

Short-term Memory in Schizophrenia

Michael Hirt, Ph.D.¹, and John Taylor, Ph.D.²

Interference as an explanatory construct for psychological deficit is applied to short-term memory and immediate recall among schizophrenics. Many of the findings are consistent with the Buss-Lang formulation, which suggests schizophrenic performance would be inferior to various control groups. Some notable exceptions, however, are reported in laboratory experiments using pictorial material, geometric designs, and digit span as stimuli.

'Dr. Michael Hirt is professor of psychology at Kent State University, Department of Psychology, Kent, Ohio.

'Dr. John Taylor is chief psychologist at the Marion County Mental Health Clinic, Salem, Oregon.

In their review of the literature on psychological deficit in schizophrenia, Buss and Lang (1965; Lang and Buss, 1965) concluded that this deficit is caused by interference, rather than insufficient motivation (Hunt and Cofer, 1944), social censure (Rodnick and Garnezy, 1957), loss of abstractness (Goldstein, 1946), or aggression (Goldman, 1962).

While their review was extensive, Buss and Lang gave only passing mention to studies involving immediate recall and short term memory functions in schizophrenics. Memory, however, has been postulated to be particularly susceptible to interference of the type proposed by Buss and Lang, and a popular theory of forgetting is based on this notion. Buss and Lang postulated that schizophrenics are unable to suppress intruding irrelevant stimuli, and that this inability forms the basis of psychological deficit in schizophrenia. Schizophrenics would thus be expected to show a deficit in immediate recall and short-term memory. The research on these memory functions in schizophrenics provides an opportunity for examining one extension of the Buss-Lang formulation.

MEMORY DEFICIT IN SCHIZOPHRENIA

Since "there are no words or ideas without an affective component, and since affectivity is essential in the mechanism of memory and recall," (Davidson, 1956, p. 151), it follows that various forms of emotional disturbances ought to have correlates in memory dysfunction. Certainly memory is not an isolated or autonomous cognitive process (Rapaport, 1951), and the possible impairments in its function as part of affective and cognitive disorders range from confabulation and fabrication to total amnesia (King, 1954). Specifically, in schizophrenia there appears to be "a thought-disorder...which involves all aspects of thought-organization, including memory" (Rapaport, 1951, p. 631).

Empirical evidence for a memory deficit in schizophrenia comes from studies using both observational and experimental approaches. Memory deficits are typically noticed among schizophrenics when their symptoms are assessed by psychiatric rating scales (Cohen et al, 1966; Wittenborn, 1951). The performance of schizophrenics on the memory items in formal intelligence tests has also generally been found to be inferior to that of non-psychotics (Brody, 1942; Hunt, 1936). Experiments using specialized memory tests like those by Wells (Shakow et al., 1941; Wells and Martin, 1923) and Wechsler (1945) have also generally shown a global memory deficit among schizophrenic Ss (Cohen, 1950).

NARRATIVE OR "MEANINGFUL" MATERIAL Schizophrenics have generally been shown to be inferior to normal groups in recalling narrative material (Arazi, 1959; Brody, 1942; Foster, 1920; Friedman, 1965; Hirschman, 1954; Lawson et al. 1964; Lipton, 1954; Lloyd, 1961; Myers, 1943; Rawlings, 1921). In Arazi's (1959) study, the schizophrenics were even further impaired when the story was emotionally charged, and they were more variable as a group in the overall adequacy of their recall. Hirschman (1954) found a group of 46 chronic schizophrenics to be inferior to a matched group of medical patients when he analyzed recall in terms of the total number of irrelevant ideas injected into the recall versions. Lawson et al. (1964) gave their Ss several short passages which varied in the extent to which the occurrences of given words were dependent on the pattern of the words that preceded them (contextual constraint). The schizophrenics were generally inferior in recall, and this deficit became increasingly marked as contextual constraint increased. Schizophrenics

have also been found to be comparable to alcoholics, depressives, and other neurotic groups in the recall of sentences and short paragraphs (Pressey, 1917; Rapaport et al., 1945). Rapaport, (1953) found schizophrenics superior to organics in both immediate and delayed paragraph recall. Schizophrenics have thus been shown to be superior to organically involved Ss, comparable to various neurotic groups, and inferior to normals in recalling narrative material.

Several studies have shown that the ability to recall narrative material may be correlated with the amount of overall disturbance among groups of schizophrenics. Wentworth (1923) found "deteriorated" schizophrenics to be inferior to "non-deteriorated" schizophrenics in recalling sentences. Belmont et al. (1964) found that schizophrenics who showed marked behavior disorders in childhood were able to recall fewer of their own Rorschach responses than were schizophrenics without such histories. Robinson (1954) compared paranoid with hebephrenic schizophrenics in recalling evaluative statements, and he found the paranoid (less impaired) group to be superior in some of the comparisons. A manipulation which seems to have a differential effect on narrative recall among schizophrenics is the subliminal presentation of aggressive stimuli immediately prior to the presentation of the material to be recalled. Such a procedure has been found to produce increased signs of pathological thought processes in the recalled versions (Silverman and Spiro, 1968; Silverman et al., 1969), and this effect is less potent with paranoid than with non-paranoid schizophrenics (Silverman and Spiro, 1967).

The inferiority of schizophrenic groups to normals and the increased impairment among more disturbed schizophrenics can be accounted for by the basic interference postulate that, as overall psychological disturbance increases, so also does interference from distracting irrelevant stimuli. The injection of irrelevant ideas into recalled paragraphs (Hirschman, 1954) is also readily interpretable with this framework. With the assumption, furthermore, that affective stimuli elicit more associations than do non-affective stimuli, the deficits observed with affective material (Arazi, 1959) and with aggressive stimuli (Silverman and Spiro, 1968; Silverman et al., 1969) are consistent with an interference interpretation. The inability to use contextual constraint as an aid to recall (Lawson et al., 1964) would also be interpretable if this deficit were related to over-and-under-inclusiveness, and if the inclusiveness tendency were, in turn, related to admitting or defending against impinging irrelevant stimuli. Research with narrative material has generally yielded findings which seem readily interpretable from the Buss-Lang interference position.

ROTE OR "MEANINGLESS" MATERIAL

Serial Material Digit Span

The digit span test has long been regarded as a test of immediate recall (Cohen, 1952a; Knott et al., 1952; Kreinheder, 1952; Rabin, 1945), and in factor analytic studies with schizophrenics and various non-psychiatric groups it has often been found to have a high loading on a factor interpreted as "memory" (Balinsky, 1941; Berger et al., 1964; Bernstein et al., 1965; Birren, 1952; Cohen 1957a, 1957b). A number of investigators have pointed out, however, that performance on it may be affected by the distractibility of the S and his susceptibility to situational anxiety (Bernstein et al., 1965; Cohen, 1952b; Griffiths, 1958; McCullough, 1950; Moldawsky and Moldawsky, 1952; Rapaport et al., 1945; Schooler and Scarr, 1962; Tolor, 1956), and this aspect of the digit span test would seem to make it especially suited for studying interference effects among

schizophrenics.

When schizophrenics have been compared with normal groups in digit span performance, the results have been equivocal. Early studies (Boring, 1913; Rawlings, 1921) showed digit span to be one of the most impaired tests of mental functioning among schizophrenics, and some direct comparisons with normal groups have found schizophrenics to be inferior (Magaret, 1942, 1943; Rabin, 1942). Other comparisons, however, have shown schizophrenics to be comparable to normals (Foster, 1920; Garfield, 1949; Gilliland et al., 1943; Myers and Gifford, 1943; Olch, 1948), while others have shown schizophrenics to be superior to normals (Altman and Shakow, 1937; Carp, 1950; Harper, 1950a; Weider, 1943).

Schizophrenics have generally been found to be comparable in digit span performance to groups of manic depressives, neurotics, and addicts (Garfield, 1948; Gilliland et al., 1943; Pressey, 1917; Rabin, 1942, 1944; Rapaport et al., 1945; Wittenborn and Holzberg, 1951). When compared with organics and mental retardates, schizophrenics have been found to be superior (Gilliland et al., 1943; Magaret and Wright, 1943; Rappaport, 1953; Watson, 1965).

Although two studies were unable to differentiate among groups of schizophrenics on the basis of digit span performance (Harper, 1950b; Stotsky, 1952), most comparisons of schizophrenic subgroups have found digit span performance to be correlated with overall level of psychological impairment (Alson, 1965; Ilanit, 1961; Markwell, 1953; McCullough, 1950; Rapaport et al., 1945).

According to the Buss-Lang interference notion, schizophrenics, being particularly susceptible to distracting stimuli, would be inferior to neurotic, psychopathic, and normal groups on any valid measure of distractibility. To the extent that the digit span test is an adequate index of distractibility, the available data do not support this aspect of

the Buss-Lang interference position.

Verbal Material

Numerous studies have compared schizophrenics with normals on immediate recall of serial rote verbal material. Lester (1960) and Deering (1963) found schizophrenics inferior to matched normals in recalling words and free associations. Conceptual clustering of serial material has been studied by Orgel (1956) and by Lauro (1963). Orgel had his Ss recall nouns that were conceptually grouped into four categories; the schizophrenics showed marked deficiencies in their ability to recall the stimulus words in terms of appropriate conceptual clustering. Lauro had his Ss recall two lists of words, with high and low clustering tendency. The schizophrenics were able to approximate the recall performance of the control group on the high clustering list, but on the list where the Ss had to determine a clustering principle, the schizophrenics were inferior. Some investigators, on the other hand, have not found a deficit in comparing schizophrenics with normals. Newberry (1954) found paranoid schizophrenics comparable to medical patients in recalling a list of words, and Donahoe et al. (1961) found schizophrenics similar to normals in recalling nonsense syllables and words.

Comparison of schizophrenic subgroups has generally shown that deficit in the ability to recall serial rote verbal material is correlated with overall level of cognitive impairment. Lewinsohn and Elwood, (1961), Lester (1960), and one study (Orgel, 1956) found that paranoid schizophrenics were better than hebephrenic schizophrenics in organizing words into meaningful conceptual categories and recalling them.

Research in this area must be regarded as generally supporting the Buss-Lang interference position, but with some important exceptions. According to an interference postulate, schizophrenics are aided by external structuring from the environment that helps in differentiating appropriate from inappropriate and interfering stimuli. Orgel's (1956) and Lauro's (1963) findings

provide direct support for this interpretation in that the schizophrenics' performance suffered when they were forced to provide clustering cues for themselves. The studies by Newberry (1954) and Donahoe et al. (1961), on the other hand, appear to be methodologically sound and cannot be readily dismissed; their findings, that schizophrenics are not inferior to normals in recalling serial rote verbal material, remain inconsistent with the interference position.

Pictorial Material

The report by Knott et al. (1952) that memory for pictures loads highly on a memory factor provides empirical justification for the use of pictorial material on tests for immediate recall. Gatewood's (1909) early finding has been corroborated by Rowell's (1958) results in showing schizophrenics inferior to matched normals in recalling pictures of common objects. Other investigators, however, have not found a schizophrenic deficit in comparison with normals (Simmins, 1933, 1935; Wylie, 1930; Zahn, 1959). When schizophrenics have been compared with normals in the ability to recall pictorial material, therefore, the results have been contradictory, and the interference position is only partially supported by these studies.

Positional Material

Watson et al. (1968) compared schizophrenics with chronic brain-syndrome patients on a modified version of the Seguin-Goddard Formboard, and found no differences between these two groups in recalling the shapes or locations of the blocks. Brengelmann (1958) had schizophrenics and neurotics recall the positions of several visually-presented geometric figures about a fixed center point. When the exposure time was two seconds, the two groups recalled the positions of the stimuli equally well; when the exposure time was 30 seconds, however, the recall performance of the neurotics was better than that of the schizophrenics. Schizophrenics

have thus been shown to be comparable to neurologically involved Ss and, under short exposure time, to a group of neurotics in recalling positional material. These results seem generally consistent with the Buss-Lang interference position. Brengelmann's (1958) results under long exposure time are particularly congruent with the interference notion, because they can be interpreted as illustrating the inability of the schizophrenics to block out interfering stimuli and thus use the extra time for committing appropriate positional cues to memory.

Geometric Designs

With the exception of one study (Altman and Shakow, 1937), the research employing visually-presented figures and designs has shown schizophrenics to be impaired when compared with normals (Arazi, 1959; Armstrong, 1952; Brody, 1942; Foster, 1920; Gatewood, 1909; Hunt and Cofer, 1944; Myers and Gifford, 1943; Niebuhr and Cohen, 1956; Wilensky, 1952). Schizophrenics have been found to be comparable to alcoholics (Pressey, 1917) and neurotics (Graham and Kendall, 1960), and superior to neurologically involved Ss (Armstrong, 1952; Howard and Shoemaker, 1954; Reznikoff and Olin, 1957; Suehs, 1964).

When schizophrenic subgroups have been compared with each other, the results have been inconsistent. Zubin et al. (1952), defining overall impairment in terms of ability to remain non-hospitalized, found the more frequently hospitalized (more disturbed) group to be superior on the Benton Visual Retention Test. Niebuhr and Cohen (1956), on the other hand, found acute schizophrenics superior to chronic schizophrenics in recalling the Bender-Gestalt figures. No general conclusion can yet be drawn about the differential design recall performance of schizophrenic subgroups.

The comparability of schizophrenics with neurotics and alcoholics, and Zubin et al.'s (1952) finding that a more impaired group of schizophrenics performed better than a less impaired group, are not consistent with the Buss-Lang interference position.

Paired-Associates Material

When schizophrenics have been compared with normals in recalling material that has been learned according to the paired-associates paradigm, the results have generally shown a schizophrenic perform ance deficit. Atkinson (1958) found schizophrenics superior to normals in recalling bisyllabic adjectives. Stedman (1966) had schizophrenics and normals

learn two highly similar lists of associates that were paired with the same stimulus list. The schizophrenics showed a substantial interference effect (of having learned the second list of associates) when they tried to recall the first list of associates. Some inconsistency has occurred in the research findings in this area, however, in that Wylie (1930) has failed to find a performance deficit among schizophrenics as compared with normals.

There is some indication that overall level of cognitive functioning may be a factor affecting the ability to recall paired associates. Kincaid (1964) had paranoid and hebephrenic schizophrenics recall their own free associations to a word list. The paranoid schizophrenics recalled nearly as many as did normals, while the hebephrenic schizophrenics were comparable to a group of neurologically impaired Ss. Although the difference between these two levels of recall was not statistically significant, the results suggest that the contradictory findings in this area may have resulted from the selection, in different studies, of Ss differing in level of psychological impairment. A further indication that such a selection factor may be operative comes from Suehs's (1964) study, involving a comparison of schizophrenics with psychotic and non-psychotic organics. The schizophrenics were superior to the other two groups, but this superiority was less marked when they were compared with the non-psychotic organics.

Stedman's (1966) finding, that

schizophrenics showed a deficit in recalling the first of two similar lists of associates, seems interpretable from the Buss-Lang interference position by the deduction that the schizophrenics were not as adept as normals in preventing distracting, irrelevant stimuli (the second list) from interfering with the recall of the first list. If Kincaid's (1964) inference that the ability to recall paired-associates is correlated with the level of cognitive functioning is valid, the findings in this area may be regarded as in general agreement with the Buss-Lang interference notion.

INCIDENTAL OR "IRRELEVANT" MATERIAL

Some investigators have studied the ability of schizophrenics to recall stimuli that are presented as extraneous parts of a task; the retention and recall of these stimuli would then be evidence for incidental or undirected learning. Greenberg (1954) found schizophrenics inferior to normals in recalling incidental material about the colors and position of geometric forms, the content and word count of a paragraph, and the metallic content of several common objects. Winer (1954), unlike Greenberg, found comparable recall between schizophrenics and normals when he tested for incidental cues relating to a manipulative sorting task, the examiner, and the immediate testing environment. Lasky (1967) also failed to find differences between schizophrenics and normals when he tested for recall of the contents of taped passages that were presented as auditory nuisance stimuli while the Ss were working on a written test.

The recall of incidental material provides a unique means for studying certain aspects of the Buss-Lang interference notion. If schizophrenics are indeed continually receptive to associations from irrelevant and extraneous stimuli, they would be expected to respond, in general, to such incidental stimuli. If no such response is found, the results can still be interpreted within the interference framework if E did not happen to test for the "correct" incidental stimuli, or if the situation were too barren for enough of the incidental associations to be elicited. A prediction from the Buss-Lang interference point of

view is that incidental stimuli that are interpersonal in nature (and that therefore elicit many associations) will be recalled by schizophrenics more efficiently than will incidental non-interpersonal stimuli. It is, in other words, precisely because the schizophrenic does respond to irrelevant interpersonal stimuli that he is unable to respond appropriately to relevant ("normal") interpersonal stimuli. The results of the research involving incidental material appear to be congruent with the expectations from the interference position. The only study showing a schizophrenic deficit in this area (Greenberg, 1954) used simple, non-interpersonal stimuli. Of the studies showing schizophrenics to be responsive to incidental stimuli, Winer (1954) used a genuine person-to-person confrontation, and Lasky (1967) used taped conversations, one of which was designed to be extremely emotionally arousing. Schizophrenics thus seem to be able to recall irrelevant, incidental stimuli, especially if they are capable of eliciting many associations.

DISCUSSION

General Findings

There are several areas of research on short-term memory and immediate recall in schizophrenia that have not yet been explored. The findings from certain other areas are conflicting and inconsistent. Finally, in areas where the results have generally been congruent, one or two exceptions have often appeared. Despite these limitations, however, certain general trends are apparent. Schizophrenics generally have been found to be inferior to normals in short-term memory and immediate recall. They have also generally been found to be superior to neurologically impaired Ss, and approximately equal to various neurotic and psychopathic groups. Many studies have involved schizophrenic samples divided into subgroups on the basis of various indices of overall impairment, such as the process-

reactive dichotomy, premorbid history, and diagnostic subtype. The results have generally indicated that impairment in immediate recall and short-term memory varies directly with the overall level of psychological disturbances.

These general trends appear, for the most part, to be consistent with the Buss-Lang interference point of view. The inferiority of schizophrenics to normals can be readily accounted for by the disruptive influence of intruding associations in schizophrenic thought. The well-known superiority of schizophrenics over organics in a variety of cognitive functions provides a basis for the acceptance of the finding that schizophrenics are superior in short-term memory and recall as well, and there is nothing in the Buss-Lang interference point of view that would lead to any other expectation. The correlation between overall cognitive impairment and recall deficit can also be accounted for; intruding associations are assumed to be the very core of schizophrenics' psychological deficit, and the schizophrenic with more interference will therefore be more disturbed.

In addition to general trends that appear to be interpretable within the Buss-Lang interference framework, many individual studies seem to provide direct empirical support for various specific aspects of this formulation. Hirschman's (1954) finding, that schizophrenics injected irrelevant ideas into the recalled versions of narrative passages, provides support for the interference point of view because the schizophrenics exhibited their cognitive dysfunction by portraying the very weakness postulated by the interference notion. When the stimuli have been highly emotionally charged, thus able to arouse more associations, schizophrenic deficit has been found to increase (Arazi, 1959). Furthermore, when extraneous stimuli have been purposefully imposed into the experimental situation, schizophrenics have been found to pay as much attention to the irrelevant stimuli as normals (Lasky, 1967; Winer, 1954).

The support for the Buss-Lang interference position by the research in this area, while impressive, is not unanimous. The general finding, for example, of comparability between schizophrenics and neurotics is contrary to the notion that schizophrenics, subject to interference, should be inferior on any task where performance is susceptible to the debilitating effect of interference. There are also several inconsistencies among studies involving similar samples and test stimuli. Most of these inconsistencies revolve around whether schizophrenics are equal or inferior to

normals. For digit span and geometric design recall, furthermore, there is contradictory evidence in reference to the correlation between level of overall impairment and recall deficit among schizophrenic subgroups. With pictorial material, the majority of comparisons have shown schizophrenics to be comparable to normals, and in the only study comparing schizophrenic subgroups of differing levels of disturbance, no difference in performance was found (Zahn, 1959). Because the interference point of view would postulate differential performance between schizophrenics and normals and between schizophrenic subgroups differing in level of disturbance, both of these findings must be regarded as contrary to the interference position. Among studies using the digit span test, there is considerable inconsistency, with the results about equally divided in finding schizophrenics inferior to, equal to, and superior to normals; in only a third of these comparisons, then, have the results been consistent with expectation derived from an interference point of view. Two studies have, furthermore, found schizophrenics equal to, rather than inferior to, normals in recalling serial rote verbal material (Donahoe et al., 1961; Newberry, 1954).

Implications for Research

Further studies are needed in order to eliminate research gaps in this area. In the studies using narrative material, for example, there has been only one comparison between schizophrenics and organics (Rappaport, 1953). There have been no comparisons between schizophrenics and neurotics using

word lists or pictures, nor have there been any comparisons between schizophrenics and organics for these types of stimuli. Schizophrenics have yet to be compared with normals, and schizophrenic subgroups have yet to be compared with each other, in recalling positional material. There have been no comparisons between schizophrenics and neurotics in recalling meaningless stimuli that have been learned in a paired-associates fashion. The research on the recall of incidental material, finally, suffers from an absence of any comparisons between schizophrenics and neurotics or between schizophrenics and organics, and there have been no comparisons of schizophrenic subgroups with each other.

With three classes of stimuli, pictorial material, geometric designs, and digit span, the results have been contrary to expectations from the Buss-Lang interference point of view. One possible explanation that warrants empirical verification is that these stimuli simply do not elicit sufficient number of associations among schizophrenic Ss for substantial interference to take place. Experimental manipulation of both the physical complexity and the interpersonal connotations of pictorial and geometric stimuli should provide control of their association-eliciting capabilities. If both the Buss-Lang interference position and this explanatory hypothesis are valid, schizophrenics would suffer gradually-increasing recall deficit as the complexity and interpersonal connotations of the stimuli are increased. A similar hypothesis can be offered to explain the failure of digit span research to support the Buss-Lang position. The bulk of the findings with the digit span test can thus be made consistent with the Buss-Lang interference position if the test is regarded as being so meager an elicitor of associations that it is only weakly sensitive to the distractibility of the S. A factor that may be related to this insensitivity to attentional losses is the very short time interval between learning and recall. Brengelmann's (1958) finding, that schizophrenics were unable to use a 30-second stimulus-presentation period efficiently for concentrating on the appropriate cues, suggests that the interference

effect can be enhanced if there is a longer time interval between stimulus presentation and recall. If future research were indeed to demonstrate a schizophrenic performance deficit in digit span under extended time intervals, the general finding of equality of recall performance between schizophrenics and neurotics might be open to serious question. Most of the comparisons between schizophrenics and neurotics have used either the digit span test or geometric designs, and in the vast majority of these comparisons the schizophrenics have not exhibited inferior recall performance. If future research uncovers the presence of interference as hypothesized by Buss and Lang in the recall of geometric designs and pictorial material with experimentally controlled complexity and interpersonal connotative-ness, and in digit span performance under delayed-response conditions, then almost the entirety of research on short-term memory in schizophrenia can be considered consistent with the interference point of view.

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