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A Paradigm for Single-Case Research: The Time Series Study of a Long-Term Psychotherapy for Depression

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This study articulates a paradigm for single-case research in psychotherapy. A patient diagnosed as having major depressive disorder was seen in an intensive, twice-weekly psychodynamic psychotherapy for $2\frac{1}{2}$ years. Each session was videotaped, and assessments of patient change were obtained at regular intervals. A time-series analysis was used to model fluctuations in the therapy process to take into account time and the effect of previous events on subsequent changes, thereby preserving the context-determined meaning for therapist and patient actions. A bidirectional analysis of causal effects shows that the influence processes between therapist and patient are mutual and reciprocal and suggests that the effect of the patient on the therapist and on the process has not been made sufficiently explicit in previous models of process and change. The potential of intensive single-case designs for uncovering causal effects in psychotherapy is demonstrated.

One of the most difficult challenges for psychotherapy research has been to demonstrate convincingly the link between what occurs in the treatment hour and patient change. Conventional group comparison designs or controlled clinical trials have been relatively ineffective in identifying associations between the therapy process and outcome (Garfield, 1990), and new approaches are needed. The possibilities of single-case research for providing evidence of such causal relations have not been sufficiently recognized, despite the fact that intensive single-case designs would seem to be a natural domain for the study of psychotherapy process and the evolution of the internal structure of the treatment. Most process research rests on two assumptions: (a) that the nature of the processes have fixed meanings that are context independent, and (b) that such processes discretely and uniquely contribute to outcomes (Shoham-Salomon, 1990). An observed process, however, is only a series of actions unless psychological meaning is attributed by its participants to the interpersonal events that occur. Each therapeutic technique or action derives its meaning from the impact it has on the ongoing patient–therapist interaction. The context-determined meaning of events makes it difficult to identify simple, direct associations between particular therapist actions or patient behaviors and treatment outcomes in group data or treatment samples (Jones, Cumming, & Horowitz, 1988; Stiles, 1988). It is here that single-case research, which more naturally captures the context in which therapist and patient actions occur, can make a contribution to identifying causal relations.

Recently an approach to the study of the therapy process has been advanced to take into account the interaction of multiple influences in clinical treatments (Shoham-Salomon, 1990). In this view, specific processes are seen as simultaneously and conjointly defining the meaning of an event; one element becomes more fully understood in relation to others. Within this framework any given interaction is best understood when viewed within a sequence of actions that extend over time (Pinsof, 1989). A longitudinal approach, that is, one that takes into account time, context, and the effect of previous hours on subsequent events in therapy, then becomes a natural framework for the study of process. Therapeutic change processes are studied as interrelated configurations or patterns of relationships along temporal dimensions (Jones, Parke, & Pulos, 1992; Jones & Windholz, 1990).

The nature of the patient's influence on the therapist and on the emerging patterns of relationship has been insufficiently emphasized. Conventionally, process investigations attempt to identify the manner in which therapist actions or techniques influence patient change. Causal influences are assumed to flow principally in one direction. One of the well-documented findings of psychotherapy research is the importance of patient characteristics, such as psychological mindedness or capacity for relationship, for successful treatments (Garfield, 1986). Patient characteristics are, however, like therapist actions or other process events, typically studied in a decontextualized manner (i.e., as independent variables contributing directly to outcome). The influence of patient characteristics and behavior on the therapist, on the therapy relationship, and on the emerging therapeutic process needs to be made more explicit. A more adequate model of the therapeutic process should, it seems, articulate mutual or reciprocal influence processes between patient and therapist.

Psychoanalytic theories about the therapy process have begun to emphasize an interactional perspective, that is, an appreciation of mutual influence processes in psychotherapy. Sandler (1976) used the term *role responsiveness* to describe the therapist's tendency to comply with the behavior or role demanded by the patient, and Gill (1982) argued that transference is not only a distorted carry-over from the past, but

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equally the result of the patient's plausible perceptions of the therapist's behavior and the interaction between them. The recognition of reciprocal influence processes in therapy research would move closer to contemporary interactive conceptions of process, such as Boesky's (1990) emphasis on the subjective experience of the therapist, and related notions about enactments (McLaughlin, 1991). It is consistent, too, with current attempts to broaden the definition of countertransference and to be more attentive to the role of the therapist's emotional interaction with the patient, both unconscious and intentional, in the change process (Casement, 1991).

The present intensive study of a single case articulates an interactional and context-determined paradigm for the study of therapy process. It attempts to capture the reciprocal influence of patient and therapist, the patterns of their relationship, and the change process within a longitudinal frame. Time-series analysis was selected as a strategy not only for modeling the fluctuations in process throughout the course of the psychotherapy, but for linking dimensions of process to patient change. Among the several approaches to time series available, we selected Gottman and Ringland's (1981) method, because it was developed specifically to model directional influences in the mother–infant dyad and had a ready psychological referent to the therapist–patient interaction.

Time-series analysis stands in contrast to the more usual procedure in therapy process research of segmenting a record of the process, usually transcripts of therapy hours, into sections of comparable length. In that method, the conjunction of two purportedly causal events is identified. Luborsky and Auerbach's (1969) symptom context method, for example, identifies the relationship of the occurrence of a symptom and its determinant; Weiss and Sampson (1986) selected patient transference tests and the patient's subsequent reaction to the therapist's response to such tests. The idea is to identify the co-occurrence of two phenomena of interest by extracting samples of segments representing the two events, which are then contrasted to randomly selected segments, thereby providing evidence for a causal relationship by demonstrating a time-bound association (Fonagy & Moran, 1990). This strategy of replication through segmentation has the difficulty of removing processes that change at a slower rate. It has the additional limitation of overlooking reciprocal influence, that is, the patient's influence on the therapist's attitude and behavioral response. Time-series analysis preserves the sequential dependencies in the therapeutic process and can identify relationships over a long period of time as well as bidirectional influences.

An illustration may help clarify the advantages of a time-series strategy for the study of interaction. It has been argued by some theorists (e.g., Malan, 1976) that the frequency of transference interpretations in brief psychodynamic psychotherapy is related to outcome. This is a classic example of a "decontextualized" conception of process. There are clearly problems with framing the hypothesis in this fashion, because it assumes that an isomorphism exists between outcome and the relative frequency of a particular therapist intervention. However, a therapist may interpret the transference relatively infrequently, but when she or he does, it may have an important impact. In this case, simply counting the relative frequency of specific therapist actions will not allow us to detect any relationship to patient change. Sequential analysis has the advantage of being able to identify relationships between events in a way that retains their context. Additionally, it can capture processes in which causality is reciprocal rather than unidirectional. It allows us to know, for example, whether the patient's experience of depressive affect is the consequence or the instigator of the therapist's interpretive activity. Clearly, such a relationship could be an alternating one.

Method

The treatment under study here was a twice-weekly, $2\frac{1}{2}$-year psychodynamic psychotherapy conducted as part of an investigation of longer term therapies for major depressive disorder being carried out by the Berkeley Psychotherapy Research Project. Patients referred to the project were assessed through the following intake procedure: (a) a videotaped semistructured interview based on the Schedule for Affective Disorders and Schizophrenia (SADS-I; Endicott & Spitzer, 1977) and resulting in a Research Diagnostic Criteria (RDC) diagnosis (Spitzer, Endicott, & Robins, 1979); (b) a second, $1\frac{1}{2}$-hr-long videotaped life history interview covering areas of distress and symptomatology, current life circumstances, and history of interpersonal relationships; and (c) a battery of pretherapy self-report measures. Patients met the following inclusion criteria: (a) a definite diagnosis of major depressive disorder on the RDC; (b) a score of 16 or higher on the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961); and (c) a score of 14 or higher on the Hamilton Rating Scale for Depression (HRSD; Hamilton, 1967).

Subjects

The Patient

The patient, M, was 35 years old at the beginning of treatment. She had divorced about 10 years ago and had three children by that marriage. M and her children were currently living with a man whom she married during the course of the therapy. Her presenting complaint was that she had gone into an emotional tailspin when her eldest son, age 16, expressed the desire to live with his father, her former husband. M's first episode of severe depression occurred 6 years ago when, in the course of a year, she underwent two abortions. She was treated by a psychiatrist through a regimen of antidepressant medication and some psychotherapy. M reported that the medication alleviated her symptoms of sleeplessness and loss of appetite but that this therapy did not seem to go anywhere.

M's father was a successful business entrepreneur whom she, as a child, adored. She remembered never being very close to her mother, who was a housewife. M had one brother, her mother's son by a previous marriage, who was 9 years older and whom she greatly admired and looked up to. M felt her father had always been disappointed in not having a son of his own. When M was 7 years old, her brother died in a swimming accident. M's mother, whom she described as once very energetic, outgoing, and vivacious, went into a severe and prolonged depression; she believes her mother never really recovered from her brother's death. M felt that her father then deserted both her and her mother, and she felt excruciatingly lonely. Her mother became increasingly passive, and her father, who was eventually himself treated for an emotional disorder, drank excessively and became mean and aggressively domineering. Nevertheless, M did well at school and was popular among her classmates. Her parents' increasingly acrimonious marriage eventually ended in divorce. At age 16, M was sent to boarding school, and eventually she went to college, where she married after her freshman year. She had her first child at age 21 and worked as a teacher. She ended her 9-year marriage largely because of her husband's problems with alcohol.

The Therapist

The therapist, Dr. X, was a psychologist and a seasoned clinician in her mid-40s who was in full-time private practice and who was active in other psychotherapy research projects. Dr. X was asked to treat M as she would any patient in her private practice; she independently sought regular consultations during the course of the therapy. Dr. X conducted the therapy out of an ego psychological perspective that has been termed *control-mastery theory* (Weiss & Sampson, 1986). The therapy was conducted over a $2\frac{1}{2}$-year period, twice weekly, for a total of 208 sessions; all treatment hours were videotaped and audiotaped. Patient and therapist completed assessment measures every 16 sessions, and a more complete evaluation was conducted every 6 months. There was also an exit interview at termination to provide the patient an opportunity to review her experience in psychotherapy. A full assessment was again completed at a 6-month and 1-year follow-up, including a taped interview.

Measures

Clinical Evaluator and Therapist Ratings

SADS-I. The SADS-I (Endicott & Spitzer, 1977) was used in the initial evaluation and at termination to generate an RDC diagnosis (Spitzer et al., 1979). Developed to reduce information variance in diagnostic evaluation, the SADS provides a detailed description of the features of the current episode of a disorder as well as the level of severity of manifestations of major dimensions of psychopathology.

HRSD. The HRSD (Hamilton, 1967) is a 17-item scale completed by the clinical evaluator at pre- and posttreatment to assess severity of depressive symptoms, including mood, guilt, suicidal ideation, sleep disturbances, somatic and psychological anxiety, and somatic complaints.

Overall Change Rating. Every 16 sessions Dr. X completed an Overall Change Rating, a 9-point scale ranging from *very much worse* (−4) to *very much improved* (+4).

Patient Self-Report Measures

The patient completed a set of assessment instruments every 16 sessions.

BDI. The BDI (Beck et al., 1961) is a 21-item self-report designed to assess current syndromal depression. Subjects are instructed to complete each item in terms of how they have felt over the preceding week.

Symptom Checklist 90-R (SCL-90-R). The SCL 90-R (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974), a multidimensional self-report inventory of symptoms, has demonstrated both good reliability and sensitivity to change in psychotherapy, and is a widely used symptom change measure.

Automatic Thoughts Questionnaire (ATQ). The ATQ (Hollon & Kendall, 1980) is a 30-item self-report instrument designed to measure the frequency and intensity of negative thoughts about the self, which cognitive-behavioral theorists posit to be an etiologic source of depression. The ATQ has demonstrated its ability to discriminate between depressed and nondepressed groups and has become one of the most widely used outcome measures in cognitive-behavior therapy research.

Overall Change Rating. The patient rated her overall change on the same scale that Dr. X did.

In addition to the evaluations at 16-week intervals, a more complete assessment was conducted every 6 months that included several additional instruments.

The Minnesota Multiphasic Personality Inventory (MMPI). The MMPI (Dahlstrom & Welsh, 1960) can be used to identify a wide range of clinical syndromes; particularly relevant for this study is Scale 2 (Depression), a 60-item true–false inventory embedded within the larger 550-item measure.

Social Adjustment Scale (SAS). The SAS (Weissman, Prusoff, Thompson, Harding, & Myers, 1978) is a 42-question self-report instrument that measures either instrumental or expressive role performance over the past 2 weeks in six major areas of functioning: work as a wage earner, housewife, or student; social and leisure activities; relationship with extended family; marital role as a spouse; parental role; and membership in the family unit.

Table 1
Patient M Scores on Assessment Measures

Measure	Pretherapy	Posttherapy	6-month follow-up	1-year follow-up
SADS–RDC	Major depressive disorder	Did not meet criteria for major or minor depressive disorder	—	—
Hamilton Rating Scale for Depression	22	1[a]	—	—
Beck Depression Inventory	24	1[a]	0[a]	0[a]
SCL 90–R (GSI)	70	32[a]	40[a]	30[a]
Automatic Thoughts Questionnaire	61	30	30	30
MMPI Depression Scale	75	46[a]	44[a]	43[a]
Social Adjustment Scale	2.1	1.4	1.2	1.2
Inventory of Interpersonal Problems	1.27	0.29	0	0
Patient Change Rating (−4 to +4)	—	4	4	4
Therapist Change Rating (−4 to +4)	—	4	—	—

Note. SADS–RDC = Schedule for Affective Disorders and Schizophrenia–Research Diagnostic Criteria; SCL 90–R (GSI) = Symptom Checklist 90—Revised (General Severity Index); MMPI = Minnesota Multiphasic Personality Inventory. Dashes indicate data not available.
[a] Patient met criteria for clinically significant change.

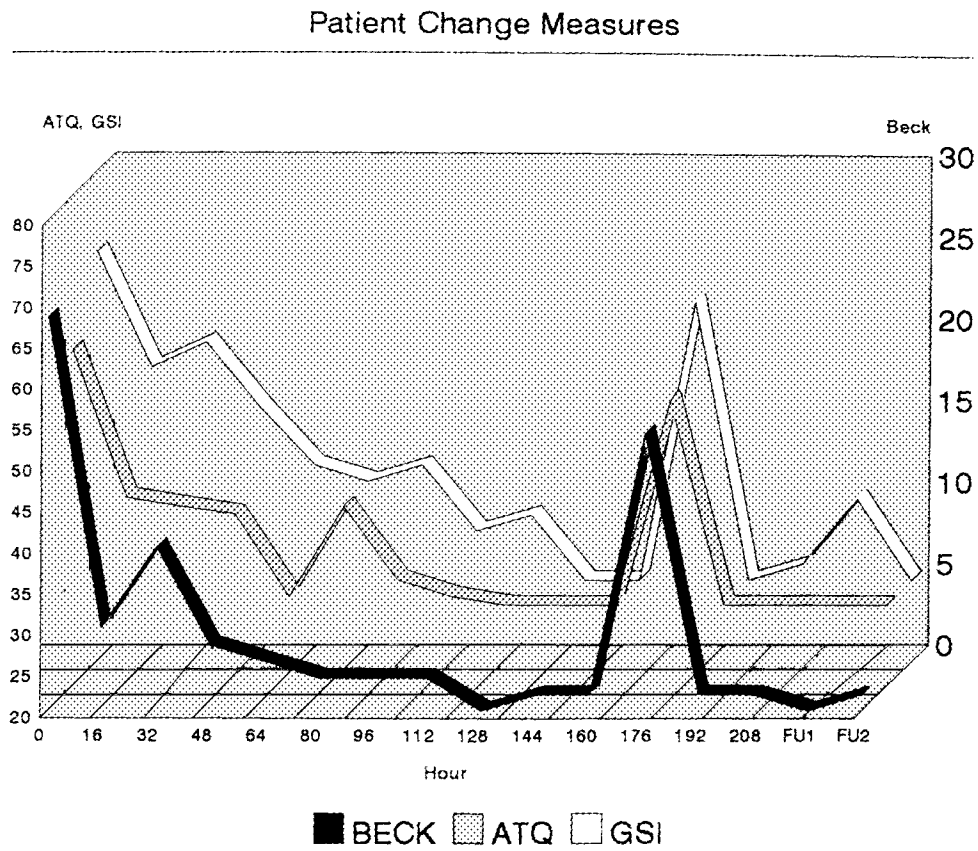

Figure 1. Plot of scores of M's symptom measures over the $2\frac{1}{2}$-year treatment and at 6-month and 1-year follow-up. (Beck = Beck Depression Inventory; ATQ = Automatic Thoughts Questionnaire; GSI = General Severity Index of the Symptom Checklist 90—Revised.)

The Inventory of Interpersonal Problems (IIP). The IIP (Horowitz, Rosenberg, Baer, Ureño, & Villaseñor, 1988) is a new 127-item measure designed to identify interpersonal sources of distress. Instructions ask the respondent to consider each problem on the list and, in a format similar to that of the SCL 90-R, to rate how distressing that problem has been on a scale ranging from 0 (*not at all*) to 4 (*extremely*). Horowitz et al. (1988) have found that although both the IIP and symptom measures are sensitive to change early in treatment, only the IIP continues to be change sensitive at later stages of treatment.

The Psychotherapy Process Q-Set

The 100-item Psychotherapy Process Q-Set (PQS) furnishes a language and rating procedure for the comprehensive description, in clinically relevant terms, of the therapist–patient interaction in a form suitable for quantitative comparison and analysis. The instrument is designed to be applied to an audiotaped or videotaped record or transcript of a single treatment hour as the unit of observation. Using the psychotherapy hour in its entirety has the advantage of allowing clinical judges to study the material for confirmation of alternative conceptualizations and to assess the gradually unfolding meaning of events. A coding manual (Jones, 1985) details instructions for Q-sorting and provides the Q-items and their definitions, along with operational examples to minimize potentially varying interpretations of the items. The special value of the Q-sort method is that it can capture the uniqueness of each therapy hour as well as permit the assessment of similarities or dissimilarities of one treatment hour to another (Block, 1961).

The PQS is best understood as a language for describing the wide range of therapeutic phenomena in terms of specific, rather than more global, constructs captured through the pattern of item placement. Recognition by trained clinical observers, in a relatively open inquiry, of patterns, consistencies, and covariations using the broad set of variables represented in the Q-items allows for the discovery of important phenomena and the relations among them. After studying the record of a therapy hour, clinical judges order the 100 items, each printed separately on cards to permit easy arrangement and rearrangement. The items are sorted into nine piles ranging on a continuum from least characteristic (Category 1) to most characteristic (Category 9), with the middle pile (Category 5) used for items deemed either neutral or irrelevant for the particular hour being rated. The number of cards sorted into each pile (ranging from 5 at the extremes to 18 in the middle or neutral category) conforms to a normal distribution, requiring judges to make multiple evaluations among items, thereby avoiding either negative or positive "halo" effects and attenuating the influence of response sets. The interrater reliability for the PQS has been consistently satisfactory across a variety of studies and treatment samples, with $r = .83$ to .89 for two raters and $r = .89$ to .92 using from 3 to 10 raters. A description of the construction of the instrument and additional reliability and validity data is available in a series of reports (Jones et al., 1988; Jones, Hall, & Parke, 1991; Jones & Pulos, 1993).[1]

[1] The relatively large number of items in the Q-set increases the possibility of making a Type I error. There is an inherent trade-off between

Table 2
Q-Descriptors of the Therapy Process With Patient M: Rank Order of Q-Item

Q-item no.	Item	Rank order
	10 least characteristic items	
20	Patient is provocative, tests limits of therapy relationship. (Placement toward uncharacteristic end implies patient behaves in a compliant manner.)	1.85
15	Patient does not initiate topics, is passive.	2.12
9	Therapist is distant, aloof (vs. responsive and affectively involved).	2.27
25	Patient has difficulty beginning the hour.	2.31
44	Patient feels wary or suspicious (vs. trusting and secure).	2.58
83	Patient is demanding.	2.69
87	Patient is controlling.	2.79
14	Patient does not feel understood by therapist.	2.95
42	Patient rejects (vs. accepts) therapist's comments and observations.	3.04
93	Therapist is neutral.	3.08
	10 most characteristic items	
92	Patient's feelings and perceptions are linked to situations or behavior of the past.	7.70
63	Patient's interpersonal relationships are a major theme.	7.51
88	Patient brings up significant issues and material.	7.44
37	Therapist behaves in a teacherlike (didactic) manner.	7.29
40	Therapist makes interpretations referring to people in the patient's life (vs. general or impersonal interpretations).	7.27
45	Therapist adopts supportive stance.	7.15
86	Therapist is confident or self-assured (vs. uncertain or defensive).	7.00
43	Therapist suggests the meaning of others' behavior.	6.85
30	Discussion focuses on cognitive themes (i.e., about ideas or belief systems).	6.84
62	Therapist identifies a recurrent theme in the patient's experience or conduct.	6.82

Note. $N = 53$ treatment hr.

The judges for the present study were graduate students in clinical psychology and research-oriented clinicians who received training in the application of the Q-sort method to therapy hours. The videotapes of every 4th hr ($N = 53$) were completely randomized, and independent Q-ratings were made by two judges who were blind to one another's ratings; when agreement was below .50, a third rater was added. Interrater reliability was calculated using the Pearson product–moment correlation coefficient; average interrater reliability achieved $r = .81$ (Spearman-Brown corrected; range, .66 to .92). Q-sort composites (i.e., meaned across judges) were used in all subsequent analyses.

Results

Assessments of Patient Change

The treatment was, by all indices of patient change, very successful. At termination, M no longer met criteria for either major or minor depressive disorder on the SADS-C (Change subscale). Her symptom scores and problem indices decreased markedly, and she maintained these gains at 6-month and 1-year follow-ups (see Table 1).

Figure 1 plots some of the symptom measures over the course of treatment and of the follow-up assessments. It depicts the initially relatively rapid and then steady decline in M's depressive symptoms. The striking, short-lived increase in symptoms at Hour 176 coincided with a visit of some weeks' duration by M's mother.

Evaluating change in the single case does not allow researchers to put such change in the context of change in other patients, as in large sample studies. This problem was addressed by estimating the clinical significance of change using the method suggested by Jacobson and Truax (1991), in which the patient achieves a postscore on the measure of interest that is more likely to belong in the functional than the dysfunctional population. A cutoff score was calculated using the means and standard deviations derived from normative data for functional and dysfunctional populations for all the measures for which this information was available, and it was then determined if M crossed the cutoff point in the direction of a functional sample from pre- to posttest. M met criteria for clinically significant change on the BDI, the General Severity Index (GSI) of the SCL 90-R, and the Depression scale of the MMPI; on the ATQ, M was already in the functional range at pretest. When normative data for functional populations are not available for a measure, as is the case for the HRSD, an alternative criterion for clinical significance can be applied—a score that is two standard deviations above the mean for a dysfunctional population (e.g., Hamilton, 1967). M easily met this criterion on the HRSD.

Q-Descriptors of the Therapy Process: Most and Least Characteristic

To identify the process descriptors that most strongly characterized this therapy, 100 item means were calculated from the

the level of Type I and Type II errors. In an exploratory study involving difficult-to-obtain data, it seems scientifically strategic to lessen the likelihood of Type II errors rather than to overprotect against Type I errors.

Table 3
Patient M: Dimensions of the Therapy Process

Q-item no.	Item	Loading
	Factor 1: Therapist Acceptance/Neutrality	
18	Therapist conveys a sense of nonjudgmental acceptance (placement toward uncharacteristic end indicates disapproval, lack of acceptance).	.85
3	Therapist's remarks are aimed at facilitating patient speech.	.84
28	Therapist accurately perceives the therapeutic process.	.80
6	Therapist is sensitive to the patient's feelings, is attuned to the patient, and is empathic.	.76
93	Therapist is neutral.	.72
31	Therapist asks for more information or elaboration.	.68
46	Therapist communicates with patient in a clear, coherent style.	.65
	Factor 2: Therapist Interactive	
24	Therapist's own emotional conflicts intrude into the relationship.	.85
37	Therapist behaves in a teacherlike (didactic) manner.	.85
77	Therapist is tactless.	.82
17	Therapist actively exerts control over the interaction (e.g., structuring, or introducing new topics).	.82
51	Therapist condescends to or patronizes the patient.	.77
5	Patient has difficulty understanding the therapist's comments.	.66
99	Therapist challenges the patient's view (vs. validates patient's perceptions).	.63
14	Patient does not feel understood by therapist.	.59
	Factor 3: Psychodynamic Technique	
67	Therapist interprets warded-off or unconscious wishes, feelings, or ideas.	.65
68	Real versus fantasized meanings of experiences are actively differentiated.	.59
50	Therapist draws attention to feelings regarded by the patient as unacceptable (e.g., anger, envy, excitement).	.55
22	Therapist focuses on patient's feelings of guilt.	.55
36	Therapist points out patient's use of defensive maneuvers (e.g., undoing, denial).	.54
47	When the interaction with the patient is difficult, the therapist accommodates in an effort to improve relations.	−.53
89	Therapist acts to strengthen defenses.	−.50
	Factor 4: Patient Dysphoric Affect	
94	Patient feels sad or depressed (vs. joyous or cheerful).	.68
7	Patient is anxious or tense (vs. calm and relaxed).	.62
26	Patient experiences discomforting or troublesome (painful) affect.	.58
70	Patient struggles to control feelings or impulses.	.58
13	Patient is animated or excited.	−.62
74	Humor is used.	−.55

individual Q-item placements of the 53 hours selected at regular intervals (every 4th hr) throughout the treatment. The Q-items were rank ordered, and the 10 most and least characteristic Q-items were identified. The Q-item means ranged from a high of 7.70 to a low of 1.85 (see Table 2) on the 9-point Q-distribution. In the narrative summarizing these 10 most and least characteristic Q-items, a strategy of organizing items according to meaning was chosen over a statistical ordering so that the results might lend themselves more readily to clinical interpretation. The Q-item numbers refer to the items in the tables; the word *reversed* (or *r*) in connection with a Q-item number indicates that the variable required reflection to be oriented comparably in the narrative.

M was rated by our judges to be compliant (Q20, r), trusting (Q44, r), and undemanding (Q83, r), and she collaborated with Dr. X rather than attempting to control the interaction (Q87, r). She felt understood by Dr. X (Q14, r) and was usually accepting of Dr. X's comments and observations (Q42, r). M rarely had difficulty beginning the hours (Q25, r) and, consistent with this, was active in initiating topics for discussion (Q15, r) and in bringing up problems and material of significance for the therapy (Q88). On her part, Dr. X was responsive and affectively involved with the patient (Q9, r), as well as confident and self-assured (Q86). Dr. X assumed a supportive (Q45) and didactic (Q37) role and generally did not take the stance of a neutral (Q93, r) commentator. The picture that emerges is of a therapist–teacher assuming an actively supportive role and offering opinions and direct encouragement to the patient.

M's interpersonal relations were an important topic during the therapy hours (Q63), and the therapeutic discourse had a

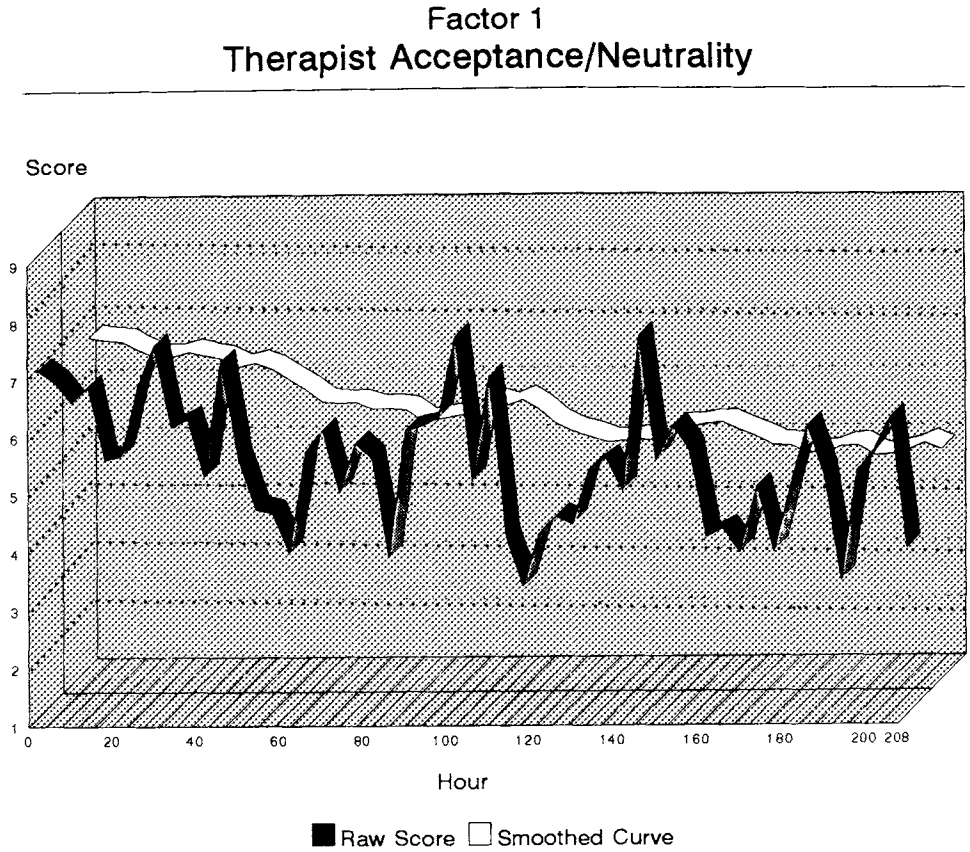

Figure 2. Plots of raw and smoothed scores for Therapist Acceptance/Neutrality factor over the 208 treatment sessions.

cognitive emphasis, that is, there was a focus on M's ideas or beliefs about herself and others (Q30). Dr. X's interpretations more usually referred to actual people in M's life (Q40), and she offered comments or explanations about the possible meaning of troublesome behavior on the part of these individuals (Q43). The psychodynamic nature of the treatment is reflected in certain aspects of Dr. X's technique, important among them interpretations that linked M's current feelings or experiences with those of the past (Q92) and the identification of recurrent patterns in M's life experience and behavior (Q62).

Identifying Dimensions of the Therapy Process

To determine whether certain dimensions of the therapy process could be identified, the Q-ratings for each of the treatment hours ($N = 53$) were subjected to an exploratory factor analysis (principal-components method). The factor analysis yielded four conceptually interpretable clusters after varimax rotation that accounted for 43% of variance in Q-sort descriptions. The items that best define the clusters are listed in Table 3.

Factor 1, which was labeled *Therapist Acceptance/Neutrality,* reflects Dr. X's nonjudgmental acceptance, her empathy and her facilitative activity, and her accurate perception of M's experience of the therapy relationship, as well as her degree of neutrality. Factor 2, labeled *Therapist Interactive,* captures Dr. X's personal and emotional responses to M; her control of the interaction with the patient; and the assumption of a didactic, challenging, and authoritative role. The cluster includes what is presumably M's reaction to this approach, that is, difficulty in understanding Dr. X and feelings of being misunderstood. Factor 3, labeled *Psychodynamic Technique,* captures those actions of Dr. X that are conventionally associated with a psychodynamic approach, including interpreting warded-off or unconscious wishes, feelings, or ideas; emphasizing feelings the patient considers unacceptable; interpreting defenses; clarifying the meanings of fantasy; and allowing difficulties or conflicts to emerge in the therapy relationship without appeasing or accommodating the patient. Factor 4, termed *Patient Dysphoric Affect,* reflects M's depression, anxiety, and other painful affect, as well as her attempt to suppress or control such feelings during the therapy hours. Factor scales were constructed by averaging the relevant PQS items for each of the four clusters after reversing the coding of items that were negative indicators of factors. The alpha reliabilities were .90, .90, .75, and .81 for the Therapist Acceptance/Neutrality, Therapist Interactive, Psychodynamic Technique, and Patient Dysphoric Affect clusters, respectively.

As a first step in attempting to identify aspects of process associated with outcome, factor scores for the treated treatment hours ($N = 53$) were correlated with the GSI of the SCL 90-R. The SCL 90-R was administered only after every 16th session; however, the relatively smooth slope of GSI scores (see Figure 1)

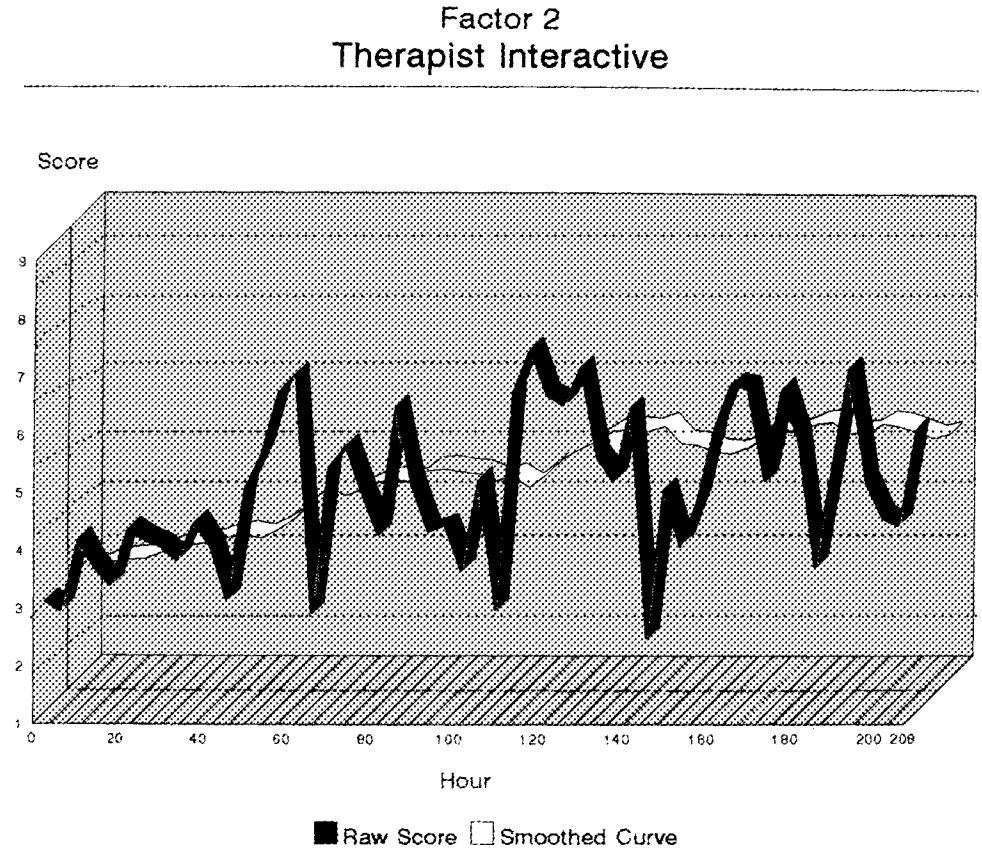

Figure 3. Plots of raw and smoothed scores for Therapist Interactive factor over the 208 treatment sessions.

suggested that values for missing scores could be reasonably estimated by calculating the mean of the two adjacent scores. The correlation coefficient for the GSI with Therapist Acceptance/Neutrality was .31 ($p < .05$); with Therapist Interactive, −.33 ($p < .05$); with Psychodynamic Technique, −.16, (*ns*); and with Patient Dysphoric Affect, −.06, (*ns*). In other words, Therapist Acceptance/Neutrality was positively correlated with higher levels of patient-reported symptoms, whereas Therapist Interactive was associated with lower symptom levels. The causal relationship of symptom levels and these dimensions of process were explored as a next step.

Time-Series Analysis

There have been few applications of time-series analysis in psychotherapy research (e.g., Grünzig, 1988; Moran & Fonagy, 1987). Time-series analysis examines the causal relation between one series of data points (e.g., scores on a dimension of therapy process, or series A) and a second series (e.g., a measure of patient functioning, or series B) that have been collected over time (e.g., during the course of a treatment). Time series requires data extracted at equal intervals over a relatively large number of measurement occasions. The essential idea of this analysis is to first control for the correlation inherent in the repeated measure of any variable and then to apply a model to determine whether series A can predict series B. *Autocorrelation* is the strength of association of a measurement taken at one point in time with its value at an adjacent point in time. Stated differently, it is the correlation of the time series with the same values being shifted for 1, 2, 3, or more time points (called *lags*); at lag = 0 the autocorrelation is $r = 1$. The cross-correlation or cross-lag coefficient is the size of the correlation between series B at one point in time with series A at a preceding point in time and provides an estimate of the extent to which B is predictable from A.

However, it has been demonstrated that large but spurious lag coefficients can be generated between two unrelated processes as a result of a large autocorrelation within each of the two (Gottman, 1981). For example, M's depression could gradually remit spontaneously over time (which would be reflected in the autocorrelation in a measure of depression obtained over that period), and Dr. X might become gradually more active over time, yet there would be no causal relation between the two despite the presence of large lag coefficients between them. Time series detects possible artifactual associations between two variables resulting from autocorrelations within each by describing the data in such a way as to show that the same patterns of relationship hold throughout the two series (i.e., that the data are "stationary").

To ensure that the data are stationary, trends or gradual shifts in the data can be removed. Such transformations can be accomplished in a variety of ways, such as by replacing the origi-

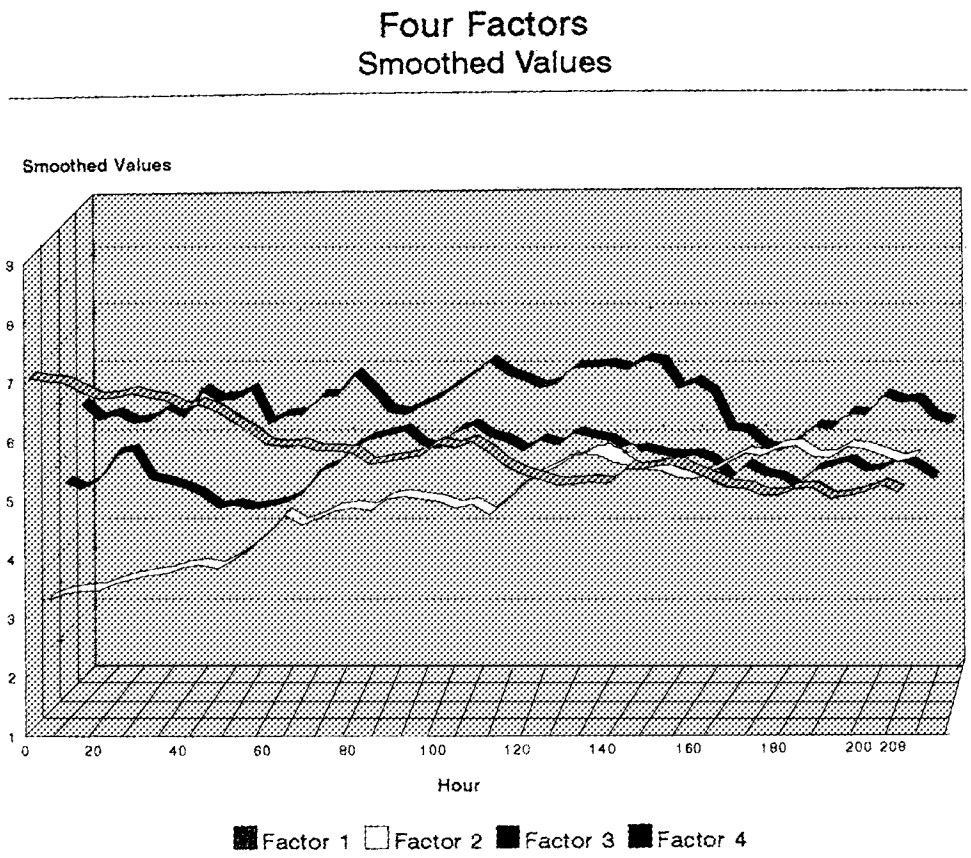

Figure 4. Plots of smoothed curves for process factors over treatment hours. (Factor 1 = Therapist Acceptance/Neutrality; Factor 2 = Therapist Interactive; Factor 3 = Psychodynamic Technique; Factor 4 = Patient Dysphoric Affect.)

nal series (or data points) with the differences between adjacent values in the original series or by other "smoothing" techniques that reduce autocorrelation. Figures 2–4 illustrate trends in the process factors through plots of the data over the 53 Q-sorted hr (every 4th hr of 208 total). Figure 2 displays the plot of scores for Factor 1. As a way of more clearly demonstrating the trend, a second curve obtained by an exponential smoothing of the raw scores is superimposed. The gradual decline in the kind of process reflected by Factor 1 is evident. Figure 3 displays the same data for Factor 2, and the gradual increase in this aspect of the process is also clear. To facilitate comparison of the trends among all four factors, Figure 4 plots the smoothed scores for the factors across the length of treatment.

An inspection of the trends in Figures 1–4 suggests a relationship between shifts in the nature of the therapy process and patient symptom change, but whether this relationship was causal remains to be demonstrated. Calculating cross-correlation coefficients is an accepted procedure when an attempt is made to associate some aspect of the therapy process with an independently derived assessment of patient change. However, this method is less adequate when the effort is to explicate the relationship between dimensions within the therapy process because cross-correlations cannot effectively capture processes that are bidirectional. For example, M's depressive affect could at one point evoke, and at another time be a reaction to, Dr. X's interpretive activity.

The time-series analysis of our single-case data could provide evidence of causal relationships in the therapy process by demonstrating that we can reduce the uncertainty in predicting M's behavior from a knowledge of Dr. X's past activity beyond our ability to predict simply from M's past behavior. We selected Gottman and Ringland's (1981) mathematical modeling approach to time series from among other available techniques (e.g., Box & Jenkins, 1970) because it is derived from studies of mother–infant and marital interaction and hence is more readily applicable to psychological data. The method also has the advantage of allowing significance tests for assessing bidirectionality by fitting a sequence of models to time-series data to test whether: (a) A (the therapist) influences B (the patient), (b) B (the patient) influences A (the therapist), (c) there is no influence, or (d) A and B influence one another (bidirectionality).

Dimensions of Process and Patient Symptom Change

Factor scores for the four process dimensions for each rated treatment hour ($N = 53$) and GSI scores were examined to determine if one series is partially predictable from another. The

Table 4
Summary of Time-Series Analysis

Model	A	B	*SSE*	*SSE/T*	C	D	*SSE*	*SSE/T*
	Therapist acceptance/neutrality				GSI total score			
i	10	10	42.67	−0.83	10	10	.06	−280.19
ii	2	1	61.33	15.27	6	5	.08	−271.58
iii	2	0	61.33	15.27	6	0	.12	−254.56
iv	10	0	48.67	5.33	10	0	.10	−116.74
i vs. ii	$K(18) = 16.10$, *ns*				$K(9) = 8.61$, *ns*			
ii vs. iii	$K(0) = 0$, *ns*				$K(5) = 17.02$, $p < .01$			
iii vs. iv	$K(8) = 9.94$, *ns*				$K(4) = 7.89$, *ns*			
Conclusions	GSI ↛ Therapist Acceptance/Neutrality				Therapist Acceptance/Neutrality → GSI			
	Therapist interactive				GSI total score			
i	10	10	65.46	18.07	10	10	.06	−285.37
ii	3	0	88.19	30.89	6	9	.07	−271.58
iii	3	0	88.19	30.89	6	0	.12	−254.56
iv	10	0	73.58	23.10	10	0	.10	−116.74
i vs. ii	$K(17) = 12.82$, *ns*				$K(5) = 11.50$, $p < .05$			
ii vs. iii	$K(0) = 0$, *ns*				$K(5) = 19.36$, $p < .02$			
iii vs. iv	$K(7) = 7.79$, *ns*				$K(4) = 7.89$, *ns*			
Conclusions	GSI ↛ Therapist Interactive				Therapist Interactive ↛ GSI			
	Psychodynamic technique				GSI total score			
i	10	10	20.37	−32.14	10	10	.06	−280.74
ii	4	0	27.45	−19.30	6	1	.11	−258.16
iii	4	0	27.45	−19.30	6	0	.12	−254.56
iv	10	0	27.10	−19.86	10	0	.10	−262.45
i vs. ii	$K(11) = 12.84$, *ns*				$K(13) = 22.58$, $p < .05$			
ii vs. iii	$K(0) = 0$, *ns*				$K(1) = 3.60$, *ns*			
iii vs. iv	$K(6) = .56$, *ns*				$K(4) = 7.89$, *ns*			
Conclusions	GSI ↛ Psychodynamic Technique				Psychodynamic Technique ↛ GSI			
	Patient dysphoric affect				GSI total score			
i	10	10	37.20	−6.23	10	10	.05	−291.71
ii	7	9	37.29	−6.13	6	10	.06	−284.56
iii	7	0	50.81	7.18	6	0	.12	−254.56
iv	10	0	49.59	6.13	10	0	.10	−262.45
i vs. ii	$K(14) = .12$, *ns*				$K(4) = 7.12$, *ns*			
ii vs. iii	$K(9) = 13.30$, *ns*				$K(10) = 30.00$, $p < .001$			
iii vs. iv	$K(3) = 1.05$, *ns*				$K(4) = 7.89$, *ns*			
Conclusions	GSI ↛ Patient Dysphoric Affect				Patient Dysphoric Affect → GSI			

Note. A and B = estimates for describing the process factors; *SSE* = error sum of squares; T = no. of observations; C and D = estimates for describing the General Severity Index (GSI) scores; → = predicts; ↛ = does not predict; $T = 53$. Comparisons of i versus ii and iii versus iv represent internal checks of the model, where as the comparison of ii versus iii indicates the presence or absence of predictability of one series from the other, controlling for autocorrelation.

minimum data points recommended for time-series analysis is $N = 50$. Because GSI scores from the SCL 90-R were only obtained after every 16th session, the values of missing scores were estimated by calculating the mean of the two adjacent scores. Results of the time-series analysis testing the relationship between the four process dimensions and symptom change (GSI score) are summarized in Table 4. These results must be interpreted with some caution because of the uncertain effect of estimating so many GSI scores. The models are tested in a manner similar to a chi-square, (i.e., inspection of marginals). The table displays results obtained by comparing the following four models:

1. A starting model (i), which provides an initial estimate of how many parameters (lags) must be included in the model;[2]
2. The best autoregressive and cross-regressive model (ii). The autoregressive (AR) model implies that the value of a variable at a given time is dependent on the value(s) of the variable at preceding time(s). The cross-regressive model denotes the value of a variable at a given time is dependent on the values of the second series at preceding times. Model ii assesses whether

[2] The complex problem of estimating the model parameters is omitted here; see Gottman and Ringland (1981) for mathematical details.

one series can be adequately predicted without the past of the other;

3. The model that removes cross-regressive terms from ii (iii); and

4. A model with 10 autoregressive terms and no cross-regressive terms (iv). Briefly stated, this procedure tests smaller models against bigger models to determine if there is a gain in predictive power. In Table 4, A and B are estimates for describing the process factors; C and D are estimates for describing the GSI scores. Comparisons of i versus ii and iii versus iv represent internal checks of the model, whereas the comparison of ii versus iii indicates the presence or absence of predictability of one series from the other, controlling for autocorrelation (see Gottman & Ringland, 1981). The statistic, K, has a χ^2 distribution; SSE = error sum of squares; and T is the number of observations.

Table 4 shows that M's symptom level as measured by the GSI is predictable from Factor 1 (Therapist Acceptance/Neutrality → GSI). GSI is similarly predictable from Factor 4 (Patient Dysphoric Affect → GSI). The directionality of the data provide some causal evidence that lower levels of the kind of process captured in Factor 1 lead to symptom improvement and that declines in patient depressive affect during therapy hours (Factor 4) precede declines in patient self-reported symptoms. Figure 5 also represents this relationship. It should be stressed that Dr. X's scores on the Therapist Acceptance/Neutrality factor remain in the "characteristic" or at least the neutral range throughout the treatment (Figure 2).

The Relation of Process Dimensions to One Another

A similar time-series analysis was then conducted to determine the nature of the relationship of the four process factors with one another. Factor 4, Patient Dysphoric Affect, predicted (→) Factor 1, Therapist Acceptance/Neutrality, $K(9) = 38.48$, $p < .001$, and Therapist Acceptance/Neutrality predicted (→) Factor 3, Psychodynamic Technique, $K(7) = 18.42$, $p < .01$. In other words, the level of M's depression helps us predict the extent of Dr. X's facilitative activity, nonjudgmental acceptance, and neutrality, and this in turn influenced the extent to which Dr. X applied psychodynamically oriented interventions. The other relationships between process factors were bidirectional: Factor 1, Therapist Acceptance/Neutrality ($K[7] = 28.48$, $p < .001$) ↔ Factor 2, Therapist Interactive ($K[6] = 29.12$, $p < .001$); Therapist Interactive ($K[6] = 13.19$, $p < .05$) ↔ Factor 3, Psychodynamic Technique ($K[10] = 29.43$, $p < .01$); Therapist Interactive ($K[10] = 21.61$, $p < .05$) ↔ Factor 4, Patient Dysphoric Affect ($K[4] = 20.36$, $p < .001$); and Psychodynamic Technique

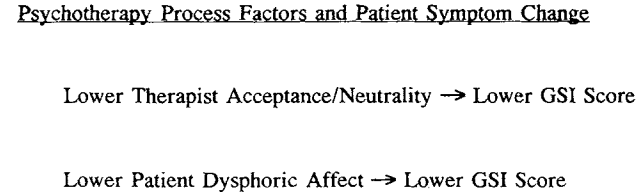

Figure 5. Results of time-series analysis of process factors and patient M's scores on the General Severity Index (GSI) of the Symptom Checklist 90—Revised. (Arrows indicate prediction.)

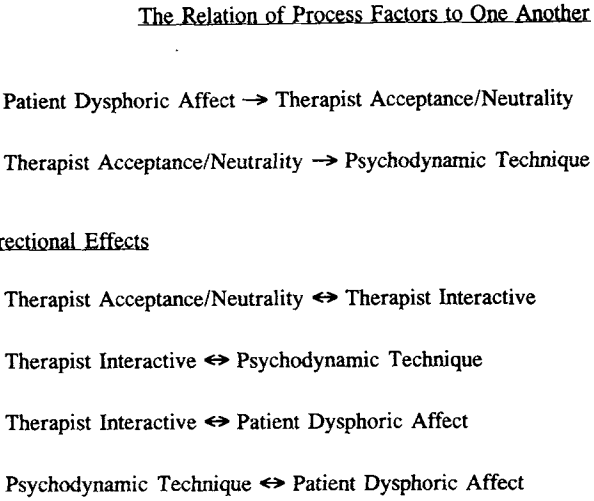

Figure 6. Results of time-series analysis examining the relationship of the process factors to one another over the course of treatment. (Arrows indicate prediction; double arrows indicate bidirectional effects.)

($K[1] = 3.97$, $p < .05$) ↔ Patient Dysphoric Affect ($K[8] = 27.73$, $p < .001$; see Figure 6).

Testing the Supportive Versus Expressive Hypothesis

It was possible to further specify potential causal effects in the therapy process by examining the relation of particular Q-items to measures of M's affective state. In particular, we were interested in exploring whether more expressive or supportive interventions on Dr. X's part had a greater ameliorative impact on M's levels of depression. To examine this hypothesis, Q-items that have been shown to reflect expressive and supportive approaches (Jones et al., 1988) were subjected to time-series analyses.

The results of the item-level analysis are complex and do not suggest a simple cause-and-effect relationship but once again a set of mutually influencing, reciprocal relationships. Q-item 45, "Therapist adopts supportive stance," predicted (→) scores on Patient Dysphoric Affect, $K(4) = 9.56$, $p < .05$. Q-item 66, "Therapist is directly reassuring," showed a bidirectional effect with Patient Dysphoric Affect ($K[5] = 17.07$, $p < .01$) ↔ ($K[4] = 11.86$, $p < .02$), that is, sometimes Dr. X was more reassuring in response to M's depression and anxiety, and sometimes M became less depressed in response to Dr. X's reassurance.

Analysis of items reflecting expressive technique showed similarly complex effects. The relationship of transference interpretations (Q-item 100, "Therapist draws connections between the therapeutic relationship and other relationships") to Patient Dysphoric Affect was bidirectional ($K[3] = 12.31$, $p < .001$) ↔ ($K[9] = 35.38$, $p < .001$), that is, transference interpretations sometimes led to increased depression and anxiety, and M's level of depression predicted the extent to which Dr. X interpreted the transference. Interestingly, Patient Dysphoric Affect was a predictor of Dr. X's use of defense interpretations (Q-item 36, "Therapist points out patient's use of defensive maneuvers"), $K(3) = 19.46$, $p < .001$. Figure 7 represents these effects. The analysis of these few selected Q-items confirms the view of

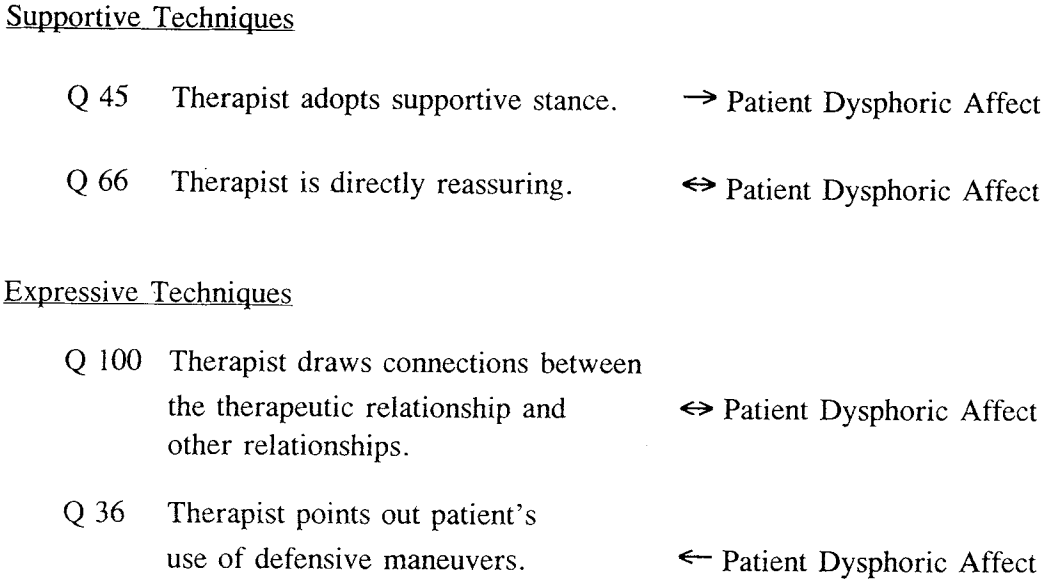

Figure 7. Results of time-series analysis examining the relationship of Q-items to in-session ratings of Patient Dysphoric Affect over the course of treatment. (Arrows indicate prediction; double arrows indicate bidirectional effects.)

therapy process as a set of mutual and reciprocal influences between therapist and patient and further underscores the limitations of considering processes as having fixed, context-independent meanings that uniquely contribute to outcome.

Discussion

The results reported here derive from the intensive study of a single psychotherapy and therefore cannot be generalized to other treatments. Moreover, it is not our intent that this study serve as a declaration about what constitutes "good" therapy or to suggest what kind of psychotherapy is effective. Such a statement would require similar research on a larger sample of long-term psychotherapies with depressed patients and is obviously beyond the scope of this article. The causal relations identified here between aspects of the therapy process and patient change may well be very different in other cases. Discovering causal processes involved in long-term change in psychotherapy is, in any case, very difficult, and the results of this study must be considered judiciously. Only replication can verify to what extent the causal effects identified in the current study are unique to this particular case and to what extent they might generalize to other, similar cases.

What the current study does accomplish is the articulation of a new paradigm for single-case research in psychotherapy. The conventional manner of studying the therapy process attempts to identify the ways in which therapist actions or techniques influence patient change. Causal influences are assumed to flow principally in one direction. Our bidirectional analysis of causal effects in the therapy process demonstrate that, at least in this case (and perhaps in most psychotherapies), therapist and patient mutually influenced one another. Modeling reciprocal influence processes in psychotherapy in this way is closer to contemporary interactive conceptions of the therapy process and is consistent with the current greater attentiveness to the role of the therapist's emotional interaction with the patient, both unconscious and intentional, in the change process.

During the beginning phase of the therapy, our data show that Dr. X was more nonjudgmental, facilitative, and neutral and that M's depressive affect during the therapy sessions seems to have gradually "pulled" Dr. X toward a more authoritative and emotionally reactive and involved posture. This change in the nature of the process was predictive of M's gradual reduction in symptom level. It should nevertheless be emphasized that Dr. X was never rated by our judges as not being accepting, facilitative, and empathic. Dr. X's scores on this factor remained in the characteristic or neutral range throughout the therapy. It would, of course, be a serious oversimplification to state that Dr. X was manipulated by M into assuming a particular role or that she complied with M's attempts to prod her into behaving in a certain manner in relation to her. Dr. X held a particular hypothesis about pathogenesis in M organized around the notion of "survivor guilt" (Weiss & Sampson, 1986). Central to this formulation was the traumatic death of M's brother in a swimming accident when she was 7 years old and her mother's subsequent depression of many years. In the therapist's view, which she communicated directly to M, the patient was given no help with her own grief about her brother's death and was essentially emotionally abandoned by both parents. Indeed, M subsequently played a caretaking role in relation to her mother, attempting to cheer her up and assuming some parental functions in the household. M came to believe that her mother would have preferred her death to that of her brother. As the treatment continued, Dr. X became convinced that the mother was depressed and emotionally neglectful of the patient even before her brother's death and that M had never been appropriately prized, encouraged, and acknowledged by either of her parents. Although Dr. X developed a clearly articulated

formulation that guided her intervention strategy, it nevertheless appears that the intensity of M's manifest depression determined at least in part when Dr. X became less facilitative and neutral and the extent to which she was more forcefully challenging and interpretive.

Sandler (1976) has used the term *role-responsiveness* to describe a therapist's partial and intermittent compliance with a patient's attempts to provoke a relationship with the therapist in which repetitions of earlier experiences and relationships are concealed. In this view, certain countertransference responses are linked to the patient's transference through the behavioral interaction between them. This conceptualization may help explain the content of the Q-items that constitute Factor 2, Therapist Interactive, which includes items capturing Dr. X's countertransference reactions and the active, challenging, didactic role she sometimes assumed. Guided by the theory that M would "test" her to confirm or disconfirm an unconscious idea about herself (e.g., as responsible for her brother's death or as unimportant or inadequate), Dr. X responded forcefully when M assumed this role in relation to her, that is, when M attempted to actualize earlier experiences and role relationships with her through her guilty depression. The Therapist Interactive factor captures the emotional tone and interpretive style in which Dr. X conveyed her understanding and ideas to M. The Q-set, of course, describes only the nature of the process and does not capture the content of the actual dialogue.

Among psychotherapies informed by psychoanalytic theory a distinction is frequently made between *expressive* and *supportive* approaches or techniques (Wallerstein, 1986). Causal analysis of both therapist techniques associated with expressive approaches (e.g., transference interpretations and the interpretation of defenses) and those usually allied with supportive treatments (e.g., therapist reassurance) suggest that both of these approaches led to symptomatic improvement in M. Indeed, Dr. X made use of a range of techniques.

This discussion may convey the impression that our statistical model reflects real-time interaction between Dr. X and M. It is important to note that observations about the process (Q-ratings) are separated by 2-week intervals (every fourth session), so that the causal processes discussed here did not occur from one session to the next but from one measurement epoch to subsequent ones. Nevertheless, the direction of the causal influences described represents clear, distinguishable trends over the entire course of the $2\frac{1}{2}$-year treatment.

The complex processes of psychotherapy are more validly and usefully captured in a model that allows for the identification of mutual and reciprocal influence between patient and therapist over time and then in turn links these influences to assessments of patient change. This strategy requires, of course, the intensive study of single cases. Such a paradigm moves beyond the more conventional and static methods that sample brief segments of records of the therapy process in a search for co-occurrence of important phenomena, as well as those methods in which influence processes and cause-and-effect relationships are considered to be unidirectional. Models for the formal study of psychotherapy that (a) are longitudinal and can hence identify relationships over long periods of time and processes that change slowly, (b) are interactive and can therefore identify mutual influence processes, and (c) are multivariate more adequately reflect the complexities of intervention processes and are more likely to permit discovery of the elusive link between therapeutic process and patient change.

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