

Silverman J. The problem of attention in research and theory in schizophrenia.  
*Psychol. Rev.* 71:352-79, 1964.  
[Veterans Administration Hospital, Palo Alto, CA]

This paper analyzes experimental and clinical studies of sensory and perceptual function in schizophrenia. A "cognitive control" model of attention is used. An attention response mechanism, "sensory input processing—ideational gating," is then formulated in order to explain some heretofore incomprehensible aspects of schizophrenic disorders. [The SSC® indicates that this paper has been cited in over 260 publications since 1966.]

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February 4, 1988

A graduate experiment within the Department of Psychology at the University of Michigan provided me with an extended opportunity to scrutinize the research literature in schizophrenia. I was astonished to find so many reports that failed to confirm other investigators' findings and even reports that contradicted other investigators' findings. My eventual insight into the reasons for this confusion formed the first part of my paper. It was essentially this: real progress in this field, therapeutic progress and conceptual progress, will not occur until researchers regularly and carefully distinguish all research subjects in terms of three interrelated categories—paranoid and nonparanoid symptom types, level of premonitory social-sexual development, and early term/long-term length of institutionalization. Eleven years later (1975) Rue L. Cromwell, writing in the *Annual Review of Psychology* chapter "Assessment of schizophrenia," referred to this work as a milestone.<sup>1</sup>

In this and in subsequent research, I elaborated upon the parameters of attention that correlated with these variables.<sup>2,3</sup> In the latter section of my paper, I proposed a mechanism that I suggested was at the core of a schizophrenic reaction—the means whereby a psychotic "breaks" with reality. The description of this mechanism, derived by piecing together various laboratory and clinical reports, was termed "sensory input processing—ide-

ational gating." Put very simply, under extraordinary conditions, the human brain is capable of breaking up or of "gating" information about the world by overresponding to its sensory attributes. "In its more refined form, such a mechanism would operate in the brain by automatically modifying psychologically noxious ideational events so that they resembled sensory events.... In the psychoses, to negate the ideational significance of stimulation would be to negate the significance of conflict situations, of aversiveness, of feelings of worthlessness, of anxiety."<sup>2</sup>

Not until 20 years later would a report be published that would provide a test of the gating formulation, although its authors would not mention it.<sup>4</sup> The circumstances in which I heard about this report are noteworthy. In January 1988 I found myself becoming interested again in research in the schizophrenias (after a long absence from the field). Monte S. Buchsbaum, a close collaborator during my time at the National Institute of Mental Health, was visiting Stanford University to present his work, and I decided to attend his presentation.

The presentation of his work, describing studies photographing the brain using positron emission tomography (PET), amazed me. His studies involved injecting radioactive glucose intravenously into normal and psychotic subjects and recording their brain activity. For normal adults, at rest and during the processing of simple stimulation, a greater degree of activity occurs in the anterior or frontal areas of the brain than in posterior (sensory-processing) areas of the brain. "The normal hypofrontal pattern observed by us...reflect[s] a greater balance of activity in frontal areas responsible for planning of goal-directed behavior than in posterior sensory processing areas."<sup>4</sup> In patients with schizophrenia and patients with affective disorders, this balance is reversed: "We observed a pattern of relatively lower [activity] in the superior frontal [anterior] cortex than in posterior areas."<sup>4</sup> From this it can be inferred that in the major psychoses the normal balance of brain activity, anterior to posterior, is shifted significantly. These findings using the PET technique constitute the neurological basis for my hypothesis of sensory input processing—ideational gating in the psychoses.

1. Cromwell R L. Assessment of schizophrenia. *Annu. Rev. Psychol.* 26:593-620, 1975. (Cited 50 times.)
2. Silverman J. Variations in cognitive control and psycho-physiological defense in the schizophrenias. *Psychosom. Med.* 29:225-51, 1967. (Cited 100 times.)
3. ———. Stimulus intensity modulation and psychological dis-ease. *Psychopharmacologia* 24:42-80, 1972. (Cited 50 times.)
4. Buchsbaum M S, DeLisi L E, Holcomb H H, Cappelletti J, King A C, Johnson J, Hazlett E, Dowling-Zimmerman S, Post R M, Morihisa J, Carpenter W, Cohen R, Pickar D, Weinberger D R, Margolin R & Kessler R M. Anteroposterior gradients in cerebral glucose use in schizophrenia and affective disorders. *Arch. Gen. Psychiat.* 41:1159-66, 1984. (Cited 35 times.)