Measuring Processes of Change: Applications to the Cessation of Smoking

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Subjects (N = 970) representing five stages of smoking cessation (precontemplation, contemplation, action, maintenance, and relapse) were given a 65-item test measuring 10 basic processes of change. Subjects recorded the last time they quit smoking, their current use, the frequency of occurrence, and the degree of item helpfulness. A 40-item questionnaire provided highly reliable measures of 10 processes of change, labeled (a) consciousness raising, (b) dramatic relief, (c) self-liberation, (d) social liberation, (e) counterconditioning, (f) stimulus control, (g) self-reevaluation, (h) environmental reevaluation, (i) reinforcement management, and (j) helping relationship. In a confirmatory analysis, 770 subjects were assessed 6 months later. The analysis both confirmed the 10-process model and revealed two secondary factors, Experiential and Behavioral, which were composed of 5 processes each and reflected how individuals in particular stages use more than 1 process at a time. The transtheoretical model of change and available external validity evidence are reviewed.

A zeitgeist has emerged in which therapists from different systems are searching for common processes of change (Goldfried, 1980). Because research has indicated that no one system of therapy is superior to another (Luborsky, Singer, & Luborsky, 1975; Parloff, 1979), the assumption has been made that effective therapies share common processes. Investigators such as Goldfried and Padawer (1982) and Strupp (1981) have suggested that integrative models can be developed only if we begin to identify and measure processes that are common to the multitude of current therapies. In a comparative analysis of 18 major systems of therapy, Prochaska (1979) identified 10 basic processes of change. Prochaska and DiClemente (1984) assumed that basic processes of change would account for how people change on their own as well as how people change in therapy. The present study reports on the development of a test for measuring basic processes of change in the context of a common addictive behavior problem, smoking cessation.

This study is based on an integrative model of change that has been applied to such problems as smoking, weight control, alcohol abuse, psychological distress, and a range of *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-III*; American Psychiatric Association, 1980) diagnoses (DiClemente & Prochaska, 1985; McConnaughy, Prochaska, & Velicer, 1983; Prochaska & DiClemente, 1982, 1983, 1984, 1985, 1986a, 1986b). The transtheoretical model utilizes three integrative di-

mensions. The processes are the independent variables that assess how people proceed to change their problem behaviors. Change processes are covert and overt activities that individuals use to modify problem behaviors. These independent variables can be applied by therapists, clients, or individuals attempting to modify problems without therapy (Norcross & Prochaska, 1986a, 1986b; Prochaska & DiClemente, 1983; Prochaska & Norcross, 1983; Prochaska, Wilcox, & Rossi, 1987a, 1987b).

Within the context of therapy, problems to be changed are organized hierarchically across five levels of change: situational, cognitive, interpersonal, family systems, and intrapersonal conflicts (Norcross, Prochaska, Guadagnoli, & DiClemente, 1984; Norcross, Prochaska, & Hambrecht, 1985; Prochaska & DiClemente, 1984, 1986a, 1986b). The level of intervention varies according to the particular client's problems. The levels, as dependent variables, represent what needs to be changed. The levels are beyond the scope of the present study and will not be discussed further.

Stages of change represent a temporal or developmental dimension (i.e., when particular changes occur). The stages were identified in a study comparing the processes used by smokers quitting on their own with those used by smokers in two treatment programs (DiClemente & Prochaska, 1982). The stages were operationalized by a 32-item questionnaire developed on a sample of 150 outpatients who had requested therapy (McConnaughy et al., 1983). A stage of change questionnaire yielded four highly reliable and statistically well-defined components labeled (a) precontemplation, (b) contemplation, (c) action, and (d) maintenance. These stages form a simplex pattern in which adjacent stages are more highly correlated with each other than with any other stages (McConnaughy, DiClemente, Prochaska, & Velicer, 1987).

In the original transtheoretical model (Prochaska, 1979), 5 global processes of change were identified: (a) consciousness

Table 1
Process of Change

Global scale	Experiential and environmental subscales
Original	
Consciousness Raising	Feedback, Education
Choosing	Self-Liberation, Social Liberation
Catharsis	Corrective Emotional Experiences, Dramatic Relief
Contingency Control	Reevaluation, Contingency Management
Conditional Stimuli	Counterconditioning, Stimulus Control
Additions	
Cognitive Restructuring[a]	Self-Reevaluation, Environmental Reevaluation
Contingency Management[a]	Self-Management, Social Management
Helping Relationship	

[a] These scales were devised to replace the original Contingency Control scale.

raising, (b) catharsis, (c) choosing, (d) conditional stimuli, and (e) contingency control. Each of the processes could be applied at both an experiential level and an environmental level. The resulting set of 10 original change processes is listed in Table 1.

Conceptually, in this formulation, contingency control combines both a cognitive process (reevaluation) and behavioral process (contingency management). In the present study, this process was developed further to yield four processes (see Table 1). In the original transtheoretical analysis of therapy systems, it was unclear whether the therapeutic relationship should be considered a process of change, the content to be changed, or a precondition for change (Prochaska, 1979). In the present study, the helping relationship was included as a separate process of change, resulting in a total of 13 initial processes of change (see Table 1).

The processes of change have previously been measured via a cumbersome interview that did not adequately demonstrate psychometric properties (DiClemente & Prochaska, 1982). The present study attempted to establish a short, reliable, paper-and-pencil measure for the processes of change by (a) establishing content validity for an initial pool of items, (b) testing the internal validity (factor structure) across two alternative formats and two temporal response sets, (c) replicating the factor structure across two geographically distinct samples, (d) establishing the internal consistency (coefficient alpha) for each scale, and (e) calculating the correlation for each scale with a measure of social desirability. The results were replicated on another data set using a confirmatory (LISREL) analysis. This procedure is essentially an updated variation on the sequential method of scale development proposed by Jackson (1970, 1971). A confirmatory procedure applied to a new administration served to confirm and elaborate the results of the first study. External validity has been investigated in a number of other studies, and these are reviewed in the Discussion section.

Study One: Instrument Development

Method

Instrument. Content validity was established by having four trained judges select items from a pool and assign them to 1 of the 13 processes. Items for which agreement did not exist were deleted. The 65 remaining items, 5 per process, were randomly ordered. Subjects responded to two

5-point Likert scales measuring the frequency of occurrence ($1 = never$ to $5 = repeatedly$) and measuring the importance of each item content ($1 = not helpful$ to $5 = extremely helpful$). Five-point scales have been shown to be generally superior to 2-point scales (Comrey & Montag, 1982; Lissitz & Green, 1975; Velicer, DiClemente, & Corriveau, 1984; Velicer, Govia, Cherico, & Corriveau, 1985; Velicer & Stevenson, 1978). Subjects responded twice: (a) retrospectively, with regard to the last time they had quit smoking and (b) currently, with respect to processes currently in use.

Subjects. Subjects in Rhode Island ($n = 510$) and Houston, Texas ($n = 460$) responded to newspaper reports and ads. The subjects were approximately equally divided into the five stages of change: (a) *precontemplation,* subjects who were currently smoking and had no plans to quit; (b) *contemplation,* subjects who were currently smoking but were planning to quit in the near future; (c) *action,* subjects who had quit in the last 6 months; (d) *maintenance,* subjects who had not smoked in more than 6 months; and (e) *relapse,* subjects who had quit in the last 6 months but were currently smoking. Each subject was paid $4 to complete at home a more extensive questionnaire that contained the different versions of the change process questionnaire.

Results

A separate principal-components analysis was performed on each of the four versions, retrospective and current, for both the frequency and helpfulness formats. The four analyses were repeated in the two samples. Each analysis was performed on a 65×65 matrix of interitem correlations. The minimum average partial (MAP) procedure (Velicer, 1976) was used to determine the number of components to retain; the MAP procedure provides one of the most accurate rules for such determinations (Zwick & Velicer, 1982, 1986). Different solutions were found for the eight versions, ranging between 8 and 13 change processes, with 10 being the most common (five) solution. After examining the interpretability of the solutions that retained slightly fewer or slightly more components, the 10-component solution was used for all eight versions. A varimax rotation was performed on the resulting component pattern.

The eight rotated patterns produced highly similar results. The varimax-rotated component pattern for the current version using the frequency-response format will be described in detail. The 1st component was labeled Consciousness Raising and contained items from the original scales of Feedback and Education. The 2nd component consisted of items from the original

Counterconditioning scale. The 3rd component consisted of Stimulus Control scale items. The 4th component consisted of Environmental Reevaluation scale items. The 5th component was labeled Self-Reevaluation and consisted of items from the original Self-Reevaluation and Corrective Emotional Experiences scales. The 6th component was labeled Reinforcement Management and consisted of reinforcement items from the original Self-Management and Social Management of Contingencies scales. The 7th component consisted of Social Liberation scale items. The 8th component consisted of Dramatic Relief scale items. The 9th component consisted of Helping Relationship scale items. The 10th component consisted of items from the original Self-Liberation scale.

Of the 13 scales that were originally defined, 7 were clearly represented by a single component each. In addition, the Feedback and Education scales combined to form a single component. These two scales represented the experiential (Feedback) and the environmental (Education) levels of the same process (consciousness raising), indicating that subjects did not differentiate these two levels for this process. Self-Reevaluation items and Corrective Emotional Experience items combined to form a scale that assesses both affective and cognitive reevaluations of self. Finally, a new scale was weakly identified that combined self-management and social management of reinforcements (but not punishments) and was tentatively labeled as Reinforcement Management.

The same 10 components could be identified in each of the eight analyses. A reduced set of 4 core items was selected that best measured each of the 10 processes. Table 2 presents these 40 items as well as the varimax-rotated loadings from the current usage analysis for frequency and helpfulness response formats for both samples. The cross-format and cross-sample stability of the component patterns is readily observable. The same pattern of results occurred for the four retrospective analyses (not presented), although they were slightly more variable. All subsequent analyses used the 40 items selected as the core items.

Similarity of responses to the two formats justified the use of only the helpfulness responses for the retrospective version and of the frequency responses for the current version. Scale scores (unweighted sums of the items) were based on the core items for each scale. Table 3 presents a multimethod–multitrait matrix comparing the two versions.

The convergent validity coefficients ranged from .34 to .72, with most values around .60 (df = 435 for coefficients). The two lowest coefficients were Self-Liberation (.36) and Social Liberation (.34). The poorly defined Reinforcement Management produced a relatively high coefficient (.65). The diagonal coefficients were higher than the cross-method, off-diagonal coefficients. Considering that different processes may have been used in different quit attempts (retrospective vs. current), we judged the results to support the construct validity of the instrument. The within-method correlations between the 10 processes were generally in the low .30 range, indicating limited overlap between the scales.

For each of the 10 scales of both the retrospective version and the current version, the coefficient alpha was calculated for the four-item scales. The reliabilities, ranging from .69 to .92, were considered acceptable for a four-item scale. The majority of estimates were .80 or above, with only the Social Liberation and Reinforcement Management scales producing estimates consistently in the .70–.80 range.

Response distortions pose potential threats to validity for a self-report inventory. The most widely discussed and difficult to control is social desirability (Edwards, 1957; Jackson & Messick, 1958). The Jackson Desirability Scale (Jackson, 1967) was administered to a subset of the sample (n = 250) and was correlated with the 10 processes of change scores. The correlations ranged between .01––.15, demonstrating no evidence of social desirability responding. The distribution of responses across the five response categories showed no evidence of either a centrality or an extremity response pattern. The clear differentiation of the 10 processes argued against a halo effect.

Study Two: Confirmatory Analysis of the Measurement Model

Study 1 permitted refinement of the theoretical model and decisions about the selection of specific items. Study 2 was designed to confirm the proposed measurement model and to select the first-order factors and, possibly, the second-order factors from among three models representing alternative ways of conceptualizing the relation between the observed variables. The correlations between the scale scores suggested the need to include second-order factors. Three models were tested: (a) Model 1 comprised 10 independent first-order factors; (b) Model 2 comprised a single general factor; and (c) Model 3 comprised 2 second-order factors representing two types (experientially oriented and behaviorally oriented) of processes.

Method

A single undifferentiated sample of subjects was used. The subjects were the same as those previously described. The responses were from a second administration of the Processes of Change Questionnaire that took place approximately 6 months after the first administration. The total subject pool was reduced by attrition and incomplete data from the initial sample of 970 to the sample of 770 used for the present analysis. Attrition was randomly spread across the subgroups, with the exception of the precontemplation subgroup, which had a slightly higher attrition rate. In addition, movement to different groups occurred and was marked by a tendency for the size of the earlier groups to decrease (precontemplator, contemplator). However, all subgroups were still well-represented, and the total sample represented a heterogeneous sample of subjects involved in the smoking cessation process.

Results

The confirmatory analysis was performed using a structural analysis procedure. We used the LISREL VI computer program (Jöreskog & Sörbom, 1984). Data input was a single 40 × 40 correlation matrix.

Model selection. The model fitting was performed in two phases. The first phase focused on the relation between the manifest variables and the primary latent variables. In this study, the manifest variables were the 40 items and the primary latent variables were the 10 change processes. The relatively unambiguous results of the first study provided a well-defined model to test. Only minor modifications were required to con-

Table 2

Forty Core Items Measuring Ten Change Processes With Varimax-Rotated Component Loadings From Two Samples

	Frequency		Helpfulness	
Item	Rhode Island sample (*n* = 437)	Texas sample (*n* = 363)	Rhode Island sample (*n* = 409)	Texas sample (*n* = 329)
Consciousness Raising				
I recall articles dealing with the problem of quitting smoking.	76	48	72	60
I think about information from articles and advertisements on how to stop smoking.	75	44	74	66
I recall information people had given me on how to stop smoking.	73	67	59	53
I recall information people had personally given me on the benefits of quitting smoking.	68	62	66	64
Self-Liberation				
I tell myself I can choose to smoke or not.	79	76	76	71
I tell myself I am able to quit smoking if I want to.	80	73	74	77
I tell myself that if I try hard enough I can keep from smoking.	72	73	68	79
I make commitments not to smoke.	(38)	49	60	70
Dramatic Relief				
Warnings about health hazards of smoking move me emotionally.	83	79	80	79
Dramatic portrayals of the evils of smoking affect me emotionally.	74	78	73	79
I react emotionally to warnings about smoking cigarettes.	82	79	79	77
Remembering studies about illnesses caused by smoking upset me.	62	69	63	76
Environmental Reevaluation				
I am considering the belief that people quitting smoking will help to improve the world.	74	77	67	71
I stop to thing that smoking is polluting the environment.	80	77	74	81
I consider the view that smoking can be harmful to the environment.	79	82	80	74
I am considering the idea that the world could be a better place without my smoking.	69	57	69	54
Helping Relationship				
Special people in my life accept me the same whether I smoke or not.	48	(20)	54	57
I can be open with at least one special person about my experience with smoking.	75	65	64	65
I have someone who listens when I need to talk about my smoking.	76	71	69	66
I have someone whom I can count on when I'm having problems with smoking.	77	75	72	71
Stimulus Control				
I remove things from my home that remind me of smoking.	74	74	71	79
I keep things around my place of work that remind me not to smoke.	76	71	69	66
I remove things from my place of work that remind me of smoking.	77	75	72	71
I put things around my home that remind me not to smoke.	(48)	(20)	54	57
Counterconditioning				
Instead of smoking, I engage in some physical activity.	63	47	49	61
I find that doing other things with my hands is a good substitute for smoking.	54	43	68	(33)
When I am tempted to smoke, I think about something else.	67	(21)	59	64
I do something else instead of smoking when I need to relax or deal with tension.	76	(24)	58	(31)
Social Liberation				
I see "No Smoking" signs in public buildings.	69	75	63	66
I notice that public places have sections set aside for smoking.	72	74	69	70
I find society changing in ways that make it easier for the nonsmoker.	72	74	69	68
I notice that nonsmokers are asserting their rights.	67	73	60	79
Self-Reevaluation				
My dependency on cigarettes makes me feel disappointment in myself.	78	76	67	68
I get upset when I think about my smoking.	75	73	58	61
I reassess the fact that being content with myself includes changing the smoking habit.	59	66	(38)	58
I consciously struggle with the issue that smoking contradicts my view of myself as a caring and responsible person.	63	66	49	58
Reinforcement Management				
I can expect to be rewarded by others if I don't smoke.	66	54	51	60
I am rewarded by others if I don't smoke.	78	63	52	59
Other people in my daily life try to make me feel good when I don't smoke.	53	69	(28)	40
I reward myself when I don't smoke.	46	(21)	66	69

Note. Values in parentheses were below the .40 cutoff for salience but are presented for comparison.
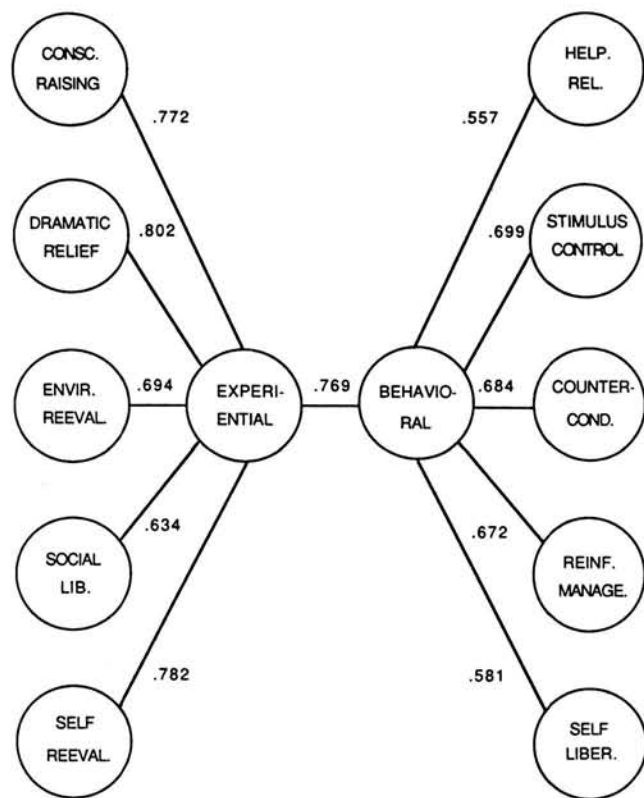
Figure 1. Standardized estimates of hierarchical model for the processes of change. (See Table 2 for full process names.)

firm this part of the model. The second phase examined the relation between the primary or first-order latent variables and the second-order latent variables. Three models were compared. Model 1 included no second-order terms. Model 2 included 1 second-order factor involving each of the 10 first-order factors. This was interpreted as a general factor. Model 3 included 2 second-order factors, each involving 5 of the first-order factors. The second-order factors were also allowed to be correlated, and the correlation was interpreted as involving a third-order general factor. A statistic sometimes used to select an appropriate model is the asymptotic chi-square test. Despite the popularity of this statistic, it is the most problematic. Simulation factor-analysis studies have produced little support (Hakstian, Rogers, & Cattell, 1982; Velicer & Jackson, 1987; Zwick & Velicer, 1986). A nonsignificant value is particularly difficult to achieve when the sample size is large, even with a model that fits well by every other criterion (Bentler, 1980). The statistic also seems to be very sensitive to nonnormality (Boosma, 1983; Harlow, 1985). As an alternative, four indices have been proposed that do not possess good guidelines for interpretation. These indices include the Goodness of Fit Index (GFI) and the Root Mean Square Residual, provided by the LISREL–VI program (Jöreskog & Sörbom, 1984); the Nonnormed Fit Index (NNFI; Bentler & Bonett, 1980); and the Parsimonous Fit Index (James, Mulaik, & Brett, 1982).

All five summary statistics were calculated for this analysis and provided a consistent pattern of results. The first model was

substantially compatible with the data but not fully adequate (GFI = .729). Both Model 2 (GFI = .883) and Model 3 (GFI = .890) provided very good to excellent fits to the data on the basis of all indices but the chi-square statistic. The large sample size (N = 770) provided an obvious explanation for the failure of this statistic. Model 3 provided a small but meaningful improvement over Model 2 and was designated as the preferred model for further interpretation.[1]

Relating the primary factors to the items. The initial model relating the items (manifest variables) to the factors (latent variables) followed directly from the previous study. Each of 10 factors was measured by 4 items. The initial model included only four nonzero paths per factor for a total of 40 nonzero paths per factor and 360 paths that were specified to be zero. A number of minor modifications were performed on the basis of the modification indices from the initial run. Correlated error terms were allowed within the set of items measuring the same factor. Twelve items were permitted to have values on factors other than those theoretically appropriate, resulting in 10 complex variables. These secondary values were typically very small. The results generally confirmed the previously reported results.[2] The most problematic factor was again Reinforcement Management, for which 3 of the 4 items also loaded on another factor. One item from the Helping Relationship factor, "Special people in my life accept me the same whether I smoke or not," did not have a high weight on its appropriate factor or on any other. This was previously a marginal item (see Table 2). The other secondary weights were statistically significant but numerically small (i.e., between .30–0). The primary weights were generally very high (i.e., between .70–1.00). Therefore, 8 of the factors were well-identified by all 4 items, 1 factor was identified by 3 of the 4 items, and 1 factor was largely identified by only complex items.

Relating secondary factors to primary factors. Figure 1 presents a representation of the model relating the 2 secondary factors to the 10 primary factors. Secondary factors were designed to account for the relations between the primary factors. The correlations between the scales (see Table 3) reported in the first study reflected this lack of independence. The first 5 factors generally involved an experiential restructuring component common to all 5 processes. This secondary factor was labeled *Experiential.* It was interpreted as reflecting a tendency to use more than 1 of these 5 processes at the same time. However, the use of the processes was still relatively independent. The second 5 factors generally involved more specific and observable behaviors and were labeled *Behavioral.* Three of the factors, Stimulus Control, Counterconditioning, and Reinforcement Management, had clear face validity for this interpretation. The other 2 processes involved public expressions and verbal commitments. However, the distinction between experiential and behavioral was not clear cut. Most of the processes reflected both, with the label expressing the most dominant theme. The correlation between the 2 second-order factors reflected this lack of

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[1] Numerical values for all fit indices are available on request from the authors.

[2] Standardized lambda weights (factor loadings) relating the manifest variables (items) to the latent variables (factors) are available on request from the authors.

Table 3

Multitrait–Multimethod Matrix for the Ten Processes Measured for Two Reference Periods

| | Retrospective (Helpfulness) | | | | | | | | | | Current (Frequency) | | | | | | | | | |
Process	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
							Retrospective													
1. Consciousness Raising	1.0																			
2. Self-Liberation	.23	1.0																		
3. Dramatic Relief	.59	.31	1.0																	
4. Counterconditioning	.33	.26	.29	1.0																
5. Stimulus Control	.36	.23	.31	.20	1.0															
6. Helping Relationship	.43	.32	.36	.26	.25	1.0														
7. Environmental Reevaluation	.52	.37	.53	.32	.40	.37	1.0													
8. Social Liberation	.52	.25	.48	.26	.40	.37	.61	1.0												
9. Self-Reevaluation	.48	.51	.53	.30	.35	.29	.59	.41	1.0											
10. Reinforcement Management	.37	.40	.34	.26	.52	.41	.41	.42	.39	1.0										
											Current									
11. Consciousness Raising	*.50*	-.06	.28	.09	.17	.14	.28	.32	.20	.14	1.0									
12. Self-Liberation	.23	*.36*	.19	.06	.10	.12	.28	.25	.29	.15	.36	1.0								
13. Dramatic Relief	.43	.13	*.61*	.28	.23	.21	.40	.38	.36	.26	.57	.32	1.0							
14. Counterconditioning	.37	.24	.32	*.58*	.25	.30	.38	.34	.39	.30	.48	.52	.42	1.0						
15. Stimulus Control	.29	.13	.23	.21	*.63*	.12	.29	.33	.22	.34	.28	.23	.30	.33	1.0					
16. Helping Relationship	.14	-.01	.09	.17	.01	*.46*	.09	.12	.01	.14	.22	.22	.15	.26	-.02	1.0				
17. Environmental Reevaluation	.34	.20	.30	.31	.24	.16	*.72*	.44	.40	.25	.46	.31	.49	.44	.31	.13	1.0			
18. Social Liberation	.20	.06	.17	.17	.12	.09	.26	*.34*	.13	.08	.36	.21	.31	.35	.15	.27	.40	1.0		
19. Self-Reevaluation	.32	.08	.29	.22	.20	.11	.40	.35	*.48*	.20	.53	.50	.52	.51	.24	.18	.48	.27	1.0	
20. Reinforcement Management	.31	.19	.24	.18	.37	.28	.34	.38	.28	*.65*	.35	.33	.39	.41	.47	.22	.33	.16	.38	1.00

Note. Convergent validity coefficients are presented in italics.

distinction. The correlation between second-order factors could also be represented as a third-order general factor. Both this general factor and the 2 second-order factors could be interpreted as reflecting a tendency on the part of a subject subset not to use any of the processes, (i.e., members of the precontemplation or long-term maintenance subgroups). Alternatively, the second-order factors may be interpreted as reflecting a tendency to not use a subset of the processes (i.e., members of the contemplator subgroup not using the behavioral processes). An alternative explanation is that the secondary factors represented response distortion. This interpretation is not supported by the results reported in the first study.

Discussion

This research resulted in a 40-item questionnaire that measures 10 important processes of change in a statistically well-defined and highly reliable manner. The change processes measured by this instrument are (a) consciousness raising, (b) dramatic relief, (c) self-liberation, (d) social liberation, (e) counterconditioning, (f) stimulus control, (g) self-reevaluation, (h) environmental reevaluation, (i) reinforcement management, and (j) helping relationship.

The results suggested important modifications of the original conceptualization of the key change processes. Self-reevaluation is not just a cognitive restructuring process but includes an affective reevaluation of one's self and of one's problem behavior. The present results suggested that, for consciousness raising, subjects do not differentiate between experiential and environmental sources of information. Reinforcement Management items tended to load also on Counterconditioning and Stimulus Control scales, suggesting that subjects tend to make reinforcements contingent on the use of these two other behavioral processes. Finally, helping relationships appear to be part of change in the natural environment as well as in therapy.

Although the confirmatory analysis supported a 10-process model, it also identified 2 secondary factors, labeled Experiential and Behavioral. These secondary factors were composed of 5 processes each and reflected a tendency of individuals in particular stages to use more than 1 process at a time. Previous research has shown, for example, that subjects in the contemplation stage emphasize such experiential processes as consciousness raising and self-reevaluation. Each of the 5 processes comprising the Experiential factor involved cognitive and/or affective activities. Each of the 5 processes defining the Behavioral factor was emphasized by subjects in the action stage (Prochaska & DiClemente, 1983). The high correlation between the Experiential and Behavioral factors indicates, however, that there is not a clear-cut distinction between these factors and that most of the processes reflected both experiential and behavioral activities. This high correlation may also represent a third-order general factor. This general factor would reflect a tendency on the part of particular subjects, namely precontemplators and long-term maintainers, not to use any of the change processes.

Evidence for the external validity of the processes of change has been found in a variety of studies. Prochaska and DiClemente (1983) demonstrated with smokers that different processes are used in different stages of change. The process variables have also been demonstrated to be good predictors of change in

smoking status 6 months in the future (Prochaska, DiClemente, Velicer, Ginpil, & Norcross, 1985). In a combined cross-sectional and longitudinal analysis of a naturalistic sample, a distinct pattern of (a) initial low use, followed by (b) increased use peaking in either contemplation or action, followed by (c) decreased use in maintenance was demonstrated for composite profiles that traced the course of smoking cessation for each of the 10 processes (Prochaska, Velicer, DiClemente, Rossi, & Guadagnoli, 1987). In a 2-year longitudinal analysis of a naturalistic sample, graphic changes in the 10 processes were found in groups that followed one of four patterns of change over time: stable, progressive, regressive, and recycling (Prochaska, DiClemente, Velicer, Rossi, & Guadagnoli, 1987).

Prochaska and Norcross (1983) demonstrated that therapists differed in predictable ways in the way they used the processes to treat psychological distress, depending on their theoretical orientations. In a behavior therapy program for weight control, subjects who lost weight over the course of the 10-week treatment program were found to move from the contemplation stage to the action stage of change. Between treatment sessions, subjects reported significant increases in action-related processes (Prochaska, Norcross, Abrams, & Fowler, 1987). The processes and stages of change best predicted the number of treatment sessions attended and the percentage of weight lost at posttreatment.

The frequency with which different change processes are used within and between therapy sessions was examined in a naturalistic study of 60 patients in a variety of psychotherapies (Prochaska, Wilcox, & Rossi, 1987a). Remarkable agreement was found between the 60 patients and their 35 therapists in reports of how frequently each change process was used within the most-recent therapy session. There was also a remarkable parallel between the relative frequency of change processes used within therapy sessions and between therapy sessions.

In a longitudinal study with a small sample size, 3 patients were assessed on the intensity of problems and change processes used within and between therapy sessions (Prochaska, Wilcox, & Rossi, 1987b). For the patient who improved dramatically, behavioral processes were used at an above-average rate within therapy sessions, and significant increases were found in the use of behavioral processes between therapy sessions. For the patient who did not improve, action-related processes were used at a below-average rate within therapy sessions, and significant decreases were found in the use of action-related processes between therapy sessions. The 3rd patient dropped out after four sessions. Within the sessions, all processes were used at a below-average rate, indicating that little was going on in therapy. Between-sessions significant decreases were found in 2 action-related processes, stimulus control and reinforcement management, and a significant increase was found in 1 process, counterconditioning. These small sample-size studies are only suggestive, but if they are replicated, the processes of change measures may demonstrate future clinical utility and may yield immediate research applications.

The present study does not address generalization across problem areas. The items presented here are specific to smoking. Separate versions of the questionnaire have been created for smoking, weight control, and psychological distress. Prochaska and DiClemente (1985) described both between-subjects and

within-subject differences in the use of the 10 processes. Prochaska, Velicer, Norcross, and Guadagnoli (1987) described the high degree of factor invariance that exists across these three problem areas. Adaptation of the items to new problem areas is direct for most processes, but translation occasionally requires a degree of creativity. In the latter situations, a larger item pool should be generated. Additional items should also be generated for the more directly translated scales, and the internal (factorial) structure should be verified. The processes of change measure can be adapted in this manner to a variety of problem areas and to both therapy and self-change settings. This will allow a better analysis of the critical independent variables that produce change in a variety of situations.

References

American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, DC: Author.

Bentler, P. M. (1980). Multivariate analysis with latent variables: Causal modeling. In M. R. Rosenzweig & L. W. Porter (Eds.), *Annual review of psychology* (Vol. 31, pp. 419–456). Palo Alto, CA: Annual Reviews.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*, 588–606.

Boosma, A. (1983). *On the robustness of LISREL (maximum likelihood estimation) against small sample sizes and non-normality.* Unpublished doctoral dissertation, Rijksuniversiteit Gronigen, The Netherlands.

Comrey, A. L., & Montag, I. (1982). Comparison of factor analytic results with two-choice and seven-choice personality item formats. *Applied Psychological Measurement, 6*, 285–289.

DiClemente, C. C., & Prochaska, J. O. (1982). Self-change and therapy change of smoking behavior: A comparison of processes of change in cessation and maintenance. *Addictive Behaviors, 7*, 133–142.

DiClemente, C. C., & Prochaska, J. O. (1985). Processes and stages of change: Coping and competence in smoking behavior change. In S. Shiffman & T. Wills (Eds.). *Coping and substance use* (pp. 319–344). New York: Academic Press.

Edwards, A. L. (1957). *The social desirability variable in personality research.* New York: Dryden.

Goldfried, M. R. (1980). Toward the delineation of therapeutic change principles. *American Psychologist, 35*, 991–999.

Goldfried, M. R., & Padawer, W. (1982). Current status and future directions in psychotherapy. In M. Goldfried (Ed.), *Converging themes in psychotherapy* (pp. 3–50). New York: Springer.

Hakstian, A. R., Rogers, W. T., & Cattell, R. B. (1982). The behavior of number of factor rules with simulated data. *Multivariate Behavioral Research, 17*, 193–219.

Harlow, L. L. (1985). *Behavior of some elliptical theory estimators with nonnormal data in a covariance structures framework: A Monte Carlo study.* Unpublished doctoral dissertation, University of California, Los Angeles.

Jackson, D. N. (1967). *Personality Research Form.* Port Huron, MI: Research Psychologists Press.

Jackson, D. N. (1970). A sequential system for personality scale development. In C. D. Spielberger (Ed.), *Current topics in clinical and community psychology* (Vol. 2, pp. 61–96). New York: Academic Press.

Jackson, D. N. (1971). The dynamics of structured personality tests: 1971. *Psychological Review, 78*, 229–248.

Jackson, D. N., & Messick, S. (1958). Content and style in personality assessment. *Psychological Bulletin, 55*, 243–252.

James, L. R., Mulaik, S. A., & Brett, J. M. (1982). *Causal analysis: Assumptions, models, and data.* Beverly Hills, CA: Sage.

Jöreskog, K. C., & Sörbom, D. (1984). *LISREL VI: User's guide.* Mooresville, IN: Scientific Software.

Lissitz, R. W., & Green, S. B. (1975). Effect of the number of scale points on reliability: A Monte Carlo approach. *Journal of Applied Psychology, 60*, 10–13.

Luborsky, L., Singer, B., & Luborsky, L. (1975). Comparative studies of psychotherapy. *Archives of General Psychiatry, 32*, 995–1008.

McConnaughy, E. A., DiClemente, C. C., Prochaska, J. O., & Velicer, W. F. (1987). *Stages of change in psychotherapy: A replication.* Manuscript submitted for publication.

McConnaughy, E. A., Prochaska, J. O., & Velicer, W. F. (1983). Stages of change in psychotherapy: Measurement and sample profiles. *Psychotherapy: Theory, Research, and Practice, 20*, 368–375.

Norcross, J. C., & Prochaska, J. O. (1986a). Psychotherapist heal thyself: I. The psychological distress and self-change of psychologists, counselors, and laypersons. *Psychotherapy, 23*, 102–114.

Norcross, J. C., & Prochaska, J. O. (1986b). Psychotherapist heal thyself: II. The self-initiated and therapy-facilitated change of psychological distress. *Psychotherapy, 23*, 345–356.

Norcross, J. C., Prochaska, J. O., Guadagnoli, E., & DiClemente, C. C. (1984). Factor structure of the Levels of Attribution and Change (LAC) scale in samples of psychotherapists and smokers. *Journal of Clinical Psychology, 40*, 519–528.

Norcross, J. C., Prochaska, J. O., & Hambrecht, M. (1985). The Levels of Attribution and Change (LAC) scale: Development and measurement. *Cognitive Therapy and Research, 9*, 631–649.

Parloff, M. (1979). Can psychotherapy research guide the policymaker: A little knowledge may be a dangerous thing. *American Psychologist, 34*, 296–306.

Prochaska, J. O. (1979). *Systems of psychotherapy: A transtheoretical analysis.* Homewood, IL: Dorsey Press.

Prochaska, J. O., & DiClemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research, and Practice, 19*, 276–288.

Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology, 5*, 390–395.

Prochaska, J. O., & DiClemente, C. C. (1984). *The transtheoretical approach: Crossing traditional boundaries of therapy.* Chicago, IL: Dow Jones/Irwin.

Prochaska, J. O., & DiClemente, C. C. (1985). Common processes of self-change in smoking, weight control, and psychological distress. In S. Shiffman & T. Wills (Eds.), *Coping and substance use* (pp. 345–364). New York: Academic Press.

Prochaska, J. O., & DiClemente, C. C. (1986a). The transtheoretical approach to systematic eclecticism. In J. Norcross (Ed.), *Handbook of eclectic psychotherapy* (pp. 163–200). New York: Brunner/Mazel.

Prochaska, J. O., & DiClemente, C. C. (1986b). Toward a comprehensive model of change. In W. Miller & N. Heather (Eds.), *Treating addictive behaviors* (pp. 3–27). New York: Plenum Press.

Prochaska, J. O., DiClemente, C. C., Velicer, W. F., Ginpil, S., & Norcross, J. C. (1985). Predicting change in smoking status for self-changers. *Addictive Behaviors, 10*, 395–406.

Prochaska, J. O., DiClemente, C. C., Velicer, W. F., Rossi, J. S., & Guadagnoli, E. (1987). *Patterns of change: II. Longitudinal analysis of self-change processes across stages of smoking cessation.* Manuscript submitted for publication.

Prochaska, J. O., & Norcross, J. C. (1983). Psychotherapists' perspectives on treating themselves and their clients for psychic distress. *Professional Psychology: Research and Practice, 14*, 642–655.

Prochaska, J. O., Norcross, J. C., Abrams, D., & Fowler, J. (1987). *Changes in stages and processes of change between behavior therapy treatment sessions for weight control.* Manuscript submitted for publication.

Prochaska, J. O., Velicer, W. F., DiClemente, C. C., Rossi, J. S., & Guadagnoli, E. (1987). *Patterns of change: I. Dynamic typology applied to smoking cessation*. Manuscript submitted for publication.

Prochaska, J. O., Velicer, W. F., Norcross. J. C., & Guadagnoli, E. (1987). *Factorial invariance of the processes of change across three problem areas*. Unpublished manuscript.

Prochaska, J. O., Wilcox, N. S., & Rossi, J. S. (1987a). [Clients' and therapists' reports on change processes used within and between therapy sessions.] Unpublished raw data.

Prochaska, J. O., Wilcox, N. S., & Rossi, J. S. (1987b). [Longitudinal changes in severity of problems and use of change processes within and between therapy sessions: A small-N analysis.] Unpublished raw data.

Strupp, H. H. (1981, August). *Some implications of psychotherapy research for training*. Paper presented at the 89th Annual Convention of the American Psychological Association, Los Angeles.

Velicer, W. F. (1976). Determining the number of components from the matrix of partial correlations. *Psychometrika. 41*, 321–337.

Velicer, W. F., DiClemente, C. C., & Corriveau, D. P. (1984). Item format and the structure of the Personal Orientation Inventory. *Applied Psychological Measurement. 8*. 409–419.

Velicer, W. F., Govia. J. M., Cherico, N., & Corriveau, D. P. (1985). Item format and the structure of the Buss-Durkee Hostility Inventory. *Aggressive Behavior, 11*, 65–82.

Velicer, W. F., & Jackson, D. N. (1987). *Component analysis vs. common factor analysis: Some issues in selecting an appropriate procedure*. Manuscript submitted for publication.

Velicer, W. F., & Stevenson, J. F. (1978). The relation between item format and the structure of the Eysenck Personality Inventory. *Applied Psychological Measurement, 2*, 293–304.

Zwick, W. R., & Velicer, W. F. (1982). Factors influencing four rules for determining the number of factors to retain. *Multivariate Research, 17*, 253–269.

Zwick, W. R., & Velicer, W. F. (1986). A comparison of five rules for determining the number of components to retain. *Psychological Bulletin, 99*, 432–442.