The Ecological Validity of Cognitive Rehabilitation for Schizophrenia

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Since schizophrenia was first described, cognitive deficits have been considered to be signs or symptoms of the disorder in terms of symptoms like hallucinations, delusions, and conceptual disorganization (Bleser, 1950; Kraepelin, 1902). More recently, schizophrenia has been described as a neurological disorder (Liberman & Corrigan, 1992); hence, neuropsychological strategies appropriate for evaluating and remediation other organic disorders might be applicable to schizophrenia. Researchers of this ilk have redefined cognitive deficits in terms of laboratory measures of discrete information processing (IP) functions with schizophrenic patients showing deficits in sustained attention (Nuechterlein, 1977), iconic memory (Sacuzzo, 1986), short-term recall memory (Koh, 1978; Ottmanns, 1975), executive functioning (Weinberger, Berman & Illowsky, 1988; Weinberger, Berman & Zec, 1986), and response selection (Broen, 1968). Laboratory-based cognitive strategies were developed out of this research to ameliorate some of these deficits. Unfortunately, while many of these strategies manifested the methodological rigor that exemplifies the laboratory, benefits of these interventions did not seem to transfer outside this limited environment.

Clinical investigators began to look for rehabilitation strategies to remediate some cognitive deficits in schizophrenia when limitations in psychopharmacology vis-a-vis these deficits became apparent. Hallucinations, delusions, and conceptual disorganization of some schizophrenic patients have been shown to decrease significantly when appropriate doses of neurolepotic medication are received. However, the effects of these medications on others have been limited, with some patients experiencing residual symptoms (Asarnow & MacCrimmon, 1982) and “treatment refractory” patients being completely unresponsive (Czerniansky, Kaplan & Hollister, 1983). Moreover, evidence regarding the effects of neurolepotic medication on discrete IP deficits has been mixed (Spohn & Strauss, 1989). Some studies have found that medicated patients have better scores on attentional measures than unmedicated patients (Orzack, Kornetsky & Freeman, 1967; Spohn, Lacoursiere, Thompson & Coyne, 1977). Other studies, however, found no improvement in attentional or higher cognitive functions after medication (Killian, Holzman, Davis & Gibbons, 1984). Moreover, some antiparkinsonian medications may actually diminish memory functioning (Baker, Cheng & Amara, 1983; Tune, Strauss, Lew, Breitinger & Coyle, 1982).

Various empirically validated, (neo)psychological approaches have been recommended for identification of specific cognitive dysfunctions in severely debilitated psychiatric patients (Diamant, 1986; Erickson & Binder, 1986) and, in turn, for providing training techniques to compensate dysfunctions in these patients (Erickson & Burton, 1986; Magaro, Johnson & Boring, 1986; Spaulding, Barbin & Crinean, 1989; Spaulding, Sturms, Goodrich & Sullivan, 1986). Investigators who have studied IP deficits resulting from schizophrenia have transposed a variety of laboratory-based measurement strategies - e.g., reaction time, dichotic listening, card sorting, backward masking, span of apprehension, and continuous performance - into rehabilitation interventions.

Investigations into laboratory-based cognitive rehabilitation interventions are presented in this paper vis-a-vis the targeted IP deficit: attention, memory, and conceptual flexibility. These rehabilitation strategies reflect much of the empirical rigor commensurate with laboratory measurement. Moreover, laboratory-based rehabilitation is readily tested in carefully controlled studies yielding results that rest on sound internal validity. Unfortunately, the precision and sophistication of these measures are seductive, luring clinical investigators into a sense of clinical utility based on experimental findings, without showing any evidence of discrete, laboratory-based functions are relevant to cognitive performance in the real world.

Attentional Deficits and Readiness to Respond

Operant contingencies have been used to focus attention and improve reaction time in several studies. For example, Wagner (1968) randomly assigned schizophrenic subjects to either an attention task (in which subjects were instructed to match a target stimulus with its replica embedded in a stimulus array) or to an abstraction task (one of three stimuli in a subsequent array shared a common physical or semantic attribute with the target stimulus). Correct performance was reinforced on fixed ratio schedules; e.g., subjects received two cents each time they made three correct identifications. Mistakes resulted in a mild response cost. Results showed that subjects in the attention training group demonstrated improved scores on the attention task, while subjects in the abstract training group did not show significant improvement. No cross over effects were found; i.e., subjects in the attention training group did not improve abstract test scores.

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These findings suggest that monetary contingencies improve primary attentional function but have little impact on more abstract encoding functions.

Previous research had shown that reaction times of schizophrenic subjects are significantly slower than normal controls when stimuli are presented simultaneously over auditory and visual channels (Broen, 1968; Silverman, 1964; Venables, 1964). To improve reaction times in dual modality tasks, Meiselman (1973) compared the effects of feedback (contingent reinforcement) to repeated practice. During the prototypical single modality task, subjects are instructed to respond to the onset of a light or tone by lifting their finger from a telegraph key. During Meiselman's dual modality task, half the trials were tone on and half the trials were light off, in random sequence. After pretests, subjects in the feedback group were told a bell would ring after each response in which reaction time was ten milliseconds shorter than the mean reaction time demonstrated during the pretest and a buzzer would be heard for any responses slower than the mean. Subjects received five cents for each bell and lost five cents for each buzzer. Results showed that all ten subjects in the feedback plus reinforcement condition improved reaction time to dual modality stimuli; however, six subjects in the control condition were quicker as well. The decrement in reaction times of the feedback group was significantly greater than the repeated practice group.

In another study, negative reinforcement was used to increase reaction times during a visual discrimination task (Karras, 1962). Either moderate or very loud white noise was sounded simultaneously to the presentation of a visual stimulus and ceased with correct identification of the stimulus. Karras found that subjects in the loud noise group had significantly faster reaction times than those in the moderate noise group. He concluded that escape from the loud noise was more negatively reinforcing to the subjects and hence, enhanced reaction time effects. Six years later, Karras (1968) elaborated on the study by using socially aversive noise (a stern reprimanding voice) as the aversive stimuli. Results showed that patients decreased reaction time from baseline when stern comments were louder. Moreover, the improvement in reaction times extinguished more slowly after negative reinforcement was removed.

Reaction time of 32 schizophrenic patients were manipulated using punishing contingencies in another study (Rosenbaum, Mackavey & Grisell, 1957). During baseline, subjects were to lift their finger from a telegraph key after hearing a buzzer. During the punishment condition, subjects received a mild electric shock that started with the onset of the buzzer and ended when the individual lifted his/her finger from the key. Subjects' reaction time decreased significantly from baseline during the shock condition.

Conclusions drawn from these studies are limited by the experimental methods employed. Investigators in these studies failed to validate the diagnoses of their subjects. While it is unlikely that a homogenous diagnostic group exists for which the attentional functioning of all members responds similarly to operant strategies, accurate diagnostic description of subjects is necessary to apply a specific attentional intervention to appropriate patient groups.

The size of effects in these studies have not been reported. This value is important for addressing questions like, Does attentional functioning of schizophrenic patients approach normal levels after participation in these protocols? Investigators should consider inclusion of a "normal" control group to determine whether posttest scores of the patient sample approximate scores of the control group.

Given the primacy of attention in some models of processing dysfunction in schizophrenia, it is surprising that studies in this area have not tested predictions of stage theories better. According to this view, later information processing deficits (e.g., short term recall, conceptual flexibility) arise because information enters the system incompletely. To test these predictions, attentional rehabilitation investigators must also assess changes in measures of more complex information processing.

Memory Deficits

Koh (1978) has shown that although the schizophrenic patient's recognition memory is relatively intact, scores on recall tasks are significantly below normal. He concluded that patients were lacking basic organizational skills that facilitate the original acquisition and subsequent retrieval processes essential to recall memory thereby making recollection more effortful. Similarly, other investigators have attributed memory deficits in schizophrenia to poor encoding of information into meaningful constructs (Calev, Venables & Monk, 1983). Hence, strategies that compensate for insufficient organization may improve recollection of information.

Koh and his colleagues (1976, 1980, 1981) found that patients who rated words on a memory task (and thereby aided encoding) in terms of pleasantness were able to increase recall to almost "normal" levels. Using a similar method, Larsen and
Fromholt (1976) instructed schizophrenic subjects to sort a word list into idiosyncratically meaningful categories. After patients sorted the list into the same categories in two consecutive sorting trials, subjects were asked to recall as many words as possible. Subjects in this group were able to recall words at the same rate as normals. Improvements in recall memory have also been shown in nonverbal domains. Patients who rated a series of faces on a pleasantness continuum were able to recall those faces as accurately as a normal control group (Koh, et al, 1981).

Findings from studies in this area are particularly remarkable because a cognitive function improved to near-normal levels in schizophrenic patients as the result of an IP intervention. Unlike attentional deficits, which have been ameliorated by manipulating the contingencies governing existing cognitive functions, short term recall was facilitated by an adjunctive IP strategy. Encoding and organization strategies significantly ameliorated memory deficits in this population.

Conceptual Flexibility

When processing information normally, individuals are able to identify commonalities across stimulus categories and to recognize rules that govern relationships between these categories. Moreover, normal individuals are able to change rules as changes occur in the task. Conceptual flexibility has been measured using the Wisconsin Card Sorting Task (WCST; Heaton, 1981) in which subjects are instructed to match stimulus cards to one of four key cards. When taking this test, subjects must determine the rule by which stimulus cards are matched to key cards (i.e., color, number, or shape) and sort accordingly. Unbeknown to the subject, the rule is changed after ten consecutive correct matches. Perservative errors result when individuals incorrectly match stimulus cards to key cards according to a no longer operative rule. Schizophrenic patients show significantly more perseverative errors than normals on this task, thereby suggesting an inflexible ability to change matching rules according to environmental information (Heaton, 1981).

In an attempt to improve patients’ ability to recognize and alternate between cognitive rules, Goldberg and his colleagues (1987) trained schizophrenic patients on the WCST. After making several perseverative errors during a pretest, 44 schizophrenic subjects were provided both overall and card-by-card instructions about the test. Overall instructions included information about the nature of the categories and the occurrence of shifting sets. During card-by-card instructions, subjects were told the operative rule; “Right, now you should be matching by color. You must ignore the number of things and the shape of things.” For patients who received overall and card-by-card instructions, perseverative errors diminished significantly during training. However, subsequent testing showed that the number of perseverative errors for subjects returned to baseline when instructions were no longer provided. Goldberg and his colleagues concluded that the inability to change rules flexibly to changing environmental information reflects a dementing process characteristic of schizophrenia that cannot be ameliorated through cognitive rehabilitation.

Two subsequent studies sought to combine operant conditioning methods with trial-by-trial instructions to improve patients’ rule-bound behavior. Bellack and his colleagues (in press) tested two cohorts of DSM-III-R diagnosed schizophrenic patients. Responses of subjects in the first cohort failed to improve despite contingent or noncontingent reward (5 cents for correct responses). Patients in the second cohort who received contingent reward and card-by-card instructions significantly increased performance during training and during a subsequent testing session. Bellack and his colleagues concluded that by providing monetary reinforcers, patients had incentive to attend to and learn the step-by-step instructions.

Green, Satz and Vaclav (1990) found mixed results when trying to train schizophrenic patients on the WCST using a similar reinforcement contingency. Ten schizophrenic patients received instructions and response contingent monetary reinforcement to motivate subsequent performance. All patients increased WCST performance during training. However, after removing instructions but continuing reinforcement, half the subjects returned to baseline while half the subjects maintained improved functioning. Green, et al (1990) concluded that perhaps a learner/nonlearner distinction can be made that reflects etiologic subtypes: learners might benefit from cognitive rehabilitation while nonlearners do not.

Generalizability of Laboratory-Based Approaches

Generalization of laboratory-based approaches might be examined in several ways including: 1) whether targeting and enhancing one discrete function influences other cognitive functions and 2) whether improving processing of laboratory-based information transfers to improvement of real-world cognition. In terms of the first question, few studies have tested whether improvement in specific cognitive skills generalizes to facilitation of other cognitive processes. If information is processed serially, then improvement in early cognitive functions like attention and vigilance should facilitate later, more complex functions as well. To our knowledge, no studies have tested this hypothesis.

The ecological validity of laboratory-based approaches is poorly demonstrated as well (Ellis, 1986; Weingartner, 1971). Does enhanced functioning that results from laboratory-based strategies translate into improved real-world cognition? Only one study using single case design was found that addressed the relationship between cognitive functioning and other psychiatric symptoms (Adams, Brantley, Malatesta & Turkat, 1981). Conclusions from this study are limited by methodological weaknesses. The effects of laboratory-based cognitive interventions on social functioning have not, for the most part, been investigated. Recently, research has examined ways of affecting the cognitive deficits that impede participation in psychoeducational programs designed to improve interpersonal functioning.

Cognitive Rehabilitation and Social Skills Training

cognitive deficits do not readily respond to skills training approaches (Liberman, Massel, Mosk & Wong, 1983; Martinez-Diaz, et al, 1983; Massel, Corrigan, Liberman & Milan, 1991). Adding cognitive rehabilitation techniques to traditional skills training programs may improve the patients' ability to both process social information and perform appropriate interpersonal skills.

Brenner and his colleagues (1987a, 1987b, 1988, 1989a, 1989b; Kraemer, Sulz, Schmid & Lassle, 1987) developed a comprehensive rehabilitation program called Integrated Psychological Therapy (IPT) to ameliorate both cognitive and social dysfunctions of schizophrenia. IPT comprises five hierarchically arranged modules that first target basic cognitive competencies and then teach more complex interpersonal skills that require advanced conceptual abilities. These modules are 1) Cognitive Differentiation, 2) Social Perception, 3) Verbal Communication, 4) Social Skills, and 5) Problem Solving Skills. During the Cognitive Differentiation Module, patients learn to discriminate stimulus categories by participating in a card sorting task. After demonstrating competence on this task, patients begin a concept formation task where they are instructed to match antonyms and synonyms, distinguish concepts with different definitions, and establish a hierarchy of related concepts. After completing this module, patients participate in the Social Perception Module, in which they are trained to accurately encode social stimuli by viewing a series of slides showing actors engaged in different social activities and displaying emotions of varied intensity. Members of the group are asked to interpret the intent of the actions and emotions displayed by the actors.

The goal of the Verbal Communication Module is to improve the patient's ability to attend to the voiced statements of others, to improve the patient's ability to accurately understand what was said, and to facilitate association between the patients' thoughts and the statements of those with whom they interact. This module specifically addressed the lack of integration between strategies that target information processing and social learning dysfunctions. During initial exercises, patients are rewarded for verbatim repetition of the statements of their partners. Reciprocal communication is subsequently shaped with questions that fostered mutuality for both listening and talking. Upon completion of this Module, patients have finished the cognitive rehabilitation components of IPT. The last two Modules - Social Skills and Problem Solving Skills - closely parallel more traditional social skills training strategies (Hersen & Bellack, 1987; Wallace, 1982).

IPT has been tested in three independent investigations (Brenner, Hodel, Roder & Corrigan, 1992). In the first study, 44 schizophrenic patients were assigned to an IPT group, a standard rehabilitation treatment group, or a no-treatment control group. After three months of treatment, subjects who completed IPT demonstrated significantly greater performance on attention tasks and diminished overall psychopathology compared to both control groups. These effects were still present eighteen months later. However, IPT had no effect on measures of more complex cognitive functions like visuo-motor integration.

The longitudinal effects of IPT were tested in the second study. A modified time series design was used in which eighteen patients with schizophrenia participated in a six week IPT program. A wider battery of cognitive measures assessing attention, verbal concept formation, and categorization ability were administered prior to treatment, after three and six weeks of treatment, and at a three week follow-up. Measures of social adjustment were gathered as well. Results showed that concept formation improved after three weeks of treatment, while IPT had little effect on other cognitive or social functions.

The relative effects of the cognitive and social components of IPT were investigated in a third study which was conducted as a single case design. Attentional and social adjustment measures were administered to two subjects during a two-week baseline, after completion of the Cognitive Differentiation and Social Perception Modules, and after completion of the Social Skills and Problem Solving Modules. Results showed that both patients demonstrated steady improvement in all measures after the first set of Modules and maintained this improvement after completion of the second set of Modules. However, the cognitive and social adjustment scores were still below normal levels at the completion of IPT. The authors concluded that treatment effects occurred in the first weeks of treatment and soon plateaued at levels below normal functioning. These findings challenge the results of the other two studies which suggested that the combination of strategies that target social and cognitive functioning produced improved performance in the interpersonal domain.

Unfortunately, these findings have been hampered by methodological limitation. Sample size was small, thereby diminishing the power of the evaluation. Random assignment was not used in the between-group study. Dependent measures assessing cognitive functioning have varied across studies, making comparisons difficult. Still, there were several features of IPT that recommend it for further study. Brenner's research and treatment program systematically attempted to combine cognitive and psychosocial rehabilitative approaches. As a result, the potential for examining effects within these domains, as well as the interaction of cognitive and social approaches, was outlined. Moreover, the group format provides an efficient use of staff resources; several patients with severe cognitive deficits can be treated at once. Research needs to continue on this approach to determine its utility.

Using a narrower approach to improve learning social skills, Liberman and his colleagues (1986) described an attention-focusing procedure that augmented conversational skills training. This protocol involved repetition of attentional prompts over several trials within a conversation training module. A confederate began a trial by making a predetermined statement to the patient; e.g., "I went shopping last night." If no response or an inappropriate comment was made, the trainer prompted, "Ask her a question." If the patient continues to respond incorrectly, the trainer provides a second prompt, "One good question is 'What did you buy?'". The combination of several trials and repeated prompt during an otherwise traditional social skills curriculum increased skills acquisition. Results of two additional studies using single subject design showed greater conversational skills after participating in the attention focusing program (Massel, et al, 1991; Wong & Woolsey, 1989).

Use of attention focusing procedures seems to improve the schizophrenic patient's processing of social information. Rather than being overwhelmed by information, patients are able to focus on details relevant to the skills being taught. Once the
information is encoded correctly, subsequent retrieval of the skills is easier.

Summary

Taken in its entirety, this body of research suggests that the effects of laboratory-based cognitive rehabilitation on information processing deficits in schizophrenia are substantial and significant. Despite these victories; however, the line of theoretical development across laboratory-based studies has been thin and unguided. Moreover, the attempt to establish the ecological validity of these interventions has been lacking. Few studies have determined how better information processing as shown on laboratory-based tasks leads to diminished psychotic processing of information, improved social cognition, or better interpersonal functioning. Rehabilitation strategies that combine interpersonal skills training and cognitive methods probably offer the most generalizable interventions. In particular, relatively nascent work like Brenner's IPT suggests this line of program development and research may be fruitful.

Generalization of treatment effects are being reconceptualized from the assumption that transfer of therapeutic effects is a natural consequence of treatment to the view that strategies need to be actively incorporated into rehabilitation to facilitate generalization (Stokes & Osnes, 1989). Hence, clinicians utilize interventions like in vivo role play, independent homework, and natural consequences to foster transfer of newly learned behaviors to other settings (Corrigan, Schade & Liberman, 1992). Similar strategies need to be developed that help generalize cognitive rehabilitation effects as well. The generalization of discrete effects to broader dysfunctions provides an even more challenging question for investigators. This kind of generalization may occur in three forms.

Generalization may occur as transfer from target process to secondary process; for example, the effects of attentional rehabilitation may be observed to improve short term recall. Alternately, generalization may occur as transfer from target process to broader task. Rehabilitation of attentional deficits specific to psychosocial skills training leads to improved skill learning and subsequent interpersonal functioning. Finally, generalization may manifest itself as a nonspecific improvement of life satisfaction; e.g., diminution of troublesome delusions through collaborative restructuring yields increased patient statements about quality of life. Clinical investigators need to account for these varied forms of generalization in developing and testing cognitive interventions that help patients improve their perception, comprehension, and reaction to real-world information.

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