

Applications of Experimental Psychopathology in Psychiatric Rehabilitation

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Abstract

Persons with schizophrenia show deficits in basic psychological functions such as attention, perception, and cognition. Remediation of these deficits by direct training may facilitate the effectiveness of neuroleptic medications, social skills training, and family therapy. In the vulnerability-stress model of schizophrenia, persons with schizophrenia may have lower thresholds for disorganization that contribute to vulnerability. Stress increases arousal, which brings many competing responses to the same strength, leading to intrusion of inappropriate responses. Interventions that reduce arousal and lower the strengths of competing responses should reduce psychological deficits. Arousal-reducing, attentional, and cognitive interventions are appropriate for the prodromal, acute, and chronic stages of schizophrenic disorders. Laboratory-based assessment and ongoing measurement of basic psychological deficits in schizophrenia are keys to the development and validation of multimodal psychiatric rehabilitation.

The methods and findings of experimental psychopathology can be useful in psychiatric rehabilitation. In experimental psychopathology behavioral disorders and mental illness are understood through laboratory measurement of basic psychological processes such as psychophysiological activation, perception, attention, reasoning, memory, and learning. These processes are often deficient in severely disabled psychiatric patients. Methods of experimental psychopathology can identify patients' psychological deficits and precisely

monitor their severity. Laboratory measurement can improve upon traditional methods of clinical assessment and outcome evaluation, and so may lead to more effective use of existing treatment and rehabilitation technologies. An understanding of psychological deficits may also point to innovative treatment procedures for their remediation.

Application of the methods and principles of experimental psychopathology promises to fill some of the current gaps in psychiatric rehabilitation technology. Pharmacological treatment often reduces the most dangerous and disruptive behavioral symptoms, and restores some basic psychological functions; but many psychological deficits are not remediated by drugs. Also, a significant proportion of severely disordered patients do not respond at all to drugs. Procedures such as social skills training contribute substantially to rehabilitation success, but they do not directly address psychological deficits. Broader application of experimental psychopathology might increase the overall effectiveness of psychiatric rehabilitation.

Our discussion focuses on techniques developed for assessment and treatment of schizophrenia. Schizophrenia is the diagnosis of the plurality of psychiatric rehabilitation patients, and it has been a nosological keystone in experimental psychopathology research. Note, however, that no specific psychological deficit or group of deficits is *unique* to schizophrenia. Other psychotic and severely disordered patients have the deficits found in

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patients with schizophrenia. Moreover, the heterogeneity of schizophrenia is highlighted by the finding that even within the category of schizophrenia, patients have different constellations of deficits. There is no reason to expect that any particular treatment should be effective for all members of any diagnostic group. The current state of knowledge demands that individual patients be presumed to have unique constellations of psychological deficits. The applicability of any intervention to any patient is thus an empirical question.

There are three prerequisites for effectively using psychological assessment and intervention for rehabilitation: (1) a conceptual model that organizes and describes in general terms the possible relationships between biological, psychological, and social deficits; (2) a repertoire of assessment methods to provide objective and quantitative measurement of the deficits; and (3) an armamentarium of intervention techniques that specifically addresses psychological deficits. A guiding conceptual model can be synthesized from the convergence of several contemporary views of the etiology of schizophrenia. For assessment, a wide range of relevant measurement methods can be adapted from the experimental psychopathology laboratory. Recent developments in cognitive-behavior therapy provide many potentially useful intervention techniques.

Theoretical Foundations

A conceptual framework is valuable in the design of rehabilitation strategies if it can stimulate working hypotheses, organize what is known about the etiology and course of schizophrenia, and suggest possible relationships between specific

psychological deficits and remedial interventions.

A model meeting these criteria was originated two decades ago (Broen and Storms 1966; Storms and Broen 1969). It integrated much of what was then known about schizophrenia, and as new understandings emerged, they were successfully incorporated with minor modifications of the original model. The contemporary version, the *hierarchy-collapse model*, explicitly incorporates two important psychopathological principles of schizophrenia not emphasized in the original version: the pervasiveness of schizophrenia, and the role of diathesis-stress in its etiology.

The idea of the pervasiveness of schizophrenia represents a convergence of several approaches to psychopathology. In ego psychology, schizophrenia has been conceptualized as severe deficits across a range of ego functions (Bellak, Hurvich, and Gediman 1973). In "medical" models, it can be seen as a final common pathway at social-behavioral levels of functioning whose tributaries extend to biological levels (e.g., Strauss and Carpenter 1981). In behavioral psychopathology, schizophrenia represents deficits across a variety of response systems (Adams, Doster, and Calhoun 1977), or across levels of functioning (Spaulding 1986). Models based on general systems theory (Schefflin 1981) and models of human occupation (e.g., Kielhoffner, Burke, and Igi 1980) describe disorganization of adaptive subsystems. All these use some version of the concept of "levels of functioning"; that is, the idea that molar social behavior represents the integration of specific processes that operate at more molecular cognitive, attentional, perceptual, and psychophysiological levels. From this perspective, schizo-

phrenia can be characterized by deficits at all these levels. Although there is agreement that deficits are pervasively distributed in schizophrenia, the causal relationships between deficits are incompletely understood.

The diathesis-stress view of schizophrenia hypothesizes two interacting etiological factors. A diathesis, or vulnerability, is a deficit that exists before the onset of illness and predisposes an individual for the illness. Stress is the body's reaction to an environmental event or series of events that place a demand on the person. Stress interacts with the diathesis, either at a particular time or over the course of development, to precipitate illness. Like pervasiveness, the idea of diathesis-stress represents the convergence of a diversity of theory and data (Meehl 1962; Zubin and Spring 1977; Cromwell and Spaulding 1978; Liberman, Nuechterlein, and Wallace 1982; Nuechterlein and Dawson 1984a). A corollary of the stress-diathesis view is that schizophrenia occurs in at least two phases. In one, a vulnerable state exists, represented by a particular pattern of enduring psychobiological deficits. In the second phase, these predisposing deficits are unlocked by stress to produce the illness state, represented by characteristic symptoms, associated disabilities, and even more severe basic deficits.

Response-Hierarchy-Collapse Model.

A useful theory of schizophrenia should explain how vulnerability is translated by stress into behavioral disabilities and symptoms. Most psychological theories of schizophrenia attempt to characterize the basic nature of schizophrenic deficits, but they do not specify or predict how such deficits might be produced or alleviated—perhaps explaining

why research on these theories has led to so little in the way of therapeutic interventions.

In their comprehensive reviews of psychological research in schizophrenia, Buss and Lang (1965) and Lang and Buss (1965) concluded that interference theories are most consistent with the accumulated evidence. However, most such theories do not specify how interference with cognitive functions is increased and decreased. In this light, it is interesting that Lang and Buss (1965) also stated that interference theories that include arousal are promising. In a review of more recent research, Nuechterlein and Dawson (1984b) conclude that a major feature of vulnerability to schizophrenia is reduced information-processing capacity, especially when higher demand and interference are present.

The response-hierarchy-collapse model of Broen and Storms (1966) and Storms and Broen (1969) suggests how arousal, which is increased by demand-induced stress, can produce response interference. It also suggests ways of reducing response interference for therapeutic effect. As an example of the kind of thinking disturbance most characteristic of schizophrenia, Arieti (1959) reports that a person with schizophrenia who meant to refer to the steering wheel of a car said "handlebars" instead. Let us see how the model can explain such associative intrusions.

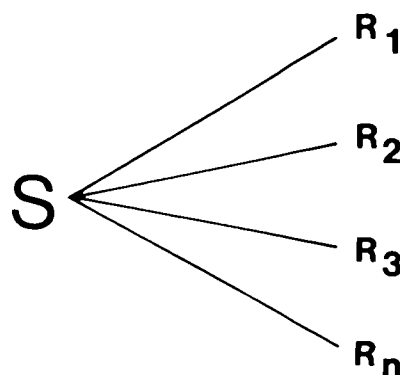
Response hierarchy. The hierarchy-collapse model is organized around the concept of a response hierarchy and hypothesizes ways in which arousal and response strength ceiling interact to affect response hierarchies.

In a given situation, there are within a person a number of simultaneous response tendencies that

collectively can be termed a "response hierarchy," similar to Hull's (1952) "habit family hierarchy." Competing response tendencies occur at different strengths, and these strength relationships constitute the organization of the hierarchy. In figure 1, S represents the stimulus situation which includes both external and internal stimuli, and R_1 - R_n represent response tendencies at different strengths. Imagine that S represents the situation in which Arieti's patient meant to refer to a car's steering mechanism. R_1 represents the dominant linguistic response "steering wheel" and R_2 the response "handlebars." Further concepts are needed to account for the occurrence of R_2 .

Arousal. This is the concept of generalized arousal, which includes the influence of the reticular activating system (Magoun 1952), especially its activation of response tendencies (Hebb 1955; Malmö 1959). Because cortical arousal is accompanied by autonomic arousal, psychophysiological measures of autonomic activation can index arousal (Dawson and Nuechterlein 1984). Increased arousal is assumed

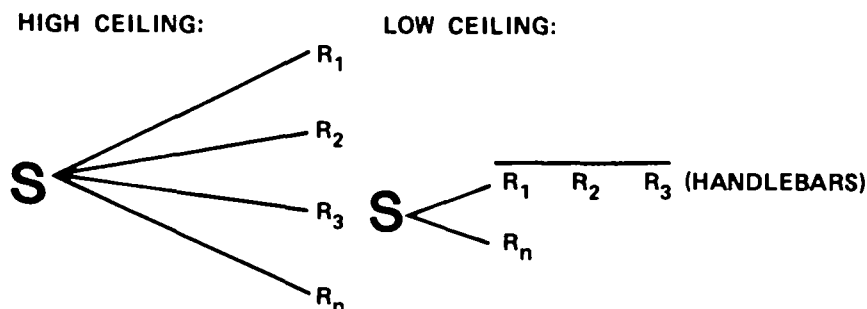
Figure 1. Response hierarchy associated with a particular stimulus situation



to lead to increased strength of all coexisting response tendencies. Arousal can be varied in a number of ways, such as by varying muscle tension or psychological stress. Arousal can be highly situational; a patient of one of the authors (L.S.) who had been hospitalized for schizophrenia found going to a nightclub with his girlfriend stressful. This increased his arousal and was associated with other problems in his psychological functioning.

Response-strength ceiling. Broen and Storms (1966) have proposed an upper limit to response strengths that may be reached at less than maximal arousal. A necessary additional hypothesis is that there are individual differences in response strength ceiling, and schizophrenics have an enduring tendency to have lower ceiling levels than nonschizophrenics. We hypothesize that the patient in the nightclub had a lower R ceiling and was thus more vulnerable to disorganization than people not suffering from schizophrenia.

Figure 2 illustrates what happens to a hierarchy with high ceiling or low ceiling after an increase in arousal. At the lower ceiling, increased arousal raises the dominant response in the hierarchy to ceiling, and further increases tend to bring other responses to ceiling, equalizing their strengths. This partial collapse of the hierarchy leads to interference from responses lower in the hierarchy, which become as strong as the dominant response. In figure 2, the response "handlebars" becomes as strong as "steering wheel" and as likely to occur. The hierarchy with the low ceiling has become partially disorganized or collapsed. Thus, the lower the ceiling, the greater the vulnerability to disorganization—or the greater the vulnerability to schizophrenia.

Figure 2. Partial collapse of a response hierarchy

Note that while the responses in the hierarchy have become partially randomized, inappropriate responses come from the response tendencies in the individual's hierarchy. The responses are meaningfully related to the stimulus situation because of past learning. Wide individual differences in learning histories may affect responses lower in the hierarchies more than those at the top. The content of the errors and intrusions would be expected to vary greatly from one person with schizophrenia to another. Thus, the behavior of schizophrenics should be very different from one individual to the next, while the underlying process is the same.

The patient in the nightclub had a recurrence of voices saying things like, "you're no good" and "get out of here." The voices probably arose from memories or thoughts initially low in a hierarchy but made as vivid as perceptions by partial randomization of the hierarchy. Changing him to a more effective neuroleptic eliminated the voices, possibly by reducing arousal so that the hierarchy could reorganize.

The partial randomization or collapse of hierarchies seems to be described by a number of authorities on schizophrenia. Bleuler (1950) described schizophrenics as responding as if "ideas of a certain

category are thrown into one pot, mixed, and subsequently picked out at random" (p. 16). The "certain category" is analogous to a response hierarchy. Freeman (1960) described schizophrenics as "unable to organize and subordinate the events occurring simultaneously in their organisms" (p. 934). This includes perceptions as well as thoughts. Shakow (1962) spoke of irrelevant associations "floating around on top of the barrel" (p. 9).

The collapse of many response hierarchies in an acute psychosis is an extremely aversive experience. The person is highly motivated to prevent its recurrence by avoiding high levels of arousal and high levels of response interference. Different individuals have different learning histories and different skill repertoires, so they are likely to develop different strategies for avoiding collapsed hierarchies. Some of these strategies may be effective but may also interfere with other behavioral processes. Also, reorganization of the hierarchy itself after its collapse may be different from the original hierarchy. The new organization may be dysfunctional with respect to the effectiveness of behaviors left at the top of the hierarchy.

Storms and Broen (1969) show how collapsed response hierarchies produced by arousal can account for

many phenomena and pervasive deficits of schizophrenia, including associative disturbances, conceptual disturbances, hallucinations, delusions, disturbances of attention, autistic behavior, and regression. The key to this range of applicability is the presence of response hierarchies at all levels of psychological functioning. At the psychophysiological level, hierarchies regulate autonomic and central nervous system activation. At the perceptual and attentional levels, hierarchies are involved in selection of input channels, deployment of attention, and selection and activation of stimulus-processing modalities. At the cognitive level, hierarchies are involved in concept formation, processing of memory information, and selection and activation of complex behavioral responses. Acute hierarchy collapse and/or maladaptive reorganization can produce deficits in any or all of these.

The applicability of the hierarchy collapse model across levels of functioning anticipates the recent emphasis on the pervasiveness of schizophrenic deficits. It also complements diathesis-stress models of schizophrenia.

Diathesis-stress and collapsed hierarchies. The hierarchy-collapse theory complements vulnerability-stress models by specifying how vulnerability is converted by stress into the phenomena of schizophrenic psychosis. A detailed vulnerability-stress model is presented and diagrammed by Liberman, Nuechterlein, and Wallace (1982) and Nuechterlein and Dawson (1984a). In this model, vulnerability includes reduced information-processing capacity, autonomic hyperreactivity, and social coping deficits. Social stressors interact with vulnerability to produce transient intermediate

states of information-processing capacity overload, hyperarousal, and deficient processing of social stimuli. These transient intermediate states result in the observable prodromata and florid symptoms of schizophrenia.

In the response-hierarchy-collapse model, lowered response-strength ceiling leads to lowered information-processing capacity. Sensitivity to hyperarousal may be present. Social coping deficits would be reflected in response hierarchies with strong competing responses in social situations and could add to basic vulnerability. Social stressors would increase arousal and would thus bring some dominant responses and competing responses to ceiling, resulting in a partial collapse of response hierarchies. This would certainly be a form of processing-capacity overload that is especially likely with hyperarousal. Deficient processing of stimuli, especially complex social stimuli, would result. The transient intermediate state of collapsed hierarchies would result in symptomatic behaviors.

The hierarchy-collapse model adds specificity to the general vulnerability-stress model, leading to more detailed predictions. For example, high-demand (stress arousal), high-difficulty (i.e., much response competition) situations would be predicted to lead to partial collapse of some hierarchies and reduced performance, which can be taken as a reflection of vulnerability to schizophrenia (Nuechterlein and Dawson 1984a). The hierarchy-collapse model predicts not only that reductions in arousal will be of benefit, which is implied by the general vulnerability model, but also that increased clarity, structure, and redundancy of stimulus input and increased informative feedback about response consequences will be helpful

due to reduced response competition.

Treatment Applications

The hierarchy-collapse model suggests three possible strategies for reducing psychological deficits, corresponding to the three parameters of the model. One is to raise the response-strength ceiling; i.e., to elevate the threshold for disorganization so that the degree of psychophysiological arousal that produced hierarchy collapse no longer does so. A second strategy is to reduce arousal from the level that produces acute disorganization, allowing the hierarchy to reorganize itself. A third is to provide environmental conditions and learning experiences that favor organized hierarchies.

Raising Response Strength Ceiling.

The response-strength ceiling presumably has a neurophysiological basis. Neuroleptic medications may help raise response strength ceiling. Influences such as alcohol, drugs, or improper diet may compromise the integrity of the nervous system and thus lower the ceiling. Correction of these problems could help raise the ceiling. Methods of orchestrating drug-psychosocial treatment interactions to improve the response strength ceiling and protect against the noxious combination of stress and vulnerability in schizophrenia have been reviewed by Falloon and Liberman (1983).

Regulation of Arousal. Administration of antipsychotic drugs clearly has an arousal-reducing effect. However, the therapeutic psychological effects of antipsychotic drugs are poorly understood and rarely measured. In clinical practice, evaluation of drug effects depends on observations of overt behavior and

subjective report, although psychological effects are often inferred from these observations. The well-known latency between administration of drugs and their antipsychotic effects may be understood in the hierarchy-collapse model as the time required for the molar response hierarchies, which mediate social behavior and report of subjective experience, to reorganize. Reorganization of more molecular response hierarchies may require less time; thus, molecular psychological functioning may improve before clinical improvement is evident.

In one of the more comprehensive studies of drug effects on psychological deficits, Spohn et al. (1977) found that molecular attentional processes associated with simple vigilance and rapid processing of visual features improve with antipsychotic drug treatment long before clinical improvement is evident. There was a general monotonic relationship between improvement in the attentional processes and reduction of psychophysiological arousal. There was also a nonsignificant trend toward improvement in more molar psychological functions (abstraction and reasoning), suggesting that eventually they too would have shown an effect, possibly secondary to normalization at the more molecular levels.

The Spohn et al. (1977) findings are complemented by a number of more focal studies of drug effects on psychological deficits (e.g., Held et al. 1970; Kornetsky 1972; Oltmanns, O'Hayon, and Neale 1978; Zahn, Carpenter, and McGlashan 1981; Braff and Sacuzzo 1982; Strauss et al. 1985). Taken together, they suggest that: (1) some molecular psychological deficits show drug effects before clinical improvement is evident; and (2) some psychological deficits are not affected by drugs at

all. Systematic laboratory assessment should therefore help predict longer-term clinical improvement and help articulate the precise therapeutic effects contributed by the drug.

Drugs are not the only means of directly reducing arousal. The success of a highly structured inpatient program in treating acutely psychotic patients without drugs (Carpenter, McGlashan, and Strauss 1977) suggests that, at least in some cases, therapeutic psychosocial interactions can achieve the same result. It has long been known (Azima and Kramer 1956; Reitman and Cleveland 1964) that reducing arousal by limiting sensory input can have therapeutic effects on acutely psychotic patients.

In the prodromal and postacute phases, patients can be taught to manage their own arousal. Zeisset (1968) demonstrated that relaxation training, a technique designed to reduce arousal through systematic induction of muscular relaxation, could produce symptomatic improvement in patients with schizophrenia. Since then, relaxation training has become a popular modality in service programs for severely disordered psychiatric patients.

A case supervised by one of the authors (W.S.) illustrates the impact of a simple relaxation intervention:

The patient was a 26-year-old man with a long history of schizophrenia, psychiatric hospitalizations and failures in rehabilitative efforts. Even when optimally medicated, he was visibly tense and anxious. His arousal became more pronounced in minimally stressful social interactions. His social behavior was punctuated in such situations by frequent "tantrums," which sometimes included threats, physical assaults, and incoherence. He saw himself as a "hopeless case," out of control of himself and

his environment, a belief shared by mental health providers and others.

The patient was taught standard relaxation training techniques. He responded unusually well, and reported practicing the exercises even more frequently than was prescribed. He came to see the exercises as one acceptable thing he could do to "feel good." He also readily accepted a suggestion that his success with the exercises showed he was potentially more in control than he had believed. His self-esteem and motivation to participate in rehabilitation activities improved accordingly. He began to perceive correctly that he was more effective in interpersonal interactions when not extremely aroused. His improved social performance had a significant impact on clinicians, who became more willing to work with him and tolerate his other behavioral deficits.

Desensitization techniques incorporate relaxation training and use conditioning principles to reduce fear, anxiety, or anger. The result is a reduction of psychophysiological arousal in the presence of stimuli that previously elicited those emotions. In patients with phobias and other anxiety disorders, desensitization effects are sometimes relatively specific; a fear and/or avoidance response in a specific stimulus situation is changed. In schizophrenic patients, desensitization effects may be more generalized. Slade (1972) used systematic desensitization to a series of family scenes (e.g., talking to mother, arguing with father) with a hallucinating patient, and found improvements in self-rated mood measures, as well as a reduction in hallucinations. Similar results have been achieved with a variety of related techniques, including *in vivo* desensitization (Alumbaugh 1971), implosive therapy (Hogan 1966), and induced anxiety (Friedberg 1969; Cockshott 1971).

There is one report of negative results using systematic desensitization with persons with schizophrenia (Serber and Nelson 1971). Desensitization techniques and other approaches that require attention and cooperation may be difficult for many persons suffering from schizophrenia. Attention and/or motivation may be deficient, so the approach may have to be adapted to the patient. For example, briefer sessions, continuous monitoring and encouragement of imagery, and rewards such as points used in a token economy may increase success.

The hierarchy-collapse model suggests that several things may be happening during relaxation training, desensitization, and other related techniques. First, the patient may be learning or reorganizing basic arousal-regulation skills. In the prodromal phase of schizophrenia this would moderate arousal and make more information-processing capacity available for coping with stress. Second, the arousal-producing potential of specific situations would be reduced, permitting better coping with those situations, reducing the danger of hierarchy collapse, and eliminating the need for avoidance.

Biofeedback may prove to be a useful adjunct to desensitization and arousal-reduction techniques in schizophrenics. Although biofeedback does not add significantly to the effects of relaxation training in less severely disordered patients (Budzynski 1977), it appears to be more important with lower functioning patients (Small, Giganti, and Steinberg 1978; Ford et al. 1982). A recent report (Schneider and Pope 1982) raises the intriguing possibility that biofeedback can produce changes in patients' brain activity analogous to those produced by antipsychotic drugs. Further research may confirm that specific psycho-

physiological abnormalities associated with the etiology of schizophrenia can be mitigated with psychological interventions.

Collections of specific techniques, including desensitization and biofeedback, have been brought together in packages generically termed "stress management" (Smith 1980; Woolfolk and Lehrer 1984). The goal of stress management is to teach the patient to reduce the effects of stress and also to help the patient create a less stressful environment. The concept of stress management complements a diathesis-stress view of schizophrenia. Psychophysiological processes are known to be involved in the relationship between family stress and recidivism in schizophrenic patients (TARRIER et al. 1979). Interventions such as social skills training and family management have components that clearly address stress management skills.

There is one report of a systematic attempt to use a stress-management package in the treatment of patients with schizophrenia (Lukoff et al. 1986). In this study, daily yoga and exercise sessions, daily meditation sessions, twice weekly stress education sessions, weekly positive imaging sessions, sessions to encourage acceptance of psychotic experiences, and sessions on building self-esteem were combined in a "holistic health" program. After 9 weeks of treatment, this group displayed at least as great and possibly greater improvement on a variety of measures of psychopathology as a comparable group trained in social skills, while the social skills group showed greater improvement in social functioning. All subjects were also treated with neuroleptic medications and a token economy.

Hierarchy-Organizing Treatment Approaches. When acute disorganization is present, reducing competing responses allows some reintegration of hierarchies (thus, reduction of confusion). With appropriate as well as inappropriate responses at ceiling for many hierarchies, it is more important to reduce the competing, inappropriate responses by minimizing distractions, providing a highly structured environment, giving explicit, repetitive instructions, and offering clear feedback about the consequences of behavior than it is to reward appropriate responding (Storms and Broen 1969; Liberman, Nuechterlein, and Wallace 1982).

With the greater stability of the postpsychotic (or prepsychotic) phase, individuals with schizophrenia can be taught strategies and skills for organizing and protecting the organization of their own hierarchies. They can learn basic attentional skills to reduce competing responses—how to ignore distractions and focus on task-relevant internal and external stimuli. They can learn to structure their physical environment and their time. With attentional deficits decreased, processing at the cognitive level is facilitated. Persons with schizophrenia can learn problem-solving skills. They can learn to discriminate fantasy from reality, and internal from external cues. These skills can help them compensate constructively for their vulnerability to deficits in situations characterized by complexity and high demand.

Liberman, Nuechterlein, and Wallace (1982), at the UCLA Clinical Research Center for Schizophrenia and Psychiatric Rehabilitation, have developed practical training procedures that emphasize the clear input and feedback endorsed by the hierarchy-collapse model:

- Keep the training setting uncluttered and devoid of distracting stimuli.
- Post graphic charts for clear and simple visual cueing of cognitive strategies.
- Use mild censure contingent on inappropriate responding as well as praise for appropriate responding.
- Conduct task analysis and break down tasks into simple steps.
- Decrease novelty by many repetitions before moving to new material or scenes.

Attentional Interventions. In the terminology of the hierarchy-collapse model, attentional deficits that do not respond to psychophysiological normalization should be understood as the result of maladaptive reorganization of a response hierarchy. Treatment should therefore aim to reestablish a more adaptive organization, through environmental structure, enriched informational input, and feedback on performance. This can be accomplished through specially structured practice on tasks that put specific demands on attentional functioning.

Meichenbaum and Cameron (1973) developed a method for strengthening attentional functioning that emphasized use of self-instructions during task performance. Patients were taught to "talk to themselves," first vocally and later covertly, while performing attention-demanding tasks. Self-talk included instructions to keep attention focused on the tasks and resist distraction, and self-reinforcing statements. Meichenbaum and Cameron (1973) demonstrated treatment effects in such diverse areas as psychiatric status, psychomotor performance, projective test performance, and interview behavior. Subsequent studies of self-instructional training with severely

disordered patients yielded mixed results. In a review of these studies, Lowe and Higson (1981) conclude the bulk of the evidence supports its efficacy, provided the self-instructional set is highly individualized, constructed after a careful idiographic assessment of each patient's attentional and cognitive difficulties.

Of course, since self-instructional sets address a diversity of attentional and cognitive functions, the specific nature or role of attentional changes in self-instructional training cannot be determined. Cueing increases use of normal processes, activating hierarchies with salient dominant responses and reduced response competition. Increased use of those processes may also reorganize hierarchies in the attentional response system, normalizing deficits. Whatever the case, self-instructional training does improve patients' attentional performance, and this facilitates performance at behavioral and social levels (Lowe and Higson 1981).

Attentional deficits were more directly treated in a patient with schizophrenia in a case reported by Adams et al. (1981). Several laboratory "distractibility" tasks from experimental psychopathology research were adapted for clinical use. The tasks were treated as exercises rather than tests, although they also yielded longitudinal measures of the patient's performance. Among other things, the patient practiced attending to recorded conversations while ignoring visual, auditory, or conversational distractions. Memory recall under distraction conditions was also practiced. The patient's performance on the laboratory measures improved with practice. At termination and 6-month followup, the patient also showed reduced thought disorder,

increased social effectiveness, and improved mood.

In a case supervised by one of the authors (W.S.), the effectiveness of the above procedure was replicated:

The patient was a 25-year-old mother of one who was undergoing a stressful separation from her husband. She had been found by friends huddled in a closet with her child. She complained of hearing the "voice of the devil," and believed the devil was after the child. Before referring herself for psychiatric services, she underwent an "exorcism" at the suggestion of friends who belonged to a fundamentalist religious group. She reported later that the "exorcism" had relieved her of the belief that the devil was about to take her child, but the voices continued unabated and she still experienced extreme anxiety.

When first seen for psychiatric services, the patient was put on a low-dose regimen of haloperidol. She reported the drug improved her sleep cycle, blunted her anxiety, and diminished the voices somewhat. She also reported the content of the voices had changed from deprecation and threats to "just voices." After she had reached a point of optimal drug response, the voices were still a significant problem. She reported she could sometimes engage in stressful activities, but that usually the voices became too intrusive and distracting to continue. An attentional training procedure was adapted from the "dichotic listening" paradigm (e.g., Wishner and Wahl 1974) of experimental psychopathology. The patient practiced listening to tape-recorded readings while a distraction tape also played. After only two sessions of the training procedure, the patient was able to perform the task without error. She reported she was able to "disattend" from her hallucinated voices the same way she could disattend from the distraction tape. She was instructed to use this disattention tactic whenever the voices became intrusive. The patient reported success in *in vivo* situations, and

showed continuing improvement in her ability to deal with stress without being disabled by hallucinations. The haloperidol was gradually discontinued without a return of psychotic symptoms.

Another case illustrates the significance of attentional deficits that remain after acute psychosis and their potential role in preventing relapse and recidivism:

A patient of one of the authors (L.S.), who had recovered from a schizophrenic episode, reported making serious mistakes in her housework, which brought disapproval from her scholarly physician husband. Analysis of the problem suggested her attention was frequently disrupted by distraction produced by her own distressing thoughts, resulting in faulty analyses of situational demands (a desire for her husband's attention may also have played a part). Her distraction problem was corroborated by poor performance on subtests of the Wechsler Adult Intelligence Test known to be affected by distractibility: Block Design, Picture Arrangement, and Digit Span. With coaching by the therapist, the patient practiced standard psychological tests which demand continuous attention and resistance to distraction: the Wechsler Intelligence Scale for Children Block Design and the Minnesota Paper Form Board. She improved significantly on all the tests, and she reported that her mistakes at home were markedly reduced. Conflict between the patient and her husband was also reduced.

One aspect of attentional functioning that has particular relevance to rehabilitation is continuous work performance, or the ability to maintain continuous attention and activity in a complex task. Individuals who cannot maintain continuous work performance for more than a few minutes are poor candidates for vocational training of any kind.

Continuous work performance is a relatively molar function, requiring vigilance, resistance to distraction, and repetitive use of instructions held in short-term memory. Severely disordered patients have deficits in all these specific functions, and they are notoriously poor at continuous work performance. Little is known, however, about how continuous work performance might be improved through therapy.

A therapeutic approach to continuous work performance was investigated in an exploratory study at the Lincoln (Nebraska) Regional Center. The treatment is part of a systematic approach to occupational therapy, designed to prepare chronic institutionalized patients for vocational rehabilitation in a sheltered workshop. Establishment of adequate continuous work performance is the first of several steps through the therapy sequence.

Nine subjects were selected for the study from a pool of 136 psychiatric inpatients. The nine selected were not distinct from the others with respect to quality or severity of symptomatology, or chronicity, but they were the worst of the pool on a simple laboratory measure of work-related attention, the Continuous Work Performance Test (CWPT). The CWPT consists of several paper-manipulation tasks: folding, cutting, stapling, unstapling, or sorting. Only one task is used in a single work session; the tasks are rotated across sessions to avoid monotony. The CWPT score is simply the number of minutes the trainee performs the task without becoming distracted or otherwise stopping work. All nine of the patients selected for special training had CWPT scores of less than 5 minutes.

Training sessions were held three times per week, 30 minutes per session. A CWPT goal was set at the

beginning of each session, with a therapist/trainer prompting maintenance of attention, and providing encouragement, performance feedback, and praise for effort. The ultimate goal of the training was to achieve a CWPT score of 30 minutes for five continuous sessions. At that point the trainee graduated to a more advanced training regimen involving increasingly complex tasks.

Of the original nine patients, seven reached the criterion for graduation and continued to progress in the subsequent stages of vocational training. One reached the criterion after 4 weeks of training but suffered a severe psychotic exacerbation shortly thereafter and was transferred to a more intensive care ward. The ninth patient showed steady clinical deterioration over an 8-month period and finally had to be transferred. Despite her deteriorating condition, she did manage to increase her CWPT score from 5 to 10 minutes in 8 months.

Figure 3 shows the progress of the seven successful trainees. Their CWPT scores are shown along with Nurses Observation Scale for Inpatient Evaluation (NOSIE-30) scores so that their workshop performance can be compared with their global psychiatric status. Inspection of figure 3 reveals that the seven patients all showed different longitudinal responses to the continuous work performance training. The least amount of training required was 4 weeks, or 12 sessions (subject 4). The most was 84 weeks, or approximately 252 sessions (subject 3). Five of the subjects showed a net improvement in NOSIE-30 ratings during the training period. In two of those, there was a relatively parallel, monotonic increase in both NOSIE-30 and CWPT (subjects 5 and 6). For these two, the hypothesis that CWPT

improvement was secondary to general improvement in psychiatric status rather than a specific training effect cannot be ruled out. For subject 6, however, the continuous work performance training was the only new intervention, introduced after his NOSIE-30 baseline had been stable for at least 10 months. It is more likely that for subject 6 the training produced a generalized change in clinical status. The other three subjects who had a net NOSIE-30 increase (subjects 1, 2, and 3) showed relatively steady CWPT improvement while their NOSIE-30 scores showed nonmonotonic fluctuations. For these three patients, CWPT progress does not appear to be correlated with improvement in symptoms or other areas of social and personal functioning. Such independence of therapeutic effects is now a well-established finding in research on schizophrenia (Strauss and Carpenter 1981).

This exploratory study demonstrates four important points: (1) laboratory measures can detect relevant psychological deficits in patients whose clinical status does not distinguish them from patients without the deficits; (2) the attentional deficits associated with continuous work performance can be improved through psychosocial intervention; (3) patients show highly individualized responses to treatment; and (4) improvement of the psychological deficit is associated with improvement of clinical status in some patients, but not others. All of these point to the value of laboratory measurement of psychological functioning in selecting and sequencing skill-training interventions, and in evaluating progress and outcome.

Another area of rehabilitation where attentional deficits are

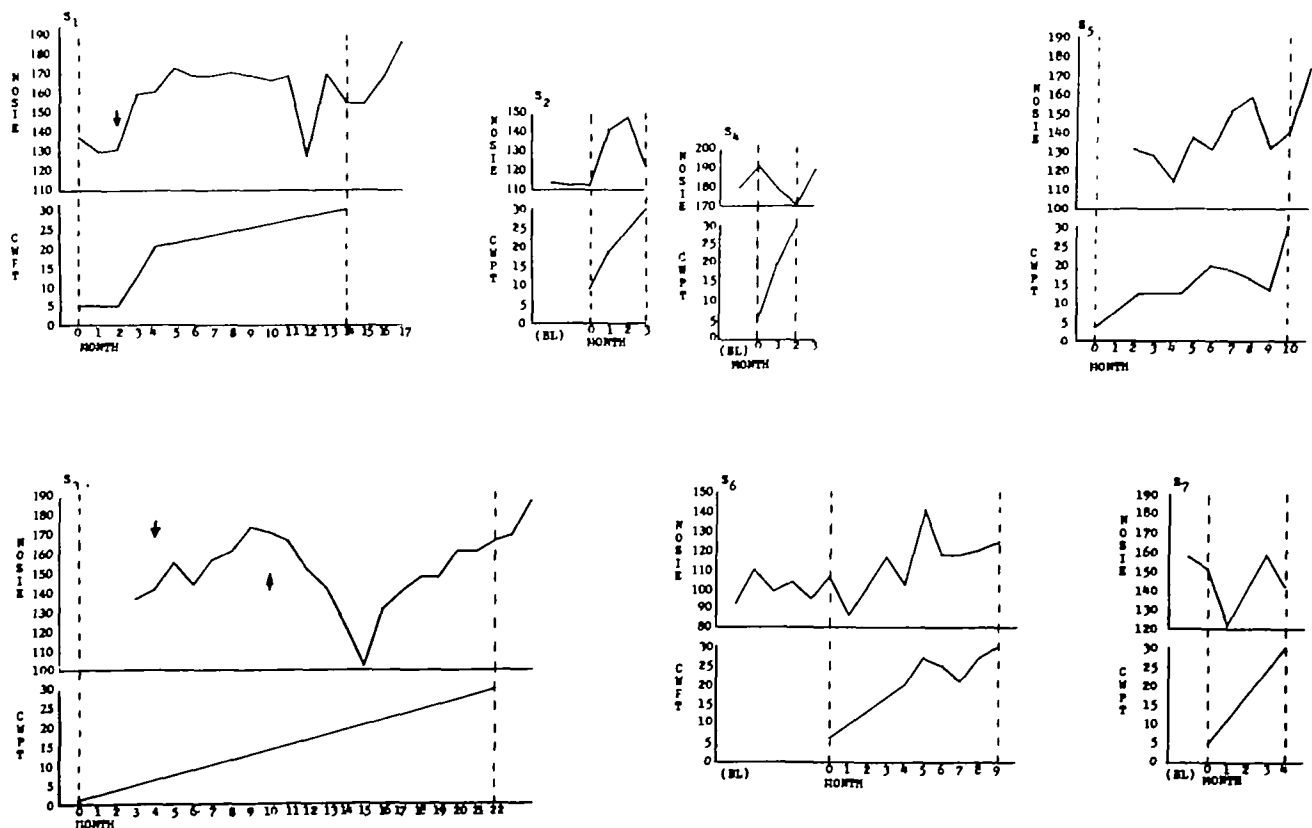
particularly relevant is social skills training (SST). As we mentioned earlier, investigators in this area have expressed concern that some of schizophrenia's most significant characteristics are not addressed in skills training (Lieberman, Nuechterlein, and Wallace 1982). Attentional deficits are assumed to be limiting factors in social skills acquisition in a group setting. Shuart (1985) tested the effects of an attentional training procedure on performance in a five-patient SST group. The subjects' daily performance during SST sessions was

assessed through observational scoring of videotapes and quizzes administered at the end of each session. The rating scales were designed to assess observable behavior associated with attention (alert posture, eye contact). The quizzes assessed subjects' assimilation and retention of material presented and rehearsed in the SST session. After an initial baseline period, subjects received two sessions per week of either an attention-enhancing self-instructional training regimen similar to that developed by Meichenbaum and Cameron (1973)

or a "placebo" procedure (semistructured conversation about the group sessions).

Attentional functioning showed a significant treatment effect. On the post-SST-session quizzes, four of the five subjects showed an improvement over placebo baseline when the attentional treatment was introduced. There was a significant rank-order correlation ($r = .90; p < .05$) between absolute level of quiz performance at the end of the study and number of actual attentional treatment sessions (the latter was different for each subject). Observa-

Figure 3. Response of 7 patients to continuous work performance training



The NOSIE-30 (Nurses' Observational Scale for Inpatient Evaluation) (Honigfeld, Gillis, and Klett 1966) is a 30-item behavioral checklist filled out by ward staff after at least 3 days of patient observation. The figure shows monthly averages of the NOSIE-30 Total Assets Scale; the data were collected weekly by ward staff. Arrows indicate change in contingency management program for subject 1, and drug titration for subject 3.

tional ratings of attentional behavior made from videotapes of the SST sessions also showed significant improvement, although the effect was not strong enough to differentiate treatment from placebo effects.

Cognitive Interventions. Cognitive interventions that facilitate the organization of response hierarchies fall into two subcategories, process-oriented and content-oriented. Content-oriented interventions attempt to change the content of key thought processes. Often they focus on attributions about the self, such as ability to be successful or current level of functioning. Well-known techniques for modifying cognitive content have been developed to treat depression (e.g., Beck 1976). Severely disordered patients often have depression-related attributional patterns, but it is not known whether they would also respond to such treatments.

The Adams et al. (1981) treatment described earlier included a cognitive content intervention that addressed a more typically schizophrenic attribution. The patient was prone to attribute unsuccessful social interactions to persecutory intentions of other people. As the patient's social skills improved, these failures were reinterpreted as a result of formerly deficient skills. Successful interactions began to occur as a result of the improved skills, and this further reduced attributions of persecutory intent.

Patients' attributions about their own psychophysiological and perceptual experiences can be an important factor in determining how disabling those experiences are. For example, a patient with auditory hallucinations may believe that they are the result of a brain disorder, or may believe that they are the voice of Satan. The attributional difference

could have a significant impact on how much the hallucinations interfere in rehabilitation activities. Johnson, Ross, and Mastria (1977) report a case in which misattributions of proprioceptive sensations produced the "delusional" belief that the patient was having sex with a supernatural "warm form." Observation revealed that the patient was generating the sensations himself. In a primarily didactic intervention, the patient was counseled to accept masturbation as normal and acceptable, and thus to understand his mysterious orgasms. This reformulation eliminated his delusional belief. Various strategies for modifying patients' problematic attributions are described by Valins and Nisbett (1971).

Self-instructional sets such as those developed by Meichenbaum and Cameron (1973) can also be categorized as modification of cognitive content. In addition to cues for maintaining attention, the sets include self-reinforcing comments and reassurances against frustration when failure occurs. These are presumably elements in most people's self-instructional sets, albeit unconscious or taken for granted. Their effectiveness in improving patients' performance can be understood in the hierarchy-collapse model as the result of enriched input. The self-instructions cue a variety of necessary responses in the psychophysiological, attentional, and cognitive levels of functioning. In other words, they change the stimulus situation to produce hierarchies with strong (and appropriate) dominant responses and weak competing responses. Without cues, these responses are vulnerable to interference from competing responses. In the case of self-instructions, the patient provides the input enrichment.

A relatively molar cognitive process is that described by the ego-psychological term "reality testing" (Bellak, Hurvich, and Gediman 1973). Reality testing is a complex collection of cognitive activities that includes sampling perceptual data, comparing it with information in memory, and devising plans to resolve discrepancies. Delusions and hallucinations can often be understood as the result of faulty reality testing, especially when perceptual data are distorted by psychophysiological or attentional functions. Shemburg and Leventhal (1972) described several cases wherein reality testing was augmented by procedures which clearly constitute input enrichment. In one example a patient reported seeing blood flowing under the door into the therapy room. The therapist said loudly and firmly, "There is no blood there," and went to the door and put his hand on the floor, and then had the patient do the same thing. The patient was relieved and the therapist continued by discussing with her other ways of discriminating the real from the unreal. Specific therapeutic effects using objective laboratory measures of reality testing have not been studied, however, because precise measures of the component processes have not been developed.

Recently Johnson (Johnson and Raye 1981; Johnson, in press) has developed a more highly operationalized cognitive model of reality testing, which she calls "reality monitoring." Reality monitoring is a collection of cognitive skills by which a person selects information from memory, discriminates the sources of memory information, and uses the information to interpret ongoing events. Unlike the original concept of reality testing, the specific processes of reality monitoring can be

separately measured. The reality-monitoring model may provide the laboratory measures prerequisite to assessment and treatment of patients who misinterpret or misattribute perceptual and memory information.

Another molar cognitive process is "problem solving," formalized by D'Zurilla and Goldfried (1974) as a five-stage process of recognition, analysis, solution generation, solution selection, and outcome evaluation. Therapeutic procedures to improve the problem solving of several patient populations, including chronic psychiatric patients, were developed by Spivak, Platt, and Shure (1976) and Wallace (1982). A variety of less severely disturbed patients also benefit from problem-solving therapy, which suggests that many people never completely learn this cognitive skill in the first place. In persons suffering from schizophrenia, the therapeutic effect may therefore be partially due to learning a new cognitive skill. In addition, the highly formalized procedures of problem-solving therapy provide structure and enriched input that could reorganize a collapsed cognitive response hierarchy.

The fact that the five specific stages of problem solving can be separately assessed has allowed detailed research in normal populations. For example, in most people the rate-limiting stage is in solution generation; the more alternative solutions a person can generate, the more effective is that person's problem solving (see D'Zurilla and Goldfried 1974). There is probably considerable potential in quantitatively assessing performance in each stage of the process, and tailoring treatment accordingly. Procedures for clinically assessing problem solving in severely disordered patients are beginning to be explored (Hansen, St. Lawrence, and Christoff

1985), and recent evidence (Wallace and Liberman 1985) suggests a problem-solving approach enhances the effectiveness of social skills training.

A more molecular cognitive process known to be deficient in many psychiatric patients is the formation of concepts. Sometimes patients use conceptual categories that are overly broad and overly narrow. Sometimes the conceptual problem lies in concept *modulation*, the process of discarding a conceptual scheme when it is no longer useful and constructing a new one. This type of deficit appears to be associated with hostility, belligerence, and persecutory beliefs (Spaulding 1978). It may be due to a particular style of processing information, wherein new perceptual data are rejected in favor of memory data (Magaro 1984). There are no reports of controlled group studies wherein concept modulation is directly modified, but a case study illustrates the potential of this type of intervention:

The patient was a 23-year-old man with chronic schizophrenia. After living for about 2 years in a supervised residential setting, he had made no rehabilitative progress, and his life had been punctuated by frequent altercations with service personnel and other patients. He had been denied admission to a residential psychosocial program because of his belligerent behavior and hostile demeanor.

The patient had been on a stable antipsychotic drug regimen for 12 months. His history indicated that drugs were necessary to control more florid psychotic symptoms. He was compliant with his drug regime and was judged to be optimally medicated. As part of a systematic assessment procedure, the patient was administered a battery of psychomotor, attentional, and cognitive tests. The

patient was within normal limits in simple reaction time, backward masking, span of apprehension, distraction effects on the reaction time task, redundancy-associated effects on the reaction time task, vigilance, and size estimation. He showed an isolated deficit on a version of the Wisconsin Card Sorting Test (see Lezak 1983), a task that requires formulation and reformulation of a conceptual scheme through trial and error. His difficulty on the sorting task was a tendency to adopt a particular scheme and perseveratively continue to use it long after the task demands had changed.

The laboratory data suggested that the patient had a specific conceptual deficit that was preventing him from using his reasonably good social repertoire in stressful situations. The nature of the deficit was hypothesized to be a tendency to schematize a situation rapidly, and then persevere with that schematization despite changes in the situation. The quality of the patient's attributional behavior in social situations suggested that he used a stereotypic conceptualization of all interactions; i.e., that the other person was trying in some way to take advantage of him. He was able to understand interactions in a better perspective when not in the situation, but this did not help when he was actively engaged. An exercise was designed to increase his ability to reconceptualize a social situation rapidly, and reject his stereotype. For 10 therapy sessions, the patient was asked to generate alternative schematizations, first to inkblots and then to Thematic Apperception Test (TAT) cards. That is, he was instructed to generate as many different percepts (to the inkblots) or stories (to the TAT cards) as he could to a single stimulus. He found this extremely difficult, especially with the TAT cards. Gradually, however, he gained an ability to generate three to four stories for each card without bizarre or perseverative elements in subsequent stories. One particular card caused him extraordinary difficulty. He reported that it reminded him of

an incident in his past that was still upsetting. Even after responding well to two or three cards, he could only generate one morbid scenario for the problem card. This experience served to demonstrate to the patient that his problem could be exacerbated by stressful situations.

The conceptual exercise was accompanied by counseling about the importance of conceptual flexibility, especially in social situations. After the end of the 10 exercise sessions, he was retested with the initial assessment battery. His previous conceptual deficit was reduced to within normal limits. He continued to receive regular counseling about social interactions, as he had before the exercises. In the following weeks, residential staff reported a positive change in his demeanor and attitudes. This was corroborated by an improvement in weekly NOSIE ratings, particularly on the Irritability subscale. At last followup, he had been accepted to the residential program that had previously rejected him.

Systematic Multimodal Assessment and Treatment. The foregoing discussion and case examples show the potential usefulness of interventions aimed at specific deficits in psychological levels of functioning. Cases selected for illustration of single interventions are always misleading, however. Recall that pervasiveness is a hallmark of schizophrenia and other severe psychiatric disorders. A patient with an isolated deficit in a single level of functioning represents the exception not the rule. In the overwhelming majority of cases, the clinician is confronted with an array of deficits with unknown mediational relationships.

Nevertheless, multiple interventions can be delivered in a systematic way. The key to delivering interventions systematically is to treat the most molecular deficits first, whenever possible. When mediational relationships are present, they

can be expected to be molecular deficits causing molar deficits. Thus, normalization of the molecular deficit should eliminate the molar deficit as well. If an intervention is aimed at a molar deficit that is mediated by a molecular deficit (e.g., social skills training attempted with patients having severe attentional deficits), the effect of the intervention can be suboptimal.

A final case study illustrates systematic use of multiple biological, psychological, and social interventions in a patient whose deficits are typically pervasive:

The patient was a 38-year-old woman. She had been transferred to an extended care ward because of failure to recover sufficiently after 2 months on an acute ward, where treatment had consisted of antipsychotic medication and milieu therapy. She showed a mixed picture of depressive, compulsive, and schizophrenic-like symptomatology, including withdrawal, auditory hallucinations, psychomotor retardation, impoverishment of thought, and bizarre posturing. She complained of fears that she would be infected by germs on the surfaces of common objects, and this was associated with bizarre dress and habits, including wearing plastic sandwich bags on her hands. She did not recognize her germ fears as irrational. Despite her fears, her grooming and hygiene were remarkably poor.

The patient had a mixed social history. Although she had sporadically supported herself for some periods, was married and had children, her lifelong pattern was one of dependence on a few family members. Over a 2-year period, her symptom picture had developed from a fairly typical chronic compulsive disorder, limited to compulsive hand-washing, to psychosis. At times during that period, her fear of germs was reported to be elaborated into bizarre somatic delusions.

There was a controversy about how the patient should be treated, but the clinical staff agreed on a working hypothesis that her most molecular deficit was a drug-responsive physiological process of the type associated with endogenous depression. She was treated initially with an antidepressant drug (doxepin) and low-demand social activities. Over the next 6 weeks, the clinical data indicated a strong but selective response to the antidepressant regime. Her weekly NOSIE and repeated Inpatient Multidimensional Psychiatric Scales (IMPS) (Lorr and Klett 1966) showed an improvement in psychomotor retardation, social withdrawal, and impoverishment of thought. She no longer reported hallucinations. However, the same measures indicated that her posturing and other bizarre behavior remained unchanged.

At 8 weeks after initiating medication, the drug response appeared to be stabilized. An attribution-oriented intervention was initiated, consisting of daily discussions with staff about personal hygiene, and realistic and unrealistic concerns about health hazards. This was reinforced with a contingency system wherein normal and appropriate hygienic behavior was rewarded with ward privileges. Over the next 4 weeks, the patient's appropriate self-care behaviors increased in frequency. In conversation she began to acknowledge that her fear of germs and her precautionary measures were irrational. These changes were accompanied by improvements in her weekly NOSIEs, to the degree that no overtly psychotic or compulsive behavior was observed on the living unit. Her IMPS profile corroborated a reduction in disordered thinking. The NOSIEs also showed improvements in the Neatness subscale, a measure of grooming and hygiene.

Despite these changes the patient was subsequently caught stealing baggies from the ward supply room and using them in private. Although she continued to acknowledge the irrationality of her fears, a behavioral avoidance

test revealed she still could not touch some objects, especially doorknobs, without considerable distress. A traditional systematic desensitization treatment was initiated, and after 4 weeks she had regained her ability to touch objects without discomfort. Her compulsive hand-washing did not reappear.

Finally, with the patient's psychophysiological and attributional problems resolved, her living skill repertoire was assessed. The Independent Living Skill Inventory (a 60-item checklist developed in our laboratory) identified significant deficits in ordinary living skills and interpersonal skills. Over the next 4 months, she received a regimen of skills training in those areas. She gradually achieved skills levels adequate for relatively independent living, and was discharged to a community aftercare facility. At an 18-month followup, she had gained competitive employment, moved to her own apartment, and had suffered no relapses.

Future Directions and Conclusions

Evidence is accumulating that deficits in patients' psychological functioning can be reduced by specialized treatment procedures directed at remediation of the basic dysfunctions. There is less evidence that improvements in these psychological levels of functioning have a direct impact on achieving the goals of rehabilitation. A pioneering project has been carried out by Brenner et al. (1983) in which a variety of attentional and cognitive treatment techniques were integrated into a comprehensive rehabilitation program for chronic schizophrenics. Patients are "stepped" through the program, with advancement to a more molar level of treatment contingent on adequate performance at more molecular levels. The molecular treatments include special

training in processing information from social interactions and encoding it in memory. More molar levels include social skills training. The project of Brenner et al. (1983) was a "field study" and the data are preliminary, but the outcome suggests that the molecular-level interventions significantly facilitate progress toward global rehabilitation goals.

Ultimately, highly controlled studies with homogeneous patient populations are required to validate the effectiveness of specific psychological interventions. One future direction for psychological interventions in schizophrenia must therefore be toward large-scale trials that test the effectiveness of specific treatments in achieving both focal and comprehensive complete psychiatric rehabilitation. There is a major obstacle to that, however. The psychological deficits found in schizophrenic patients are heterogeneous. A large-scale trial requires a population homogeneous with respect to the deficits being treated. It will be a long time before a significant number of trials have been run on subgroups of patients whose constellations of deficits are similar enough to assume group homogeneity.

Meanwhile, there is still much to be learned from smaller scale studies. Multiple replications of single case, controlled experimental designs can be helpful in the further development and validation of specific treatment techniques. Of the many measurement paradigms in experimental psychopathology, only a few have been adapted for practical use. Through smaller-scale exploratory studies, we learn what treatment approaches and measurement techniques are practicable in clinical settings, and what kinds of interventions deserve more detailed study. Similarly, the importance of short-

term treatment outcome should not be underestimated. The benefits of an attentional intervention, for example, may lie in facilitating the first small steps a patient makes in a longer-term trajectory of improvements in social skills training or vocational rehabilitation.

A second future direction in this area should therefore be toward expanding the armamentarium of psychological intervention and measurement techniques through smaller-scale and shorter-term studies. The intriguing questions that could be addressed include: Are autonomic measures of arousal (heart rate, sweat gland activity, electro-myogram) adequate for monitoring response to psychophysiological interventions, or will this require more expensive and complex central nervous system measures (e.g., averaged evoked cortical potentials)? Is naturalistic monitoring of psychophysiological responsivity (Tarrier et al. 1979) superior to laboratory measurement? What laboratory measures best identify the "modality-discrimination" deficit apparently associated with auditory hallucinations? Is the modality-discrimination training effect really a change in attentional functioning, or a reattribution of the deficit? To what degree do the effects of distraction-resistance training generalize outside the treatment setting or to other perceptual modalities? Can individualized self-instructional sets be developed based on laboratory assessment of attentional deficits? To what degree are short-term memory deficits in naturalistic settings separable from attentional deficits? Should they be treated separately? Can the ephemeral cognitive skills of "reality testing" and "problem solving" be compartmentalized into meaningful and treatable components?

Even after the psychological armamentarium is expanded and tested in large-scale trials, use in rehabilitation will not be a simple process. Patients' individual constellations of deficits are probably unique enough to preclude a "cookbook" approach to treatment. Idiographic assessment and individualized treatment regimens will probably always be necessary, even to take full advantage of skill training "packages" designed to remediate cognitive deficits through repetition, overlearning, focused demonstrations, video-assisted learning, and teaching problem-solving strategies (Wallace and Boone 1984). Interventions should therefore follow a hypothetico-deductive course, wherein theory guides initial data collection, treatment is delivered on the basis of inferences from the initial data, and outcome data validate the process. In other words, intervention strategies should aspire to well-controlled *n-of-1* experimental design (Barlow and Hersen 1984).

The hypothetico-deductive approach to treatment brings other problems with it. Extensive continuous data collection capabilities are required. The institutional setting must be amenable to treatment based on measured outcome rather than preconceived policies about what is or is not appropriate treatment. The work of Gordon Paul and his colleagues (Paul and Lentz 1977) has demonstrated that this is possible through extensive clinical staff training, computer-assisted assessment and data management, and careful attention to the bureaucratic and administrative context of mental health services.

The clinical data system devised by Paul and his colleagues (see Paul and Lentz 1977) was supported by a mainframe computer. The data were

limited to a social-behavioral level of functioning, focusing on consumption of reinforcers and other aspects of token economy treatment. Since that pioneering project, microcomputers have appeared, bringing powerful data-processing capabilities within the means of any mental health agency. Microcomputers can also provide measures of psychophysiological, attentional, and cognitive functioning at a cost much lower than required for a conventional psychopathology laboratory (Spaulding et al. 1981; Spaulding, Crinean, and Martin 1983). In view of these developments, a third future direction will inevitably be in the areas of multimodal data management technology and data-based clinical administration.

With systematic application of laboratory methods, integrated approaches that address psychological deficits can be evaluated for their impact on social competence, quality of life, and subjective comfort and satisfaction. Two guidelines can assist the rehabilitation practitioner in efficient use of multimodal interventions. First, being capable of *flexible levels of intervention* will reduce the number of patients deemed "refractory" to treatment; increasing the amount of time, spectrum of interventions, accessibility of services, and personalized contact when necessary will improve outcomes. Second, a *minimum-maximum strategy* will improve cost-effectiveness by first offering the least amount of services deemed clinically indicated and then adding additional services incrementally as new goals are formulated.

The choice of techniques to investigate and the variables to measure, as well as the coordination of assessment and treatment interventions in individual cases, is more focused and efficient when guided by

a coherent theory. Thus, assessment and intervention should be guided by a general model of schizophrenia sensitive to empirically established psychopathological principles. This is illustrated by the relationships between theory and the approaches to treatment and rehabilitation presented in this article. When these requirements are met, an accumulation of knowledge is begun which can eventuate in meaningful group outcome studies. Given the apparent potential for laboratory assessment and treatment of psychological deficits, it seems appropriate to move forward.

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