.

Single-element familiarity. A déjà vu experience may be triggered by one element of the present setting that is objectively familiar but unrecognized because it is experienced in a new and changed context. The familiarity elicited by the one unidentified object is misinterpreted as a response to the entire setting, resulting in déjà vu. To illustrate, suppose that you visit a friend's home for the first time, and the grandfather clock in the corner is identical to one in your aunt's home. While you experience a familiarity reaction to this element, you are unable to connect your response to the "old" object and misattribute the familiarity to the entire new setting, resulting in a déjà vu. This interpretation was proposed in earlier writings on the déjà vu experience (Banister & Zangwill, 1941a; Boirac, 1876; Boring, Langfeld, & Weld, 1935; Bourdon, 1894; Conklin, 1935; Humphrey, 1923; James, 1890; Lapie, 1894; Leeds, 1944; Oberndorf, 1941) and has been resurrected in more recent speculation (Jordan, 1986; Levitan, 1969; Reed, 1979; Sno & Linszen, 1990; Zeidenberg, 1973).

MacCurdy (1925) called this phenomenon *restricted paramnesia*: the experience in which an element of the present setting is familiar but its prior identity is obscure. Banister and Zangwill (1941a, 1941b) used hypnotic suggestion to test this notion that a previously encountered but "forgotten" stimulus can be misidentified as familiar. They did not intend to create a déjà vu, but wanted simply to evaluate whether participants could misattribute a hypnotically forgotten stimulus to the wrong setting. On the first day, participants studied pictures and odors during a normal waking state. On Day 2 they were hypnotized and presented with additional picture and odor stimuli, followed by a posthypnotic suggestion to forget these Day-2 stimuli. On Day 3, participants were tested with a mixture of new and old stimuli, and most participants (3 out of 5) misidentified some Day-2 stimuli as having been presented on Day 1. Although Banister and Zangwill (1941a, 1941b) emphasized that their study supported the possibility of such paramnesias, they noted that the relationship between their study and déjà vu was "conjectural" and said that the results "throw little light on the origin of déjà vu" (Banister & Zangwill, 1941b, p. 51). Despite this disclaimer, hypnotic procedures may hold some promise for an experimental paradigm to elicit déjà vu if accompanied by a sufficiently unique context within which to later experience the subsequently forgotten stimuli.

Also related to the single-element hypothesis is Whittlesea and Williams's (1998) extension of the processing fluency theory of familiarity. Jacoby and Dallas (1981) demonstrated that when information is reexperienced, it is processed more easily and rapidly than in the first encounter, and this fluid reprocessing gives rise to a sense of oldness concerning the stimulus. Whittlesea and Williams argued that in the real world, the processing fluency basis of familiarity occurs primarily when the object or person is encountered in an unexpected context. In theory, meeting your spouse in your own kitchen should engender considerable processing fluency because of repeated exposures, leading to a strong familiarity response. However, this does not occur. In fact, such encounters curiously elicit no sense of familiarity. In contrast, if you unexpectedly spot your spouse sitting in the middle of your class as you lecture, this would arouse an intense and immediate sense of familiarity. Similarly, seeing your mail carrier at your front door arouses no sense of familiarity, but seeing him or her at the movie theater evokes a strong sense of familiarity due to the novel context (Reed, 1979). Applying this interpretation to déjà vu, if an individual experiences a single familiar (but unrecognized) element in an unfamiliar context, the fluent reprocessing of this one element may elicit a déjà vu experience specifically because the context is different.

Extending the single-element position in a different direction, Sno and Linszen (1990) proposed a holographic explanation of déjà vu (see also Meurs & Fies, 1993). If memories are stored as holograms (cf. Pribram, 1969), then each memory involves a unique pattern of neural activation involving the entire cortex. That is, a memory (first kiss, favorite song) is not based on physical storage but on a unique wave form pattern of neural activation. If any perceptual element in a new scene overlaps with an element of a previous memory, then this has the potential to reactivate the entire old memory (Kafka, 1989). If only the implicit familiarity component of that prior experience is reactivated, a déjà vu results. However, if both implicit and explicit components are reactivated, the present setting simply reminds the person of a prior experience.

The single-element interpretation of a déjà vu is also related to the Poetzl (1917/1960) phenomenon, in which elements of a briefly presented stimulus appear later as a response in an unstructured generation task such as free association, day dreaming, or doodling (cf. N. F. Dixon, 1971). Whereas later extensions of this research evaluated a psychoanalytic theory of dreams, Poetzl's work was experimentally oriented and involved subthreshold presentations of simple stimuli, or brief suprathreshold presentations of complex visual scenes. The Poetzl phenomenon occurs when these stimulus elements are not immediately accessible (remembered) but appear later in subsequent free associations to word or pictorial stimuli (Allers & Teler, 1924/1960; Erdelyi, 1970; Haber & Erdelyi, 1967; Shevrin & Fritzler, 1968; Silverman & Silverman, 1964). Although usually evaluated through recall procedures, the Poetzl phenomenon could occur with recognition as well, and could underlie the déjà vu experience.

The above interpretations focus on a single element; however, it is possible that several familiar elements are involved in a déjà vu experience (Findler, 1998; Fleminger, 1991; Wohlgemuth, 1924). Wohlgemuth (1924) presented an extensive analysis of a personal déjà vu experience and found that three elements in the setting duplicated aspects of three separate episodic memories. He speculated that these multiple single elements summated to create an unusually strong feeling of familiarity, whereas none of the individual elements' contextual associations was sufficiently strong to

reach threshold, or competition among the separate contextual associations blocked access to any specific episodic memory. This mechanism is similar to that proposed by Hintzman (1988) in his MINERVA model of memory.

Single-element emotional association. Another framework for interpreting a déjà vu is that some aspect of the present situation triggers an affective response which then elicits a déjà vu. Under this interpretation, the strange feeling accompanying a déjà vu is not elicited by the unsettling contrast between implicit familiarity and explicit source memory failure. Instead, the feeling is evoked by a conditioned emotional association to a particular stimulus. Under most circumstances, a person can identify the particular stimulus (seeing a person, hearing a name, smelling a perfume) that elicits an emotional reaction. When this implicit emotional reaction cannot be connected to its source, the person misidentifies the emotional arousal as familiarity to an unfamiliar setting and a déjà vu results (Pagliaro, 1991; Siomopoulos, 1972). Thus, the implicit affective (emotional) response is immediately reinterpreted in a cognitive (familiarity) manner. To illustrate, imagine you enter a hotel you have never been in before, and a couch in the corner of the lobby is identical to one that was in your grandparents' house. You experience a strong implicit (and positive) emotional reaction to the item of furniture without explicitly recognizing the item as the source of your affective response. Baldwin (1889) suggested that the emotional reaction must reach a certain level of intensity before it forces the inappropriate feeling of familiarity, and Siomopoulos (1972) speculated that implicit emotional associations to objects may persist long after conscious recollection has disappeared. In support of this possibility, Johnson, Kim, and Risse (1985) demonstrated that in patients with Korsakoff's amnesia, an affective response to a stimulus could be acquired in the absence of explicit memory.

MacCurdy (1928) speculated that there are always two components of a nominal recognition response: an initial affective reaction, followed immediately by the familiarity (cf. Zajonc, 1980). Although these two stages usually follow in quick and seamless succession, and are essentially indistinguishable as separate processes, déjà vu results when the initial affective stage is not succeeded by a clear second-stage memory match. Fleminger (1991) similarly suggested that the affective and cognitive channels of information processing usually work in concert but that déjà vu results from "aberrant activity in the pathway responsible for affective interpretation of percepts" (p. 1418). Linn (1953) further speculated that it is not an affective response, in general, that triggers a déjà vu. Rather, anxiety evoked by some aspect of the present situation disrupts the normal functioning of the reticular activating system. Thus, Linn (1953) assumed that a change in arousal precipitates a déjà vu, rather than a specific affect associated with a stimulus.

These emotion-based interpretations of the déjà vu experience are related to the subliminal mere exposure research, in which unfamiliar stimuli exposed at levels well below perceptual threshold (i.e., 5 ms) are later preferred over nonexposed stimuli even though participants are unable to recognize these exposed stimuli as old (Bornstein, 1992; Kunst-Wilson & Zajonc, 1980). In fact, Seamon et al. (1983) specifically related their research on subliminal mere exposure to déjà vu:

> In déjà vu, stimuli are recognized as familiar without recognition of the basis of their familiarity. Essentially, the same outcome was observed in this study: people liked familiar stimuli without recognizing the basis for their familiarity. In this respect, the finding of target selection by affect in the absence of recognition is similar to the well-known, but poorly understood, phenomenon. (p. 188)

This parallel with subliminal mere exposure may be strained because what is typically measured in this research is preference or liking—a modest affective response, at best. What is needed is a way to experimentally evoke the type of intense affective reaction characteristic of a déjà vu. Both number of exposures and test delay are directly related to preference (Bornstein, 1989), so perhaps a large number of subliminal exposures and long input-to-test delay could intensify the affective response to a level capable of eliciting a déjà vu.

Gestalt familiarity. When the overall perceptual configuration of the present stimulus array is similar to one experienced previously, this gestalt correspondence could trigger a déjà vu (Reed, 1974). Recall the example of the first visit to a friend's home as an illustration; it is not the grandfather clock in the corner of your friend's living room that is familiar, rather the familiarity comes from the fact that the room has a layout similar to the one in your aunt's house: a sofa to the right of the love seat with a stairway to the left going up the wall, a grandfather clock against the back wall, and an Oriental rug on the floor. None of the elements in the newly entered living room is identical to one from the previous context, but the particular configuration of elements fits the same template. Sno and Linszen (1990) suggested that different scenes and individuals often overlap in many structural details, and when perception is degraded the general framework of a prior experience may overlap considerably with the present one. Using similar logic, Levitan (1969) suggested that in recognizing an entire scene or setting, people automatically break it down into simpler perceptual forms such as cubes, triangles, circles—a process similar to what cubist painters did. This is also related to Biederman's (1987) notion that all perceptual experience can be reduced to a relatively small set of *geons*, which represent the range of all primitive perceptual forms. Thus, the untoward sense of familiarity eliciting déjà vu in an unfamiliar setting may arise because the arrangement of the reduced perceptual forms matches those from a prior experience. Gloor (1990) also used this gestalt analogy and tied his speculation to déjà vu experiences in the preseizure aura of TLEs. Drawing on the parallel distributed processing model of Rumelhart and McClelland (1986), Gloor suggested that the erratic firing of neurons in the temporal lobe prior to the seizure gives rise to spurious matches between the present visual scene and prior visual experiences. For both Sno and Linszen (1990) and Gloor, perceptual degradation was more likely to precipitate such configural matches. Assuming that fatigue or stress are associated with such reduced perceptual precision, this fits with the earlier suggestion of an association between fatigue and déjà vu.

Attentional Explanations

The fourth framework for interpreting déjà vu is that an ongoing stream of perceptual experience is divided into two separate perceptions through distraction or inattention. A brief initial perception of a scene under diminished attention is followed immediately by a second perception under full attention. The second impression

matches that experienced moments earlier under degraded attention, and the individual does not consciously identify the prior experience as moments old but rather attributes it to a more distant past. Many researchers have espoused different versions of this interpretation (Conklin, 1935; Heymans, 1904; Lalande, 1893; Osborn, 1884; Wigan, 1844), and Titchener (1928) provided the following, oft-cited illustration:

> 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, which 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. (pp. 187–188)

Leeds (1944) called this phenomenon *split-perception* and proposed that an eye blink could possibly divide these two successive perceptions. Mayer and Merckelbach (1999) even suggested that this type of double take may be part of routine perception. The first second of information processing may be a platform from which a "quick and dirty" unconscious processing can have important effects on subsequent reactions to the stimuli around us. Though Mayer and Merckelbach related their speculation to anxiety disorders, their ideas have clear relevance to the déjà vu phenomenon. Finally, Krijgers Janzen (1958) speculated that an initial and unattended eidetic image matches a regular perception moments later. He argued that all people experience eidetic imagery occasionally and that regular eidetic imagers would experience déjà vu more frequently than individuals who have eidetic images infrequently.

Perceptual fluency. This model for the déjà vu experience was evaluated by Jacoby and Whitehouse (1989), who discovered that when a test word was briefly presented (and masked) at subthreshold levels immediately prior to presentation on a recognition test, individuals were more likely to call the word "old" compared with a word not briefly preceded by itself. They attributed this illusion that the word had occurred on a prior list to its facilitated processing (perceptual fluency) engendered by the immediately prior subliminal presentation. This fluency bias supposedly precipitates the common experience of having a word appear to "jump out from the page" when reading (Jacoby & Dallas, 1981, p. 333). Similarly, when a primed perceptual element suddenly and forcefully stands out, and source identification is lacking, this may precipitate a déjà vu. Jacoby and Whitehouse related this finding directly to the déjà vu phenomenon, but the paradigm is lacking the element of "this could not have happened here before." In this type of experimental setting, participants logically can misattribute the word to having occurred in the prior experimental list rather than being convinced that they could not have experienced this word before.

There has been debate over whether participants in this particular paradigm are consciously aware of the masked prime word (Bernstein & Welch, 1991; Joordens & Merikle, 1992; Watkins & Gibson, 1988), but this issue does not undermine the potential relevance of this paradigm for modeling the déjà vu phenomenon. In fact, a supraliminal perceptual experience corresponds to Titchener's (1928) illustration above, and modifying the Jacoby–Whitehouse design to have a divided attention manipulation, rather than subliminal presentation, may better model the déjà vu experience. Merikle, Smilek, and Eastwood (2001) summarized the literature on perception without awareness and indicated that there are numerous investigations that suggest that stimuli presented either subliminally or supraliminally (but unattended) consistently have a potential to influence subsequent behavior.

Inattentional blindness. Related to this interpretation of the déjà vu, recent research suggests that individuals often miss objects that are clearly visible if they are focused on some other object in the visual array. This inattentional blindness, extensively investigated by Mack and Rock (1998), could explain how an initial brief perception of objects in a scene can go undetected. When an extraneous visual stimulus (e.g., shape, object, word) accompanies a target stimulus (e.g., cross) to which the participant is instructed to respond (e.g., Which line of the cross is longer?), the individual often misses seeing the extraneous stimulus. When the target stimulus is in the periphery and the extraneous (ignored) stimulus is in the center of the visual field (fovea), inattentional blindness is more likely than when the target stimulus is in the fovea and the extraneous stimulus is in the periphery. Individuals who fail to report the extraneous (e.g., word) stimulus still process it, as reflected in significant priming on a subsequent word stem completion task (Mack & Rock, 1998). Such a paradigm, in which the stimulus is above threshold but unattended (rather than subthreshold), better models people's natural perceptual experience (Merikle et al., 2001) and provides a more realistic framework for studying the déjà vu experience. For example, one may enter a room talking on a cell phone or thinking about an upcoming meeting while looking directly at a particular stimulus, and moments later this same stimulus is consciously perceived and elicits a déjà vu. Perhaps one of the most blatant examples of inattention to suprathreshold stimuli is the "time gap" experience, in which one's entire perceptual experience over several minutes (e.g., during highway driving) is unrecallable (Reed, 1979).

It is possible that an inhibitory mechanism underlies the inattentional blindness effect. In elaborating on Poetzl's (1917/1960) earlier speculation, N. F. Dixon (1971) suggested that during an initial brief stimulus exposure there is "a rapid fragmentation of the sensory information, wherein 'inhibition by interference' causes parts of the stimulus field to interfere with the development of other parts" (p. 106). Thus, certain elements in the stimulus array may suppress or block the perception of other elements, similarly to lateral inhibition in the visual system (cf. Martindale, 1981). In a second glance at the scene immediately after the first, the initially inhibited portion of the visual scene is disinhibited and now matches the present perception. The possibility that inhibition–disinhibition underlies déjà vu is supported by the fact that both inhibitory processes and déjà vu frequency decrease with age. The magnitude of negative priming interference, for which a response which is actively inhibited on one trial is more difficult to generate on the immediately succeeding trial, is much smaller with older than younger adults (Hasher, Stoltzfus, Zacks, & Rypma, 1991). If the visual inhibition of parafoveal elements similarly decreases with age, this would reduce the likelihood that inhibited features would later disinhibit and lead to a déjà vu.

Questionnaire Development

A redesign of the retrospective survey is needed, along with the publication of the survey results based on a large and representative sample of individuals across a wide range of ages as well as ethnic and racial backgrounds. Do individuals in cultures more tolerant of mystical experiences tend to report more déjà vu experiences (cf. Stevenson, 1987)? Given the relative rarity of déjà vu, a research effort that combines retrospective and prospective questionnaire methodologies would prove most useful. The survey should ask about acute and chronic stressors, current medications, recent changes in residence and work location, and belief in paranormal phenomena. Respondents should also provide their personal definition of déjà vu, and oral versus written administration methods should be compared (M. A. Harper, 1969). Déjà vu in TLEs should be systematically examined and compared with that experienced by people without epilepsy. Furthermore, the presence of déjà vu in people with various neurological conditions should be explored (cf. Richardson & Winokur, 1968), including individuals with various amnesias and cerebral commisurotomy ("split-brain") patients (cf. Kirshner, 1973).

Experimental Evaluation

Scientifically based speculation concerning the déjà vu experience has spanned more than a century. Some have expressed pessimism about the possibility of scientifically studying déjà vu, mainly because of the phenomenon's transient nature (Sno & Linszen, 1991) and the absence of any clearly identifiable eliciting stimulus event (Funkhouser, 1983; Green, 1966; Osborn, 1884). Perhaps the biggest challenge in creating a laboratory paradigm to simulate a déjà vu experience will involve eliciting the overwhelming sense of familiarity, accompanied by the confidence that this stimulus could not have occurred previously in this context. In past research touching on the déjà vu experience, the experiential context has not been novel (Banister & Zangwill, 1941a, 1941b; Jacoby & Whitehouse, 1989; Seamon et al., 1983) in that both study and test procedures occurred in the same laboratory setting with homogeneous stimuli. This problem needs to be seriously addressed in any future experimental approach to modeling the déjà vu experience in the laboratory.

Below are several experimental approaches that have potential to help clarify the déjà vu phenomenon. Though none may duplicate a natural déjà vu experience, several may create an approximation sufficiently close to allow further theoretical speculation and direct exploratory efforts.

Neurological. The neurological model of déjà vu, which is based on variation in normal processing sequence, could be evaluated in a continuous recognition procedure with split screen presentation. On each trial, two stimuli would be shown on a computer monitor—one in the left and one in the right visual field—and participants would make a recognition decision about whether either or both stimuli are old. On critical trials, the two stimuli would be identical (i.e., same word or picture in both visual fields) but presented asynchronously. If a delay in the secondary path underlies the déjà vu, then slightly retarding (by several

milliseconds) the presentation of a new word in the left visual field or new picture in the right visual field should increase false alarms relative to a synchronous presentation of the two duplicate versions of the new stimulus. If a slight delay in the primary pathway underlies the déjà vu, then retarding the presentation of a new word in the right visual field or new picture in the left visual field should increase false alarms relative to synchronous trials.

Memory. With respect to creating an implicitly familiar stimulus in the absence of explicit recollection, several procedures could be used. With the subliminal mere exposure paradigm (Seamon et al., 1983), a large number of subliminal exposures and long input-to-test delay (Bornstein, 1992) could substantially increase the magnitude of the affective response to the subsequent, supraliminal presentation of the stimulus. Post hypnotic suggestion also holds some potential (Banister & Zangwill, 1941a, 1941b) for eliminating the sense of familiarity for a previously encountered stimulus.

To evaluate the single-element familiarity position, photographs of complex visual scenes (living room, hotel lobby, courtyard) could be used in a continuous recognition task, with single elements from prior scenes (chair, wall picture, fountain) inserted into new scenes. One group of participants would indicate whether the whole scene was a repetition. If single-element familiarity drives the déjà vu experience, participants should have more "global" false alarms to new scenes containing an old element compared with new scenes without an old element, and confidence in such false alarms should be higher for the former than for the latter stimuli. A second, comparison group would be instructed to focus on the individual elements in the scene and to respond "old" if any element had appeared in a previous scene. These manipulations could have even greater verisimilitude by using virtual reality technology with naturalistic environmental stimuli.

Attentional. The research domain of perception without awareness seems to hold a tremendous potential to elucidate the déjà vu experience.

> How does information that is perceived without awareness influence conscious experience? This question has received relatively little attention in experimental studies to date because the goal of the vast majority of studies has been simply to demonstrate perception without awareness. (Merikle et al., 2001, pp. 128–129)

Divided attention manipulations with unique and complex stimuli (natural scenes, impossible figures, Chinese ideographs) could also model the déjà vu experience. A good experimental vehicle is the flanker task (Hawley & Johnston, 1991; Mulligan & Hornstein, 2000), in which a focal (attended) stimulus is presented in the center of a computer screen with flanker (unattended) stimuli presented either above, below, left, or right of the focal stimulus. A flanker stimulus on Trial N, which becomes the target on Trial N + 1, could elicit the type of false familiarity characteristic of a déjà vu. Also, complex natural scenes could be used in which the participant's attention is directed to one feature (e.g., Is there a bird's nest in the tree?), and a nonfocal feature of the present scene (a barn) becomes the focal element in the scene that is presented next in the series (e.g., "Is there a window in the barn?"). Recognition decisions could include confidence ratings, as well as source evaluations on whether the scene is an intraexperimental (recent or

remote trial) or extraexperimental (cf. Schacter, Harbluk, & McLaughlin, 1984) duplication.

Conclusions

Déjà vu is experienced by a majority of the population, and occurs about once a year in experients. The incidence decreases with age but increases with education and socioeconomic class. Déjà vu is more common under conditions of stress and fatigue, and it is experienced more frequently by persons who travel. Societal acceptance of the phenomenon appears to have increased over recent decades. Though déjà vu historically has been linked to temporal lobe epilepsy and schizophrenia, this association has not been convincingly demonstrated. Explanations of the phenomenon have included (a) momentary alteration in the normal operation of two usually coordinated cognitive processes; (b) neurological dysfunction (seizure, slowed synaptic transmission); (c) implicit memory activation based on familiarity of processing, object, or gestalt configuration; and (d) unattended perception (under distraction) followed immediately by a fully aware perception. Although the déjà vu experience occupies a solid position in the popular culture, the community of research psychologists has been largely silent on the topic. It is hoped that the use of more sophisticated research techniques to help elucidate this illusion of recognition will change this situation and that the findings from such research efforts could expand the field's understanding of routine memory functions. As Roediger and McDermott (2000) suggested, "distortions of memory provide a fertile ground for studying interesting and important psychological phenomena" (p. 123).

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