

The Mere Exposure Effect in Patients with Schizophrenia

by Ariane Marie, John D.E. Gabrieli, Chandan Vaidya, Bonny Brown, Felicia Pratto, R.B. Zajonc, and Richard J. Shaw

Abstract

The mere exposure effect refers to the development of an emotional preference for previously unfamiliar material because of frequent exposure to that material. This study compared schizophrenia subjects ($n = 20$) to normal controls ($n = 21$) to determine whether implicit memory, as demonstrated by the mere exposure effect, was intact. Patients with schizophrenia demonstrated a normal preference for both verbal and visual materials seen earlier relative to novel materials, despite impaired performance on a recognition task for explicit memory using similar materials. Previous studies of schizophrenia subjects have shown a dissociation between implicit and explicit memory on verbal tasks. We found a similar dissociation demonstrated by normal functioning on an implicit memory task and impaired functioning on an explicit memory task. Potential implications of these findings are discussed with regard to treatment and rehabilitation.

Keywords: Schizophrenia, mere exposure effect, implicit memory, explicit memory.

Schizophrenia Bulletin, 27(2):297–303, 2001.

Much of contemporary research in schizophrenia has led to findings that suggest a wide range of neurocognitive deficits. For example, patients with schizophrenia are found to have impairments on tasks that assess attention, memory, verbal fluency, and affect recognition (Shoeqirat and Mayes 1988; Carter et al. 1992; Hanes et al. 1996; Shaw et al. 1999). Many of these findings have been used to generate hypotheses regarding the neuroanatomical and neurophysiological basis of schizophrenia.

Given the overwhelming evidence supporting deficits in patients with schizophrenia, it is important to find areas that show preservation of functioning in order to define the limits of impairment. One area of functioning that may be

preserved in patients with schizophrenia is that of *implicit memory*. Implicit memory is assessed by tasks that do not explicitly instruct subjects to recall past events and experiences. Although there is no explicit reference to a past event, the subject's performance on implicit tasks is facilitated by prior exposure due to a phenomenon referred to as priming (Graf and Schacter 1985). *Explicit memory*, by contrast, does require the ability to consciously recollect past experiences. Several studies suggest that performance by schizophrenia subjects on verbal tasks demonstrates normal implicit memory but impaired explicit memory (Schmand et al. 1992; Schwartz et al. 1992; Clare et al. 1993; Gras-Vincendon et al. 1994; Bazin and Perruchet 1996; Michel et al. 1998; Kazes et al. 1999).

Common experimental tests used in the assessment of implicit memory include associative memory and word stem completion tasks, as well as tests of semantic priming and category production. One other paradigm that may have particular value in assessing implicit memory in patients with schizophrenia is the *mere exposure effect* (Zajonc 1968). The mere exposure effect is the development of an emotional preference for previously unfamiliar material due to frequent exposure to that material; that is, subjects express greater liking for familiar stimuli than for unfamiliar stimuli (Zajonc 1980; Bornstein 1989). Items that are preferred have acquired an emotional association that may function as one of the many discriminating cues for different memories. An important characteristic of the mere exposure effect is that it occurs independent of conscious or explicit memory of the same material. Participants develop a liking for repeated stimuli regardless of their impression of familiarity with the same stimuli (Zajonc 1980; Murphy et al. 1995). For example, one study demonstrated that patients with alcoholic Korsakoff's syndrome developed the same increase in preference for previously heard melodies as normal con-

Send reprint requests to R. Shaw, Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, 401 Quarry Road, Stanford, CA 94305-5719.

trols, despite impaired explicit recognition of these melodies (Johnson et al. 1985). Thus, the ability to develop preference as demonstrated by the mere exposure effect depends upon intact implicit memory (Manza and Bornstein 1995; Seamon et al. 1995). Traditional reviews and a meta-analysis of mere exposure research demonstrate that the exposure effect is a robust, reliable phenomenon in healthy participants that is replicable across diverse cultures (Bornstein 1989; Bornstein et al. 1990; Murphy et al. 1995).

In the current study, we examined whether patients with schizophrenia demonstrated the mere exposure effect. Specifically, we compared the performance of schizophrenia subjects with the performance of normal control subjects on preference and recognition tasks. An important feature of our study design was that the only difference between the preference (implicit memory) and recognition (explicit memory) tasks was that subjects were asked to state which of the two stimuli they liked better or had seen previously. All other aspects of the two tasks—stimuli, study-test interval, and presentation time—were held constant. Our hypothesis was that schizophrenia subjects would have intact performance on the implicit memory task but impaired performance on the explicit memory task.

Methods

Participants. Subjects were chronically ill male patients with schizophrenia. Diagnoses were reached by consensus of a clinical psychiatric interview conducted by a senior psychiatrist or psychologist and a Structured Clinical Interview for *DSM-III-R* (Spitzer et al. 1990) carried out by a trained research assistant. Participants were tested after 2 weeks of inpatient status and 2 weeks of medications and treated with either a conventional antipsychotic agent or risperidone. Patients were assessed as competent to give informed consent for the study and to complete the study tasks. Exclusion criteria included a prior history of major medical or neurological illness, seizure disorder, head injury, or loss of consciousness, but not comorbid substance or alcohol abuse.

A Brief Psychiatric Rating Scale (BPRS) score was obtained from each subject. The BPRS is a widely used clinician-based rating scale that is used to derive 18 items representing common psychiatric symptoms (Overall and Gorham 1962). The total score is used as a global measure of psychopathology. Subsets of the scale can be used to derive a BPRS positive symptom score (Conceptual Disorganization, Hallucinatory Behavior, Unusual Thought Content) and a BPRS negative symptom score (Emotional Withdrawal, Motor Retardation, Blunted Affect). Faustman (1994) provides a comprehensive

review of the properties of the scale and its application as a research instrument. The mean total BPRS score for our subjects was 37.3 (range 22.5–62.5) with a mean positive symptom score of 8.0 (range 3.0–14.5) and a mean negative symptom score of 6.5 (range 4.0–11.0).

The performance of the schizophrenia subjects was compared to that of male normal controls who were recruited from the local community and who were screened for evidence of chronic diseases, substance abuse history, or psychiatric illness. The control group did not significantly differ from the schizophrenia subjects in age, childhood socioeconomic status as assessed using the Hollingshead Index (Hollingshead and Redlich, 1985), hand preference, or ethnicity. There was a difference in education level between the control group and schizophrenia subjects ($p < 0.01$). The lower education level of the patients with schizophrenia was an expected consequence of chronic mental illness (Stone et al. 1998). Demographic data for both groups are presented in table 1.

Apparatus. Stimuli were presented to the participants using a PsyScope software program run on a Macintosh computer (Cohen et al. 1993). Participants sat in a dimly lit room about 2 feet from a computer screen that was set to maximum brightness. The experimenter sat slightly behind the participant, reading the instructions aloud and entering participants' verbal responses.

Stimuli. The verbal stimuli were 48 Turkish words of uniform length; none of the participants read or spoke Turkish. The nonverbal stimuli were 48 black-and-white photos of male faces with neutral expressions; the photos had been obtained from a college yearbook. All stimuli were rated and paired by matching for degree of preference as measured by normal volunteers.

Table 1. Demographic variables

Variables	Normal control subjects ($n = 21$)	Schizophrenia subjects ($n = 20$)
Age (mean)	42	43.2
Hollingshead Index (mean, childhood SES)	2.9	3.2
Hand preference		
Right	16	20
Nonright (left or ambidextrous)	5	0
Ethnicity		
Caucasian	17	12
Black	2	5
Hispanic	0	1
Asian	2	2

Note.—SES = socioeconomic status.

Procedure. The experiment consisted of study and test phases. The paired stimuli were divided to form two sets of 48, set A and set B, each containing 24 words and 24 faces. In the study phase, half of the participants saw set A and half saw set B. Participants were visually exposed five times each to stimuli from their set. The order of the 240 exposures was randomized, mixing words and faces, and then held constant for all participants. The exposure duration was 700 milliseconds (ms) with an intertrial interval of 20 ms. Participants were told that the experiment was composed of two parts but were not told the nature of the test series before completing the study phase. The interval between the study phase and the test phase was only as long as was required to read the directions and answer possible questions from the subject.

In the test phase, all participants saw both sets and made paired comparisons between stimuli from set A and set B. For half of the stimulus pairs, participants were asked to choose which one they had seen before in the study phase (recognition judgments). For the remaining pairs, they were asked to indicate which stimulus they preferred (preference ratings). For the recognition judgment, subjects were told by the instructor, "Your task is to indicate which picture/word in a pair is 'Old' (which picture/word have you seen before). Whether it was the one on the RIGHT or the one on the LEFT." For the preference ratings, subjects were instructed "Your task is to indicate which picture/word in a pair do you PREFER (which picture/word do you like better). Whether it was the one on the RIGHT or the one on the LEFT." The administrator entered responses of "left" or "right." These judgments were made in blocks of 12 items each and were presented in the following order: one block of recognition judgments, two blocks of preference ratings, and one block of recognition judgments. Thus, the mean study-test interval was identical for recognition and preference judgments. Each pair was presented for 2,500 ms, and then the participant had as much time as necessary to make a choice. After completing the test phase, participants were debriefed.

Results

The numbers of studied (previously exposed) words and faces selected as "preferred" on the preference test and as

"old" on the two-choice recognition test were analyzed in separate repeated measures analyses of variance with group (control or schizophrenia) as a between-subject factor and repetition (studied or chance) and stimulus type (words or faces) as within-subject factors. Because subjects were tested in blocks of 12 pairs, selection of 6 studied items constituted performance at chance. Table 2 shows the number of studied items as a function of stimulus type.

Participants showed a preference effect—the number of studied stimuli selected as "preferred" was greater than chance (main effect of repetition, $F_{1,37} = 23.6, p < 0.0001$). The magnitude of preference for old stimuli did not differ between control and schizophrenia subjects or between words and faces, as shown by the finding that no other main effects or interactions approached significance (p 's > 0.22).

On the two-choice recognition test, participants performed above chance (main effect of repetition, $F_{1,37} = 263.1, p < 0.0001$). However, control participants' recognition performance was superior to that of patients with schizophrenia (Group by repetition interaction, $F_{1,37} = 30.7, p < 0.0001$). Participants' recognition performance did not differ for words and faces, as shown by the finding that there were no main effects or interactions involving stimulus type (p 's > 0.24).

In the schizophrenia group, there was no statistically significant correlation between psychiatric symptoms (BPRS total, positive, or negative symptom scores) and performance on either the preference or recognition tasks. Education was not included as a covariate in the statistical analyses because the lower education level of the schizophrenia patients did not influence preference formation, and so was not expected to differentially influence recognition performance.

Discussion

Both the schizophrenia patients and normal controls developed a preference for novel material because of prior exposure to that material. Critically, the magnitude of preference did not differ between groups. However, schizophrenia participants were less accurate than normal controls on the recognition task. In other words, schizophrenia participants demonstrated the mere exposure effect to

Table 2. Mean number of studied words and faces selected on preference and two-choice recognition tasks¹

Group	Preference (Implicit Memory Test)		Recognition (Explicit Memory Test)	
	Words, mean (SD)	Faces, mean (SD)	Words, mean (SD)	Faces, mean (SD)
Normal control subjects	7.9 (2.3)	6.8 (1.2)	10.9 (1.4)	10.6 (1.5)
Schizophrenia subjects	7.1 (2.3)	7.1 (2.4)	8.1 (2.3)	8.6 (1.8)

Note.—SD = standard deviation.

¹ Chance = 6.0.

the same extent as control participants, despite impaired recognition for the same stimuli. The results suggest that preference formation based upon prior exposure, a measure of implicit memory (Manza and Bornstein 1995; Seamon et al. 1995), is intact in schizophrenia patients.

While the mere exposure effect has not previously been examined in patients with schizophrenia, there have been similar studies using alternate methodologies that support our results. For example, Huron et al. (1995) describe a study in which performance by schizophrenia subjects on a recognition task was impaired in contrast to intact performance on a task that assessed familiarity without any explicit recollective experience. Additional studies of schizophrenia subjects have used verbal tasks to assess implicit memory and have shown a dissociation between implicit and explicit memory (Schmand et al. 1992; Schwartz et al. 1992; Clare et al. 1993; Gras-Vincendon et al. 1994; Bazin and Perruchet 1996; Michel et al. 1998; Kazes et al. 1999). In our study, we used the formation of preference for previously exposed material to test implicit memory and showed a similar dissociation between implicit and explicit memory.

There has been considerable speculation regarding the significance of the finding of a dissociation between performance on tasks of implicit memory and performance on tasks of explicit memory in both normal and schizophrenia subjects. There is evidence to suggest that there may be both functional and neuroanatomical differences that explain this dissociation. Tulving and Schacter (1990), for example, suggest that the dissociation between performance on tests of implicit and explicit memory may reflect the operation of separate memory systems. By contrast, other authors have suggested that it may reflect a distinction between unconscious and conscious mental processes used to retrieve previously learned information (Schwartz et al. 1993). In addition, there is evidence that the hippocampus is required for explicit, but not implicit, memory functioning (Squire 1992). Efforts to interpret these findings include the suggestion that schizophrenia patients may have a disturbance in the *internal representation of context*, also described as working memory or the ability to keep information actively in mind, that interferes with performance on explicit but not implicit memory tasks (Gras-Vincendon et al. 1994; Servan-Schreiber et al. 1996; Goldman-Rakic and Seleman 1997). Support for this hypothesis comes from evidence that working memory appears to be modulated by the prefrontal cortex and is significantly impaired in patients with schizophrenia (Goldman-Rakic 1991; Gold et al. 1992; Seidman et al. 1995; Kremen et al. 1996). Our study adds to the existing literature by using a different experimental paradigm to demonstrate the preservation of implicit memory in schizophrenia.

This body of research has also generated speculation about the potential implications for the treatment and

rehabilitation of schizophrenia patients. Schwartz et al. (1992) suggest that distinguishing between the nature of the specific memory deficits may be useful in subtyping patients with schizophrenia to help in predicting a patient's prognosis, in addition to leading to the potential development of new therapeutic strategies. Wexler et al. (1997) demonstrated that training techniques based on principles of implicit learning helped chronic, symptomatic, low-functioning schizophrenia patients attain neurocognitive performance levels within the normal range. These authors conclude that with appropriate training procedures, including those based on implicit learning, schizophrenia patients may have much greater potential in the domains of rehabilitation and employment than is generally expected. This conclusion is also supported by Bazin and Perruchet (1996), who argue that the "deficit of schizophrenics in some tasks can be attenuated or suppressed if the subjects are oriented toward an efficient strategy," which in their study of implicit and explicit associative memory involved prompting subjects to use context to improve their performance on the experimental task. Finally, Wilder et al. (1998, p. 247) showed that schizophrenia patients were able to demonstrate the acquisition of preference through operant conditioning in a task that the authors propose is dependent on implicit memory. These authors also suggest that their paradigm may be useful in the rehabilitation of patients with schizophrenia.

The results of this study should be generalizable to other chronically ill and clinically stable male schizophrenia patients. Limitations of our study include the use of exclusively male subjects and a lack of data on the IQ and reading level of the participants. In addition, we were unable to examine the influence of medication status, because our schizophrenia participants were taking a variety of different medications and our sample size was too small to create subgroups. Various authors have reported that the anticholinergic effects of antipsychotic and antiparkinsonian medications may cause or exacerbate memory disturbance (Ragland et al. 1996; Stip 1996; Heinik 1998). Similarly, patients taken off haloperidol have been shown to have significant increases in remote verbal memory (Gilbertson and van Kammen 1997). However, other studies of implicit and explicit memory in schizophrenia have concluded that neuroleptics and anticholinergic drugs had no significant effect on cognitive and memory functioning (Gras-Vincendon et al. 1994; Huron et al. 1995). There is also some evidence that priming (implicit) effects do not correlate with doses of antipsychotic or anticholinergic medications, in contrast to tests of explicit memory (Schmand et al. 1992; Stip and Lussier 1996), although not all studies have supported these findings (Barch et al. 1996). Finally, there is the possibility that the differential deficit observed in this study does not reflect differences in underlying processes but differences in task difficulty. Because we do not have information on

whether the preference and recognition tasks are matched in task difficulty, this interpretation cannot be excluded.

We believe that the investigation of preference formation warrants further investigation in studies of schizophrenia. Future exploration of the distinction between explicit and implicit memory may lead to a better understanding of how neurocognitive functions are either affected or spared in schizophrenia, with potential implications for both treatment and rehabilitation.

References

- Barch, D.M.; Cohen, J.D.; Servan-Schreiber, D.; Steingard, S.; Cohen, J.D.; Steinhauer, S.S.; and van Kammen, D.P. Semantic priming in schizophrenia: An examination of spreading activation using word pronunciation and multiple SOAs. *Journal of Abnormal Psychology*, 105(4):592–601, 1996.
- Bazin, N., and Perruchet, P. Implicit and explicit associative memory in patients with schizophrenia. *Schizophrenia Research*, 22:241–248, 1996.
- Bornstein, R.F. Exposure and affect: Overview and meta-analysis of research, 1968–1987. *Psychological Bulletin*, 106:265–289, 1989.
- Bornstein, R.F.; Kale, A.R.; and Cornell, K.R. Boredom as a limiting condition on the mere exposure effect. *Journal of Personality and Social Psychology*, 58:791–800, 1990.
- Carter, C.S.; Robertson, L.C.; and Nordahl, T.E. Abnormal processing of irrelevant information in chronic schizophrenia: Selective enhancement of Stroop facilitation. *Psychiatry Research*, 41:137–146, 1992.
- Clare, L.; McKenna, P.J.; Mortimer, A.M.; and Baddeley, A.D. Memory in schizophrenia: What is impaired and what is preserved? *Neuropsychologia*, 31:1225–1241, 1993.
- Cohen, J.D.; MacWhinney, B.; Flatt, M.; and Provost, J. A new graphic interactive environment for designing psychology experiments. *Behavioral Research Methods, Instruments, and Computers*, 25(2), 257–271, 1993.
- Faustman, W.O. Brief Psychiatric Rating Scale. In: Maruish, M.E., ed. *The Use of Psychological Testing for Treatment Planning and Outcome*. Hillsdale, NJ: Lawrence Erlbaum Associates, 1994. pp. 371–401.
- Gilbertson, M.W., and van Kammen, D.P. Recent and remote memory dissociation: Medication effects and hippocampal function in schizophrenia. *Biological Psychiatry*, 42:585–595, 1997.
- Gold, J.M.; Goldberg, T.; and Weinberger, D.R. Prefrontal function and schizophrenic symptoms. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology*, 5:253–261, 1992.
- Goldman-Rakic, P.S. Prefrontal cortical dysfunction in schizophrenia: The relevance of working memory. In: Carroll, B.J., and Barrett, J.E., eds. *Psychopathology and the Brain*. New York, NY: Raven Press, 1991.
- Goldman-Rakic, P.S., and Seleman, L.D. Functional and anatomical aspects of prefrontal pathology in schizophrenia. *Schizophrenia Bulletin*, 23(3):437–458, 1997.
- Graf, P., and Schacter, D.J. Implicit and explicit memory for new associations in normal and amnesic subjects. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 11(3):501–518, 1985.
- Gras-Vincendon, A.; Danion, J.-M.; Grangé, D.; Bilik, M.; Willard-Schroeder, D.; Sichel, J.P.; and Singer, L. Explicit memory, repetition priming and cognitive skill learning in schizophrenia. *Schizophrenia Research*, 13:117–126, 1994.
- Hanes, K.R.; Andrews, D.J.; and Pantelis, C. A brief assessment of executive control dysfunction: Discriminant validity and homogeneity of planning, set shift, and fluency measures. *Archives of Clinical Neuropsychology*, 11(3):185–191, 1996.
- Heinik, J. Effects of trihexyphenidyl on MMSE and CAMCOG scores of medicated elderly patients with schizophrenia. *International Psychogeriatrics*, 10:103–108, 1998.
- Hollingshead, A.B., and Redlich, F.C. *Social class and mental illness*. New York: John Wiley & Sons, 1958.
- Huron, C.; Danion, J.-M.; Giacomoni, F.; Grangé, D.; Robert, P.; and Rizzo, L. Impairment of recognition memory with, but not without, conscious recollection in schizophrenia. *American Journal of Psychiatry*, 152(12):1737–1742, 1995.
- Johnson, M.K.; Kim, J.K.; and Risse, G. Do alcoholic Korsakoff's syndrome patients acquire affective reactions? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 11(1):22–36, 1985.
- Kazes, M.; Berthet, L.; Danion, J.-M.; Amado, I.; Willard, D.; Robert, P.; and Poirer, M.-F. Impairment of consciously controlled use of memory in schizophrenia. *Neuropsychology*, 13(1):54–61, 1999.
- Kremen, W.S.; Seidman, L.J.; Oscar-Berman, M.; Shore, A.R.; Faraone, S.V.; and Tsuang, M.T. Neuropsychological probes of prefrontal dysfunction in schizophrenia. *Biological Psychiatry*, 38:578–9, 1996.
- Manza, L., and Bornstein, R.F. Affective discrimination and the implicit learning process. *Consciousness and Cognition*, 4:399–409, 1995.
- Michel, L.; Danion, J.-M.; Grangé, D.; and Sandner, G. Cognitive skill learning and schizophrenia: Implications for cognitive remediation. *Neuropsychology*, 12(4):590–599, 1998.

- Murphy, S.T.; Monahan, J.L.; and Zajonc, R.B. Additivity of nonconscious affect: Combined effects of priming and exposure. *Journal of Personality and Social Psychology*, 69:589–602, 1995.
- Overall, J.E., and Gorham, D.R. The Brief Psychiatric Rating Scale. *Psychological Reports*, 10:799–812, 1962.
- Ragland, J.D.; Censits, D.M.; Gur, R.C.; Glahn, D.C.; Gallacher, F.; and Gur, R.E. Assessing declarative memory in schizophrenia using Wisconsin Card Sorting Test stimuli: The Paired Associate Recognition Test. *Psychiatry Research*, 60:135–145, 1996.
- Schmand, B.; Kop, W.J.; Kuipers, T.; and Bosveld, J. Implicit learning in psychotic patients. *Schizophrenia Research*, 7:55–64, 1992.
- Schwartz, B.L.; Rosse, R.B.; and Deutsch, S.I. Toward a neuropsychology of memory in schizophrenia. *Psychopharmacology Bulletin*, 28:341–351, 1992.
- Schwartz, B.L.; Rosse, R.B.; and Deutsch, S.I. Limits of the processing view in accounting for dissociations among memory measures in a clinical population. *Memory and Cognition*, 21:63–72, 1993.
- Seamon, J.G.; Williams, P.C.; Crowley, M.J.; Kim, I.J.; Langer, S.A.; Orne, P.J.; and Wishengrad, D.L. The mere exposure effect is based on implicit memory: Effects of stimulus type, encoding conditions, and number of exposures on recognition and affect judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21(3):711–721, 1995.
- Seidman, L.J.; Oscar-Berman, M.; Kalinowski, A.G.; Ajirole, O.; Kremen, W.S.; Faraone, S.V.; and Tsuang, M.T. Experimental and clinical neuropsychological measures of prefrontal dysfunction in schizophrenia. *Neuropsychology*, 9:481–490, 1995.
- Servan-Schreiber, D.; Cohen, J.D.; and Steingard, S. Schizophrenia deficits in the processing of context: A test of a theoretical model. *Archives of General Psychiatry*, 53(12):1105–1112, 1996.
- Shaw, R.J.; Dong, M.; Lim, K.O.; Faustman, W.O.; Pouget, E.R.; and Alpert, M. The relationship between affect expression and affect recognition in schizophrenia. *Schizophrenia Research*, 37:245–250, 1999.
- Shoqeirat, M.A., and Mayes, A.R. Spatiotemporal memory and rate of forgetting in acute schizophrenics. *Psychological Medicine*, 18:843–853, 1988.
- Spitzer, R.L.; Williams, J.B.W.; Gibbon, M.; and First, M.B. *User's Guide to the Structured Clinical Interview for DSM-III-R: SCID*. Washington, DC: American Psychiatric Press, 1990.
- Squire, L.R. Memory and the hippocampus: A synthesis from findings with rats, monkeys, and humans. *Psychological Review*, 99(2):195–231, 1992.
- Stip, E. Memory impairment in schizophrenia: Perspectives from psychopathology and pharmacotherapy. *Canadian Journal of Psychiatry*, 41(8, Suppl 2):S27–S34, 1996.
- Stip, E., and Lussier, I. The effect of risperidone on cognition in patients with schizophrenia. *Canadian Journal of Psychiatry*, 41(8, Suppl 2):S35–S40, 1996.
- Stone, M.; Gabrieli, J.D.E.; Stebbins, G.T.; and Sullivan, E.V. Working and strategic memory deficits in schizophrenia. *Neuropsychology*, 12:278–288, 1998.
- Tulving, E., and Schacter, D.L. Priming and human memory systems. *Science*, 247:301–306, 1990.
- Wexler, B.E.; Hawkins, K.A.; Rounsaville, B.; Anderson, M.; Sernyak, M.J.; and Green, M.F. Normal neurocognitive performance after extended practice in patients with schizophrenia. *Schizophrenia Research*, 26:173–180, 1997.
- Wilder, K.E.; Weinberger, D.R.; and Goldberg, T.E. Operant conditioning and the orbitofrontal cortex in patients with schizophrenia: Unexpected evidence for intact functioning. *Schizophrenia Research*, 30:169–174, 1998.
- Zajonc, R.B. Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, 9(2, Pt 2):1–27, 1968.
- Zajonc, R.B. Feelings and thinking: Preferences need no inferences. *American Psychologist*, 35:151–175, 1980.

Acknowledgments

This study was supported in part by grants from the National Institutes of Mental Health (MH53673 and MH30854). We are grateful for the support of Adolph Pfefferbaum, M.D.; Kaaren Hanson, Ph.D.; Melissa Dong, B.A.; and Sarah Rawson.

The Authors

Ariane Marie, B.A., was working as Research Assistant, Department of Psychiatry and Behavioral Science, Stanford University School of Medicine, Stanford, CA, at the time the study was conducted; she is currently an M.D./Ph.D. student in the Preventive Medicine Department, University of Southern California. John D.E. Gabrieli, Ph.D., is Associate Professor, Department of Psychology and Neuroscience Program, Stanford University, Stanford, CA. Chandan Vaidya, Ph.D., was a graduate student, Department of Psychology, Stanford University, Stanford, CA; she is currently Assistant Professor, Psychology Department, Georgetown University, Washington, D.C. Bonny Brown, Ph.D., was a

graduate student, Department of Psychology and Neuroscience Program, Stanford University, at the time the study was conducted; she is currently Senior Research Scientist, Vividence Corporation, San Mateo, CA. Felicia Pratto, Ph.D., was Assistant Professor, Department of Psychology and Neuroscience Program, Stanford University, at the time the study was conducted; she is

currently Associate Professor, Psychology Department, University of Connecticut. R.B. Zajonc, Ph.D., is Professor, Department of Psychology, Stanford University. Richard J. Shaw, M.B., B.S., is Assistant Professor of Psychiatry and Pediatrics, Department of Psychiatry and Behavioral Science, Stanford University School of Medicine.

