Samuel Sutton: In Memoriam

BY
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Delivered Friday, June 27, 1986
at the Eighth International Conference on
Event-Related Potentials of the Brain

Sam's spirit so permeates this conference and his presence is so much felt that it is as difficult to eulogize him now as it would be if he were physically present. I feel privileged, however, to help celebrate the occasion of our homage to him for his scientific accomplishments, his sterling qualities as a human being, and his magnificent plans for the future, which his loyal colleagues are carrying on.

Sam was scheduled to have spoken to us here, about the papers on ERP in relation to attention and information-processing. His comments, I am sure, would have been, as they always were, thoughtful and valuable. But Sam's achievements in the ERP area I will leave to my colleagues who are to follow me. I shall speak of his other contributions.

For 32 years he worked in our vineyard and left a heritage which has spread both nationally and internationally, reflecting credit on him, the Department of Psychophysiology which he headed, and the New York State Psychiatric Institute which housed his endeavors.
Sam was born in New York in 1921, only 64 years ago. His family came from Syria and brought over a Middle-Eastern Orthodox Jewish cultural heritage that was unsympathetic to the pursuit of secular knowledge and to Sam’s scientific curiosity in his early years. Somehow, though, he refashioned the Orthodox Jewish tradition of scholarly argument over text into an equally stringent but broader and secular search for knowledge. Rejecting his cultural and familial preference for a mercantile career, he entered Brooklyn College in 1946, after serving for 4 years in the U.S. Air Force during World War II. A year later he transferred to the University of Chicago where he initially studied personality theory while minoring in Anthropology -- and thereby meeting his wife, Connie, an Anthropologist.

He soon found personality theory insufficiently engaging for him intellectually, and he also objected to its disinterest in finding out what went on "inside the black box." Seeking an approach that could overcome the mind-body dualism of the time, he was attracted to the work being done by Dewey Neff and his students in psychophysiology. Beginning with an interest in studies of perception, using animals for experimentation, he became a research assistant to Harold Schuknecht, then Professor of Otolaryngology at the University of Chicago, who was investigating audition in cats. Sam combined the experimental techniques he learned in psychology with the surgical techniques learned from Schucknecht to carry out his
doctoral research on the effects of cochlear lesions on the threshold responses of the cat's auditory cortex. This research contributed to resolving the controversy of the time concerning place vs. frequency theory in audition.

In 1954, Sam joined me on a project at the New York State Psychiatric Institute. Years later he confessed that he was curious as to why I had selected him as my associate in a project on prognosis in schizophrenia when his prior research experience had been on the inner ear of the cat. The answer is that I, like him, while attracted by personality theory had realized the need for physiologically grounded experimentation if that theory was to prosper, and I pinned my hopes on Sam's expertise in psychophysiology to open up a new avenue for both of us. Our prognostic project led him first to a series of studies on the relationship of eye movements to reversal of an ambiguous figure -- the Necker Cube. During this brief period his abiding interest in brain function languished until revived by his review of M.A.B. Brazier's classic book on the Central Nervous System and Behavior. There followed a series of studies on delayed auditory feedback, initiated with Richard Chase, to find out whether schizophrenics were immune to its effects, which did not turn out to be the case.

The next series of studies dealt with the effect of shift in sensory modality on serial reaction time in schizophrenics. It turned out that
the modality shift produced an increase in latency compared to normals. This increased latency, one of the potential markers of schizophrenia still under investigation by laboratories in the U.S.A. and abroad, is what ultimately led to the discovery of P300. We wanted to know why the delay occurred and what the brain was doing during this delay.

With the creation of the Biometrics Research Unit in 1956, Sam became Deputy Director of the Unit and we both attracted a considerable number of Ph.D. candidates from the Columbia University Department of Psychology. There followed a series of studies in pupillography (as well as P300) with Gad Hakerem, Dave Friedman and Stuart Steinhauer, a return to auditory work with Harvey Babkoff, studies of dichotic listening, binaural interaction of transients and laterality with Gerald Bruder, work in vision, on critical duration of sensory integration with Mitchell Kietzman and Pat Collins, studies of vulnerability with Bonnie Spring and especially the discovery of P300 in 1964. The ERP work with the major collaboration of Patricia Tueting and Daniel Ruchkin included the discovery of the relation of the amplitude of P300 to uncertainty, salience and evaluation of the stimulus: to the finding that the schizophrenics had a diminished amplitude, and to the resolution of P300 into its components. In retrospect it is not difficult to find the connecting thread that ran through all of Sam's research. The prime mover was his interest in
how the brain relates to behavior. This theme was played in many variations ranging from the inner ear of the cat, through studies of ambiguous figures, pupillography, auditory and visual research, reaction time and event related potentials. It is in this last area that he found the closest link between the brain and behavior.

Sam was not only a superb researcher; he also had extraordinary gifts in administration, despite the fact that he thought of administration as a necessary evil which took time away from doing his research. As Deputy Chief of the Biometrics Research Unit, he helped manage the Unit and directed its training program, while carrying a heavy teaching load and supervising many dissertations. He had a special consideration for the role of women in research, and it was primarily to his credit that, in the 60's and early 70's, the Biometrics Research Unit had 3 female heads of section in contrast to the other departments at the Psychiatric Institute which had not a single section headed by a woman. Perhaps his special talent as an administrator was to be effective while at the same time always treating colleagues, students, and employees with consideration and respect.

The Department of Psychophysiology, which grew out of the section of psychophysiology of the Biometrics Research Unit, was established in 1979 when the Biometrics Research Unit disbanded soon after my retirement. This new department developed 7 laboratories under its aegis, six engaged in research with humans and one with
animals. Of the human laboratories, two utilize physiological measures: evoked potentials and pupillography, and three utilize behavioral measures: audition, vision and reaction time. The pain research laboratory uses both behavioral and physiological measures. The temporal properties of central nervous system function are under study in the animal laboratory. The focus there is on understanding the structure and function of the short-interval (seconds to minutes) and long interval (circadian) biological clocks.

Time does not permit me to report on the accomplishments of this department, but it can be summarized by Sam's plan to apply the knowledge gained through the 32 years of basic endeavor to such conditions as schizophrenia, depression, aging, and dementia. But while he, like Moses, was not destined to see this Promised Land, his followers are devoting themselves to carrying out his design.

In addition to his substantive contributions, Sam also made notable contributions to basic methodology which grew out of the need to modify designs and strategies developed for normals so as to render them suitable to abnormal individuals. In many of these strategies he had the ever ready collaboration of Muriel Hammer, head of the Anthropology Section in the former Biometrics Research Unit. These now classic designs may actually outlive the substantive contributions, since the latter are changed by additions and new findings, while basic methodology seems to transcend time. Among
these are the "iterative method" and the "limitation of options in responding". The iterative method grew out of the recognition of the fallible criteria that now serve for classifying the mentally ill into such categories as schizophrenia, depression, dementia, etc. Instead of depending solely on these clinical criteria as a basis for classification and considering the laboratory data as dependent variables, he turned the tables and utilized the laboratory results as the independent variable and the clinical interview results as the dependent variable. In this way he could shake out the individual who showed the highest relationship between the two sets of variables. By continuing this winnowing process iteratively, he was able to purify the laboratory results as well as the clinical data, winding up finally with more homogeneous classification.

Another innovation introduced was the imposition of some kind of a task to engage the interest and attention of the subject. Sam's compassion led him to empathize with the subject's need for avoiding boredom, and his scientific sophistication led him to realize that this was of methodological as well as humanistic significance. In much of the previous work in ERP, psychophysiologists regarded their task as tapping the central nervous system directly for its integrity and functional characteristics without any attention to psychological factors. Sam felt that his purpose was to determine what the central nervous system was doing when the
subject was tackling some psychological task or expectancy. Because of the unpredictability of the behavior of the mentally ill, one could not depend upon simple instructions for carrying out tasks as is done with normals. Designs had to be provided in which the options for responding were reduced to a single choice, the patient not being permitted to choose any other response for themselves, so that the results could be matched against the expected performance. This was one reason why his research narrowed the field by focusing on the first 1,000 milliseconds following stimulation. Moreover, he believed that if the subject's interpretation of the situation affected the brain's responses, one could not get true readings when this interpretation was ignored. Thus, the methodological need for a task that engages the subject, and for an experimental design that delimits the subject's interpretive options. This is how P300 was born. When there is no task, P300 is not as potent.

A third strategy was to develop designs in which the patients could perform in such fashion that they appeared to do better than the normals in order to remove the possibility that they were not as involved. For example, in the case of the Place & Gilmore phenomenon, patients count more accurately the number of lines presented. Place and Gilmore explained this anomaly by assuming that the normals were impeded in their counting by paying attention to the gestalt of the lines, while the patients ignored the gestalt qualities of
the structure of the lines. However, regardless of the explanation, the correct counting of lines on the part of the patients could not have occurred under conditions of lack of attention and motivation, which so often turn out to be the underlying explanation of differences found between patient and normal samples.

Perhaps his most striking characteristic was the way in which his respect for ideas interacted with his respect for people. He brooked no hierarchies, no restrictions; no one's ideas were sacrosanct and no one's ideas ignored -- a real democracy where everyone who had an idea was welcome and allowed to try it out. There wasn't a bureaucratic bone in his make-up!

In paying tribute to Sam the person, and scientist, I would like to end by citing from his talk in 1983 at the EPIC meetings in Florence where he was being honored. I select what Sam felt to be two principles that had guided his work and which he thought might be of use to young scientists. Most helpful was, he said and I quote: "Don't put interesting or unusual findings on the back burner! Key research findings have a way of turning up unpredictably when one is involved in other things and when one has a long and complex timetable heading in other directions. New findings are even sometimes jarring, in that they go against what was expected. One needs both the institutional leeway and the personal willingness to be derailed, in order to pursue the unusual findings where they are going. One of the few things I am
willing to pat myself on the back for in relation to the early work on P300 is that when it first turned up, I dropped everything else and pursued the new finding.... A second thought I would like to communicate is another "don't" or, differently formulated, another "do".... Despite the fact that I accepted the usefulness of operationalizing one's concepts, I did not accept the notion that one had to brainwash oneself of ideas that could not yet be operationalized. So in the private area of my covert responses, I remained open to variety of heretical notions. This openness was quite important in permitting me to realize that P300 could be emitted in response to the absence of an expected stimulus. In order to come to such a realization, it was necessary to be open to a concept as loosely defined as expectancy."

To the very end, Sam continued to work on the meaning of a significant absence and expectancy. For those of us close to him, his absence becomes more bearable as we continue to pursue the study of expectancy.