

COGNITIVE IMPAIRMENT AND SUBJECTIVE TIME IN JAPANESE SCHIZOPHRENICS AND NONSCHIZOPHRENICS

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Abstract

An important aspect of studies on time perception lies within the psychiatric realm. Accordingly temporal disintegration of the relation between past, present and future indicate a disrupted timeline and induce depersonalization. Disruption of psychological time is a central feature of many kinds of psychopathology, for instance in patients with brain lesions, in schizophrenics, in individual with Korsakow syndrome, in depressive patients, etc. Schizophrenia is in general regarded as a disorder of cognition (Bleuler, 1911). Time perception disturbances in schizophrenia have received most attention, and the research literature has often suggested that schizophrenics have a disturbed sense of time and that the schizophrenic's ability to estimate time is disrupted. Minkowski stated as early as 1927 that extreme distortion of subjective time was the central symptom of schizophrenia. The present study was conducted to compare time perception of short durations, including intra- and interindividual variability of subjective duration judgments, in Japanese schizophrenic and in nonschizophrenic subjects. The psychophysical methods of reproduction, and of verbal estimation in subjective seconds, were used. It was found 1) that the means of the reproductions do not differ between the two groups, 2) the schizophrenics verbally estimated all durations longer and less veridical than the nonschizophrenic subjects, 3) the variability of the estimates between, as well as within, subjects is much greater in schizophrenics than in the nonschizophrenic group, 4) also the estimates by the schizophrenic group showed an approximately linear function of responses vs. the reference durations in log-log coordinates, in agreement with Stevens' power law. Schizophrenics are described in terms of distraction and of chaotic and disorganized behavior. This important aspect of schizophrenic symptomatology typically results in cognitive impairment. The impairment may be at the root of the deviant, though fairly consistent, estimations by the schizophrenics. They seem to be unable to translate perceived time into numbers (seconds), probably because of their general difficulty to quantify. The conclusion is that our result does not support the view of general time distortion as such in schizophrenia.

Time is an important dimension of both personality and social structure. Subjective (the psychological, perceived) time judgment is the human ability to estimate objective (physical) time without the cues of external clocks.

Subjective (psychological, perceived) time is more than a perception. It is the conscious experiential product of processes that allow the human organism to adaptively orient and organize itself in line with the sequential relations in a particular environment. Identity and the ability to perceive time (time sense) are fundamental integrative cognitions of human experience. Time is an important dimension of both personality and social structure (Fraser, 1975; Melges 1990). Time distortion may be a manifestation of mental illness or

brain damage. It is assumed that there is no one "timing center" in the brain, and the brain as a whole can be considered as the "organ of time sense". Distortions of perceptual senses, such as vision and hearing, although upsetting, do not wreak as great a psychological havoc as that induced by time distortions.

An important aspect of studies on time perception lies within the psychiatric realm. Time perception disturbances in schizophrenia have received the most attention, and the evidence has generally indicated that the schizophrenic's ability to estimate time is disrupted (Melges, 1982; Wahl & Sieg, 1980). According to Pierri, et al., (2001) schizophrenia is associated with deficits in working memory. Minkowski (1927) emphasized the loss of the present "I-here-now" position in schizophrenia.

Schizophrenia is generally regarded as a disorder of cognition (see Bleuler, 1911; Mo, 1990; Spitzer, Endicott & Robins, 1978). Fischer (1929) pointed out that there was no schizophrenic disorder which was not a space-time disorder. Other researchers also suggested that timelessness and other temporal distortions are quite common in schizophrenia (Davalos, Kisley & Freedman, 2005; Fuchs, 2005; Rabin, 1957). Minkowski (1927) stated that extreme distortion of subjective time were the central symptoms of schizophrenia. On the other hand Fraisse (1967, p. 209) pointed out that in schizophrenics what seems to be selectively affected is the feeling of time (Zeitgefühl) and not the biological clock (Zeitsinn) or the notion of time.

Goldstone and Goldfarb (1962) reported that schizophrenic patients overestimate elapsed time to a greater degree than nonschizophrenic patients or normal subjects and contend that the reported difference may specifically relate to schizophrenia, rather than to chronic illness or to psychiatric disorder in general. Other studies also reported overestimation of elapsed time by schizophrenics (Carlson & Feinberg, 1968). An investigation by Wahl and Sieg (1980) likewise indicated that schizophrenics were more likely to overestimate than the control group. Dobson (1954), however reported no differences between schizophrenics and a healthy group on estimation of short intervals.

Therefore studies on subjective (psychological) time in schizophrenics may lead to better understanding of the cognitive processes and of the vulnerability factors of experiencing time and of the time-structuring behavior, which is important knowledge how the schizophrenic individuals orient themselves in time and space.

The present study is concerned with comparisons of judgments of short time intervals obtained from Japanese schizophrenic and healthy male subjects using the psychophysical methods of reproduction (Experiment 1) and verbal estimation (Experiment 2). Our approach is to elucidate the cognitive and the biological factors in time perception by these two methods in the schizophrenic and in the healthy males. Time judgments involving semantic relations between words and duration (obtained by the method of verbal estimation) are influenced by cognitive factors. The method of reproduction on the other hand is more influenced by biological factors. By using these methods for both groups we have the intention to elucidate the relationship between the time distortion and the biological and cognitive factors in the schizophrenic in comparison with the healthy group.

More specifically, the following hypotheses were tested: (1) the prediction from a biological clock perspective was that the schizophrenic as well as the healthy subjects reproduce durations about the same, and (2) from a cognitive perspective that verbal estimation of duration in subjective seconds, which is influenced by cognitive factors, will differ between the schizophrenic and the healthy group.

The theoretical starting point for the data treatment is the psychophysical power function (Stevens' Law):

$$\Psi = \alpha (\Phi - \Phi_0)^\beta,$$

where Ψ denotes subjective and Φ physical duration, and α , β , and Φ_0 parameters to be determined from the data. The exponent β characterizes the continuum under investigation, α is a proportionality constant, usually an arbitrary unit, and Φ_0 the subjective zero (A. D. Eisler & Eisler, 1994; H. Eisler, 1975, 1976, 1995, 2003).

Most psychophysical experiments deal with group data. Because of the great interindividual parameter variations in, at least, time perception, in the present study the raw data are treated individually (see A. D. Eisler, 1995, 2003).

Method

Subjects. Thirteen Japanese schizophrenic and 26 healthy males (age range 21 to 43 years) served as subjects. They were matched in age and educational level. None of the subjects had previously participated in a time perception experiment and they were naive with regard to the experimental hypotheses. All subjects had normal hearing.

Stimuli. Ten standard durations, ranging from 1.3 to 20 seconds in logarithmic steps (1.3, 1.8, 2.5, 3.3, 4.5, 6.0, 8.1, 11.0, 14.8, 20.0 s) were used. The durations, both standards and reproductions, were indicated by noise of 50 dB.

Procedure. In the first experiment the subjects were instructed individually to reproduce the standard durations. In the second experiment they were required to verbally estimate in seconds the presented standard duration's length (the same standard durations as in the reproduction session). In each session, the 10 standard durations were presented three times each in an individual pseudo-random series. Thus each subject made 60 judgments ($3 \times 10 \times 2 = 60$), 30 reproductions and 30 estimations. The design was the prospective paradigm.

Data treatment and results

The arithmetic mean over the 3 reproductions, and the 3 estimates of every standard duration was computed for each subject separately.

An analysis of variance approached significance in verbal estimation of durations between the schizophrenic and the healthy group [$F(1,20) = 3.71$, $p = .06$] and a significant interaction between duration and group [$F(9,180) = 4.11$, $p = .05$]. (See Figure 1).

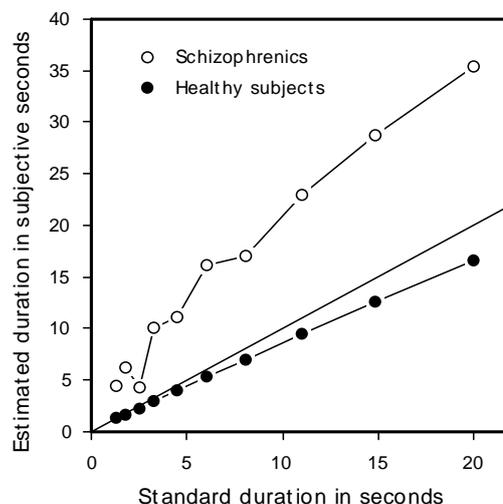


Figure 1

Note, that there was no significant difference between the schizophrenic and healthy group in duration reproduction.

Finally, the differences between the verbal estimation and the reproduction for the schizophrenics is shown in Figure 2.

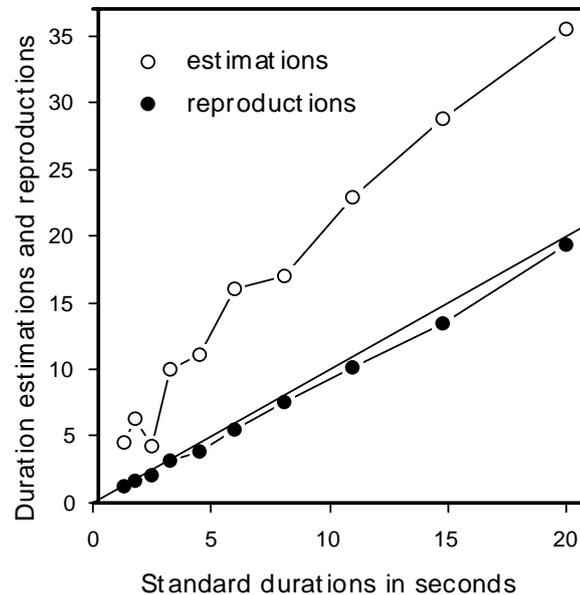


Figure 2

The values of the parameters of the psychophysical function were computed individually (see A.D. Eisler, 1995; A.D. Eisler & Eisler, 1994, 2001; A.D. Eisler, Eisler & Montgomery, 2004; H. Eisler, 1995, 2003). In the verbal estimation the value of the exponent β was .82 for the schizophrenics and .94 for the healthy group. In the reproduction the value of the exponent β was 1.0 for the schizophrenic and .92 for the healthy group.

Discussion

The results of these experiments show that time perception for short intervals in a prospective paradigm, measured by method of verbal estimation, differ between Japanese schizophrenic and healthy subjects. The schizophrenic *verbally estimated the durations longer* and less veridical than the healthy group. In contrast there was *no* significant difference in the *reproduction* of durations between the two groups. Thus as was mentioned the method of reproduction is based on biological processes to a larger extent and less influenced by cognitive factors. Somewhat surprisingly it was found that reproduction and verbal estimation by the healthy group were about the same.

Our tentative conclusion is therefore that that time sense and the ability to perceive subjective duration are *unaffected* in schizophrenics. The variability of the estimates between, as well as within, subjects is much greater in the schizophrenic than in the healthy group. Still, the estimates by the schizophrenic group showed likewise an approximately linear function versus reference duration in log-log coordinates, so the power law holds. More interestingly, the schizophrenics do not constitute a uniform group regarding time perception as is seen in the interindividual variability, as opposed to what often is stated in the research literature. The important aspects of schizophrenic symptomatology typically results in cognitive impairment, distraction and disorganized behavior. This vulnerability seems to entail that the schizophrenics have difficulty translating perceived time into numbers (seconds), probably because of their general difficulty to quantify. Another explanation is that

the tendency to transfer perceived time to greater numbers may reflect that schizophrenics experience the passing of time more slowly than do healthy subjects. Taken together, our result does not support the view of general time distortion in schizophrenia.

More research is required, before substantial progress can be achieved in research on time perception in schizophrenics.

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