THE STAGES AND PROCESSES OF CHANGE FOR SMOKING CESSATION: TESTING THE TRANSTHEORETICAL MODEL

by

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A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Doctor of Philosophy

in

Psychology

Waterloo, Ontario, Canada, 1997

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Abstract

Cigarette smoking has had a devastating impact on the health of Canadians for decades. Few smokers try to quit; of those who make an attempt, the vast majority fail to remain smoke-free beyond a short period. The purpose of this thesis was to critically evaluate the empirical support for the Transtheoretical Model (TTM), an extremely popular and relatively recent theory that has promised to provide a revolutionary approach to smoking cessation (Prochaska, DiClemente, & Norcross, 1992). The TTM proposes that smoking cessation is a complex process that requires movement through a series of stages of readiness to change rather than a simple shift from smoking to non-smoking. It proposes that smokers in each of the stages have unique thoughts, feelings, and behaviours relevant to their smoking and, by implication, have different intervention needs. The TTM maintains that smoking-cessation programs built around "processes of change" that are matched or targeted to the needs of each stage will lead to greater change than is presently obtained by current, non-targeted approaches. The critical review of the TTM literature in this thesis, however, identified substantial gaps in its conceptual and scientific foundations. Conceptually, the model's structure has been presented in a vague and imprecise manner that does not provide clear guidance to other researchers. In addition, the main tenets of the model – that smokers in different stages use different processes of change, and that smokers in different stages need to apply different processes in order to maximize their outcomes – have either been untested, or have received little support. This thesis provided a comprehensive account of the structure of the model and its claims, and the appropriate analytic strategies for testing those claims. Using a longitudinal survey study of 386 smokers, this thesis provided the first focused tests of the main tenets of the model. The claim that smokers in different stages use different processes of change was completely unsupported; instead, primarily quantitative distinctions among the stages on their use of the processes were observed. The claim that smokers in different stages need to use different processes received partial support; while there was some indication that the processes' effects varied by stage, these effects were not as differentiated as claimed by the proponents of the TTM. The implications of these findings for the model, and for interventions based upon its principles, were fully explored with the goal of identifying ways to improve the empirical foundations of the model to permit its responsible use by health care practitioners.

Acknowledgments

I give my sincerest thanks to my supervisors, Dr. Don Meichenbaum, Dr. Geoff Fong, and Dr. Roy Cameron. Thank you, Don, for your mentorship, and for handing me an article on the TTM several years ago. "Read this!" you said, perhaps never suspecting what you might start. I think we could have bantered on the stages model for hours, and I'm thankful that we didn't do it all long-distance. I'm grateful for having had such a devoted mentor. Thank you, Geoff, for your unstinting guidance. We scaled new heights together in cyber-supervision. I couldn't have asked for a more stimulating and supportive correspondent, and I hope to continue to learn from you for a long time yet. And thank you, Roy, for helping me to appreciate the nature of the behaviour I was studying, and for reminding me that models, however well-specified, are meant to describe the experiences of real people.

My friends and colleagues are all guilty of having supported me when I needed it the most. My deepest thanks to Mel Simoneau in particular, for caring as much about my work as I do, and for making sure I had what I needed to do it. To James Karr, Jane Evans, Deborah Fitzpatrick, Krista Breithaupt, Doug McLauchlan, Steve Hotz, Lynne Leonard, and Ron Plotnikoff: you know what you did, and I appreciate it. Thank you for making my work easier, and for reminding me that there was a life waiting for me when I was finished.

Joyce Fisher, you are a gem, but you've heard that before. Add me to the list of graduate students who have appreciated your caring and your keen attention to wayward rules and regulations.

My final thanks go to all of those individuals who volunteered their time to participate in this research. I was touched by their sincerity, by their willingness to help, and by their desire to know more. I couldn't possibly have done this without them.

Table of Contents

Introduction 1

The Transtheoretical Model (TTM) 4

The Stages of Change 4

The Processes of Change 5

The Integration of the Stages and Processes of Change 7

Decisional Balance 13

Self Efficacy 14

The Impact of the TTM 16

Building Confidence in the TTM: What is Needed? 24

The TTM and Smoking Cessation – A Review of the Literature 25

Is There Stage-specificity in Smokers' Use of the Processes of Change? 25

What Kind Of Data Would Support Cross-Sectional Specificity? 31

... and Have The TTM Researchers Found It? 34

Is a Weaker Degree of Cross-Sectional Specificity Present? 38

Conclusions 41

Is there Stage-specificity in the Processes as Predictors of Change? 42

What Kind of Data Would Support Longitudinal Specificity? 42

... and Have The TTM Researchers Found It? 43

Longitudinal Correlational Studies. 43

Longitudinal Experimental Studies. 50

Conclusions 52

The Goals of This Thesis 54

Method 54

Participants 54

Baseline Measures 55

Follow-up Measures 60
Procedures 62
Results 63
Description of the Sample 63
The Stages of Change 68
The Processes of Change 72
Behaviour Changes at Follow-up 73
Cross-Sectional Analyses: Is there Stage-Specificity in Smokers' Use of the Processes of Change? 75
Are Contemplators Distinguished By Their Use Of The "Contemplator Processes?" 80
Are Preparers Distinguished By Their Use Of The "Preparation Process?" 82
Summary 86
Longitudinal Analyses: Is there Stage-specificity in the Processes as Predictors of Change? 87
Predicting Stage Movement With The Processes Of Change 88
Summary 92
Predicting Intentions And Behaviour With The Processes of Change 101
Predicting Intentions And Behaviour By Stage With The Processes of Change 108
Predicting Intentions Among Precontemplators 109
Predicting Behaviour Among Precontemplators 111
Summary 114
Predicting Intentions Among Contemplators 114
Predicting Behaviour Among Contemplators 117
Summary 119
Predicting Intentions Among Preparers 121
Predicting Behaviour Among Preparers 122
Summary 126

Discussion 128

The TTM: Structure and Implications 129

The TTM Literature: Support for Specificity? 131

Cross-Sectional Evidence 131

Longitudinal Evidence 132

The Present Study: Testing The Claims 133

Cross-Sectional Evidence 134

Longitudinal Evidence 135

Analyzing Stage Movement 135

Analyzing Continuous Measures Of Change 136

Summary 140

Conclusions and Implications 141

Limitations 143

Where To From Here? 145

References 147

Appendix A. Stage Assessment Items and Algorithm for Assignment to Stages 159

Appendix B. Baseline Questionnaire 160

Appendix C. Recruitment Brochure – Kitchener-Waterloo Region 186

Appendix D. Recruitment Notice Posted on the World-Wide-Web 188

Appendix E. Introductory Letter 190

Appendix F. Follow-up Interview Information Sheet 192

Appendix G. Follow-up Interview Script (Telephone Version) 193

Appendix H. Follow-up Interview (E-mail Version) 199

Appendix I. Debriefing Letter 205

List of Tables

Table 1. The Processes of Change 6
Table 2. The Integration Between Stages and Processes of Change 7
Table 3. Phases In The Development Of The TTM Literature 26
Table 4. Studies Investigating Stage Differences on the Use of Processes of Change 27
Table 5. Internal Consistency of the Processes of Change Subscales 58
Table 6. Intercorrelations of the Processes of Change Subscales 59
Table 7. Means (Standard Deviations) and Frequencies of Demographic Variables by Sex and Participant Group 64
Table 8. Means (Standard Deviations) and Frequencies of Smoking Behaviour Variables by Sex and Participant Group 66
Table 9. Means (Standard Deviations) and Frequencies of Social Smoking Context Variables by Sex and Participant Group 67
Table 10. Stages of Change – Demographic and Participant Characteristics 70
Table 11. Stages of Change – Smoking-related Variables 71
Table 12. Scale Means of the Processes of Change 72
Table 13. Stages of Change – Follow-up Behaviour Change 74
Table 14. Stage Comparisons on the Processes of Change 77
Table 15. Mean Processes of Change By Type of Stage Movement for Precontemplation 89
Table 16. Mean Processes of Change By Type of Stage Movement for Contemplation 91
Table 17. Mean Processes of Change By Type of Stage Movement for Preparation 92
Table 18. Predicting Intentions to Quit Smoking with the Processes of Change 102
Table 19. Predicting Intentions to Reduce Smoking with the Processes of Change 104
Table 20. Predicting Smoking Reduction (CPD) with the Processes of Change 106
Table 21. Predicting Total Days of Change with the Processes of Change 107
Table 22. Predicting Precontemplators' Intentions to Quit Smoking 110
Table 23. Predicting Precontemplators' Intentions to Reduce Smoking 112
Table 24. Predicting Precontemplators' Smoking Reduction (CPD) 113
Table 25. Predicting Contemplators' Intentions to Quit Smoking 115
Table 26. Predicting Contemplators' Intentions to Reduce Smoking 117

Table 27. Predicting Contemplators' Smoking Reduction (CPD) 118
Table 28. Predicting Contemplators' Total Days of Change 120
Table 29. Predicting Preparers' Intentions to Quit Smoking 121
Table 30. Predicting Preparers' Intentions to Reduce Smoking 123
Table 31. Predicting Preparers' Smoking Reduction (CPD) 124
Table 32. Predicting Preparers' Total Days of Change 125
Table 33. Summary of Processes Important to the Prediction of Intentions and Behaviour .. 137

List of Illustrations

Figure 1. Processes of Change by Stage: Hypothetical Data Illustrating Stage-specificity.....32
Figure 2. Processes of Change by Stage: Relationships from DiClemente et al., 1991. 34
Figure 3. Processes of Change by Stage: Relationships from Fava et al., 1995. 35
Figure 4. Processes of Change by Stage: Weaker Support for Specificity. 40
Figure 5. Mean Processes of Change for Precontemplators and Contemplators.....81
Figure 6. Mean Processes of Change for Contemplators and Preparers.....83
Figure 7. Mean Processes of Change for Precontemplators and Preparers. 85
Figure 8. Mean Processes of Change for Precontemplators, Contemplators, and Preparers.....86
Figure 9. Mean Processes of Change by Type of Stage Movement for Precontemplators.....94
Figure 10. Mean Processes of Change by Type of Stage Movement for Contemplators.....96
Figure 11. Mean Processes of Change by Type of Stage Movement for Preparers.....97

Introduction

Almost 45 years ago, the Canadian Medical Association began to warn the public about the health hazards associated with cigarette smoking. Fifteen years later, the Association informed the federal government of Canada that the cessation of smoking ranked with the pasteurization of milk and immunization as an essential focus for preventive medicine (CMA policy summary, 1991). Society has long been aware of the financial and human costs associated with smoking-related diseases.

Unfortunately, the problem remains at the forefront of Canadian public health in the 1990's. In 1991, one person in five died as a direct or indirect result of smoking (Makomaski Illing & Kaiserman, 1995). Approximately 845,000 heavy smokers[1] in Canada over the age of 18 will smoke more than 21 million cigarettes among them *each* day. The remaining five and a half million smokers who consume less than a pack a day will also put themselves at risk for smoking-related illnesses including cancers of the lung and throat, emphysema, and coronary heart disease (Stachenko et al., 1992). Only a third of smokers will even try to quit each year (Fiore et al., 1990). Of those attempters, only one third will be able to maintain their abstinence for more than a month (Marlatt, Curry & Gordon, 1988).

Smokers tend to attempt quitting on their own, rather than participating in structured treatments or formal therapies. Some estimates of the ratio of self-quitters to program-assisted quitters are as high as nine to one (Fiore et al., 1990). Given these figures, it is likely that a smoker's physician is the person most likely to offer assistance, or even to raise the issue of smoking cessation ("Smoking and Health: A Physician's Responsibility," 1995; CMA Policy Summary, 1991). Most studies show that 60 to 85% of physicians address their patients' smoking behaviour during office visits (Jelley & Prochazka, 1991; Lindsay et al., 1994), although some estimates are as low as 40% (Kottke, Brekke, Solberg & Hughes, 1989). In addition, the majority of patients who smoke expect their physicians to ask about their smoking, while approximately half expect their physician to offer assistance with quitting (Kviz, Clark, Hope & Davis, 1997). Physicians are in a unique position to intervene with

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[1] Those smoking more than one pack of 25 cigarettes per day (Cohen et al., 1989).

smokers, as they are able to offer individual, face-to-face consultation in the context of a trusting relationship whose focus is the personal well being of the patient.

Unfortunately, not all physicians receive adequate training in smoking cessation counselling (Kristeller & Ockene, 1996). Physicians themselves report a lack of information and training, and connect this problem to their low success rates with smokers (Ockene, Aney, Goldberg, Klar & Williams, 1988). One study found that only 10% of physicians were "often satisfied" with their efforts to address smoking with their patients, and that only 14% had received any formal training in smoking counselling techniques at all (Jelley & Prochazka, 1991). Moreover, physicians tend to intervene more with the smokers who wish to quit than with committed smokers (Ockene et al., 1994). When they do intervene, they tend to rely on advice-giving, nicotine replacement therapy, and self-help pamphlets at the expense of a more broad range of cognitive and behavioural strategies (Lindsay et al., 1994; Mowat, Mecredy, Lee, Hajela & Wilson, 1996).

A lack of training is not the only obstacle to physicians' work with smokers. Many have reported that the amount of time involved in cessation counseling, and a lack of patient receptivity to such counselling are significant barriers to their efforts (Goldberg, Ockene, Ockene, Merriam & Kristeller, 1993). In addition, some physicians hold unrealistically high expectations for success with their smoking patients, and see patient factors such as noncompliance as the major source of their difficulty (Mowat et al., 1996). The frustration that practitioners can experience in their work with smokers can be considerable. One group of researchers training perinatal workers to offer smoking-cessation counselling found that the workers felt considerable anger and frustration toward their patients for placing their unborn babies at risk. The perinatal workers required "empathy training" to improve rapport with their patients in order to use their smoking-cessation training effectively (Adams & Naylor, 1997).

In summary, smoking continues to be a significant health threat that health care practitioners often feel ill equipped to address despite an almost unanimous interest in doing so. Physicians and other health care practitioners who have the opportunity to intervene with smokers require a model or framework for understanding smoking behaviour. Although particular cessation strategies such as nicotine replacement therapy can be effective in the

context of a treatment program, techniques and tools on their own do not comprise an explanatory system for understanding *how* people quit smoking. Most importantly, they do not explain how smokers develop the desire to engage in treatment or to use such strategies in the first place. Practitioners require a model that can help explain why certain smokers fail even to become interested in smoking cessation, why others fail to quit even after repeated cessation attempts, and, most importantly, how to intervene in such circumstances.

A new model of smoking behaviour change has recently emerged that promises to address all of these issues – problems of low patient compliance, practitioner frustration, low success rates, and early dropouts and relapsers – and practitioners are understandably enthused. Prochaska and his colleagues have formulated a model that they believe explains how smokers change, *and* that offers guidelines for intervention that are tailored to individual smokers' needs (Prochaska, DiClemente & Norcross, 1992).

Prochaska et al. argue that current smoking cessation models offer little to practitioners because an overly simplistic view of smoking and quitting prevails. In this simplistic view, smoking cessation is a single, unitary event; following an intervention, either people quit smoking or they do not (Prochaska & Goldstein, 1991). Researchers who subscribe to this view obtain low change rates in their studies, because few smokers quit in any given period. Consequently, the large numbers of smokers who do not quit remain misunderstood. Practitioners who subscribe to this dichotomous view of smoking approach their patients with action-oriented cessation programs, which do not attract the attention of smokers who are not yet ready to quit. Practitioners are thus unable to reach this "unreachable" group of smokers, and tend to work only with those who are more likely to succeed.

Instead of this all-or-none view, Prochaska and his colleagues argue that both researchers and practitioners should recognize smoking cessation as a complex, continuous process. They suggest that quitting smoking involves moving through a series of stages over time. Each stage involves the development of different cognitions, affects, and behaviours, and, by implication, involves different tasks that smokers must accomplish in order to move along to the next stage in the quitting process. These tasks center on the development of readiness (Prochaska & DiClemente, 1982; 1983). As smokers progress through the stages, the target of readiness shifts; the smoker first develops cognitive and affective readiness to

think about changing, then to decide to change, and finally to initiate and maintain change. Thus, actual quitting occurs only in the final stages. This view offers a more optimistic approach to intervention than do dichotomous models. Practitioners who were previously frustrated by their patients' failures to quit can learn to see these smokers as "early stage" individuals who can work on stage-appropriate pre-quitting tasks. The idea that smokers in different stages have different intervention needs is the central premise of the model developed by Prochaska and his colleagues, the Transtheoretical Model (TTM) (Prochaska et al., 1992).

The Transtheoretical Model (TTM)

The initial impetus for this model was the desire to develop a truly eclectic model of change in psychotherapy. Prochaska and his colleagues theorized that readiness to change could provide a meaningful structure for organizing the essential ingredients from every theoretical orientation. Thus, the methods and tools from all approaches are deemed useful and effective, but at different phases along the continuum of readiness.

Prochaska et al. initially drew upon the psychotherapy and personality literatures in assembling the organizing structure of the stages of readiness and the clusters of change strategies presumed relevant to each stage (Prochaska & DiClemente, 1982; McConnaughy, Prochaska & Velicer, 1983). However, they developed the model most extensively in their studies of smoking cessation, and validated their constructs and scales on this behaviour. According to the TTM, smoking cessation requires movement through five sequential stages of change. Each stage represents a period of time as well as a set of tasks or processes of change that smokers must accomplish in order to proceed to the next stage.

The Stages of Change

In the first stage, precontemplation, smokers do not intend to quit smoking in the next six months. In the second stage, contemplation, smokers are smoking regularly, but considering quitting sometime in the next six months, but not within the next 30 days. The third stage is preparation, the stage in which smokers are considering quitting entirely within the next 30 days. To be classified in this group, smokers must also have had a previous quit attempt within the past year; those who have not had a previous attempt, but who have intentions to change in 30 days, are considered contemplators. In the fourth stage, action,

individuals have quit smoking within the past six months. By the fifth and final stage, maintenance, ex-smokers have maintained their smoke-free status for more than six months (Prochaska et al., 1992).

Smokers are classified to stage of change with the use of a five-item scale that assesses current smoking behaviour, past quitting attempts, and intentions to quit in the near and distant future (DiClemente et al., 1991) . Please see Appendix A for the five questions and the scoring algorithm used to assign individuals to stages. The recent summary of the TTM work (Prochaska et al., 1992) indicates that stage of change may also be measured continuously with the use of a scale developed in the psychotherapy domain (McConnaughy, DiClemente, Prochaska & Velicer, 1989). However, this continuous scale has not appeared in any published study involving the measurement of stages of change for smoking; to date, all TTM studies investigating smoking have employed the categorical five-item scale. The categorical measure of stage is therefore used in the present study.

The Processes of Change

Processes of change are the goal-directed strategies that people can use to modify their smoking. Drawing on their work on the different systems of psychotherapy (Prochaska, 1979), Prochaska and DiClemente distilled what they regard as a finite set of 10 change processes (Prochaska, Velicer, DiClemente & Fava, 1988). These processes, according to Prochaska et al., explain *how* change occurs (Prochaska et al., 1992). The processes of change represent "...activities and events that create successful modification of a problem behavior" (DiClemente et al., 1991, p. 295). They are "independent variables" (Prochaska, DiClemente, Velicer & Rossi, 1992; Prochaska, Velicer, Guadagnoli, Rossi & DiClemente, 1991; Velicer & DiClemente, 1993) and they are types of activity used for "... modifying affect, behavior, cognitions, or relationships" (Prochaska & DiClemente, 1986, p. 7).

The processes of change are measured with a 40-item scale containing statements descriptive of the change strategies, including "When I am tempted to smoke, I think about something else" and "I tell myself I can choose to smoke or not." Five of the 10 processes reflect behavioural strategies – specific, observable behaviours directed at changing smoking. The other five processes are cognitive or experiential in nature, reflecting the thinking and

feeling activities of the smoker attempting to quit. Respondents rate their frequency of use of each process on a 5-point scale from "Never" to "Repeatedly." See Table 1 for a list of the 10

Table 1

The Processes of Change

Process	Description and Sample Item
Cognitive/Experiential:	
Consciousness raising (CR)	Increasing information about self and problem. *"I recall information people have given me on the benefits of quitting smoking."*
Dramatic relief (DR)	Experiencing and expressing feelings about one's problems and solutions. *"Warnings about health hazards of smoking move me emotionally."*
Environmental reevaluation (ER)	Assessing how one's problem affects physical environment. *"I stop to think that smoking is polluting the environment."*
Self-reevaluation (SR)	Assessing how one feels and thinks about oneself with respect to a problem. *"I get upset when I think about my smoking."*
Social liberation (SO)	Increasing alternatives for nonproblem behaviours available in society. *"I find society changing in ways that make it easier for nonsmokers."*
Behavioural:	
Self-liberation (SL)	Choosing and commitment to act or belief in ability to change. *"I tell myself I can quit smoking if I want to."*
Reinforcement management (RM)	Rewarding oneself or being rewarded by others for making changes. *"I am rewarded by others if I don't smoke."*
Helping relationships (HR)	Being open and trusting about problems with someone who cares. *"I have someone who listens when I need to talk about my smoking."*
Counterconditioning (CC)	Substituting alternatives for problem behaviours. *"I do something else instead of smoking when I need to relax."*
Stimulus control (SC)	Avoiding or countering stimuli that elicit problem behaviours. *"I keep things around my home or place of work that remind me not to smoke."*

Note. Descriptions of processes adapted from Prochaska et al., 1992.

processes and sample items. The short form of the processes of change scale (Fava, Rossi, Velicer, & Prochaska, 1991) can be viewed on page 180 in Appendix B, which contains the instrument used in the present study.

The Integration of the Stages and Processes of Change

In a recent review of their work, Prochaska and his colleagues stated that an integration between the stages and processes of change is "one of the most important findings to emerge from our self-change research" (Prochaska et al., 1992). Elsewhere, they tell of a "compelling correspondence" (Prochaska & DiClemente, 1992) between these two elements in their model. Table 2 represents this integration.

Table 2

The Integration Between Stages and Processes of Change

Precontemplation	Contemplation	Preparation	Action	Maintenance
	Consciousness raising			
	Dramatic relief			
	Environmental reevaluation			
		Self-reevaluation		
			Self-liberation	
				Reinforcement management
				Helping relationships
				Counterconditioning
				Stimulus control

Note. Adapted from Prochaska et al., 1992.

Prochaska and his colleagues maintain that particular processes "tend to be emphasized" within some stages and not others (Prochaska & DiClemente, 1983), and that there are "systematic relationships between the stage people were in and the processes they were applying" (Prochaska & Velicer 1997b, p. 43). The integration in Table 2 represents an

"aggregate" of findings from their cross-sectional research, and depicts what these process-by-stage relationships look like (Prochaska et al., 1992).

Which processes are used by smokers in each stage? The placement of the processes between pairs of adjacent stages, rather than underneath the stages that use them, is initially puzzling. The text that accompanies the table offers clarification, however. The processes that Prochaska et al. describe as characteristic of a particular stage are shown one-half step to the *left* of that stage in the integration. For example, in the integration, three processes appear to the left of contemplation; in the accompanying text, Prochaska et al. stated that they have found these processes to be the change activities normally used by contemplators (1992, p. 1109). Therefore, the processes that "belong" to, or typically characterize, each stage, are shown one-half step to the left of the stage. Correspondingly, any processes *not* listed as characterizing a particular stage are understood to receive little attention from individuals in that stage[2].

Why list the processes between stages rather than directly underneath the stages they characterize? Prochaska and his colleagues wished to extend their work beyond a simple description of what smokers do; their goal was to identify what smokers *should* do in order to move from one stage to the next. The integration indicates "how particular processes can be applied or avoided at each stage of change" (Prochaska et al., 1992, p. 1109).

Quite simply, smokers in a given stage should use the processes characteristic of the next stage in the sequence in order to progress into that stage. For example, Prochaska and Velicer describe precontemplators as "needing to apply" consciousness raising and dramatic relief – processes that their work revealed to be characteristic of contemplators – in order to progress to the contemplation stage (1997b, p. 43). These processes are therefore shown in the integration as "spanning" or "bridging" the gap between precontemplation and contemplation. In hypothesis-testing terms, precontemplators who use the processes in this span will be more likely to progress to the contemplation stage than those precontemplators who do not use them. In this regard, Prochaska et al. imply that what smokers do *within* a stage identifies what "the

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[2] Prochaska et al. (1992) have asserted that precontemplators are the least active of the stages. Therefore, none of the processes is described as characterizing that stage.

next step" should be for smokers trying to move *into* that stage from the one preceding it. Correspondingly, processes *not* appearing in a particular span are assumed to be irrelevant to that transition. Thus, precontemplators who use self-liberation will not be likely to progress because this process bridges a different transition, that leading into action from preparation[3].

The two sets of processes – those that describe what smokers *do* and those that describe what smokers *should* do – are therefore not the same. Prochaska and his colleagues believe that smokers must "do the right thing at the right time" in order to achieve the most benefit from their efforts, and that this demands stage-matched interventions (Prochaska et al., 1992). Unaided, smokers will not progress in great numbers. Some will use the appropriate stage-matched strategies, but the majority will either continue to use the processes that "belong to" their stage, which will lead to stagnation within that stage, or they will prematurely use the processes for the too-distant action stage and suffer a rapid relapse (Prochaska et al., 1992; Prochaska & Velicer, 1997b). Smokers in each stage need to be guided away from what they usually do and toward the processes that will help them advance.

In which direction do the processes work? It would seem that they should facilitate positive outcomes or forward movement through the stages. However, Prochaska's assertion that smokers could *incorrectly* apply the processes (i.e., use them during the wrong stage) implies that the processes could also have negative effects; incorrectly applied, they might encourage stagnation within a stage, or backward movement through the stages. Although Prochaska et al. have observed the processes influencing different directions of stage movement (Prochaska, DiClemente, Velicer, Ginpil & Norcross, 1985; Fitzgerald & Prochaska, 1990), their integration indicates only facilitative, forward movement.[4]

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[3] Prochaska et al. (1992) did not describe these relationships as explicitly as they are described here. For example, their reasoning about how they used their cross-sectional data to derive causal hypotheses about stage movement was not explained. They indicated only that they used their data "as a point of departure" (Prochaska et al., 1992, p. 1109) to develop the integration. Their strategy is evident on an implicit level, however; the model's relationships as summarized here are evident both in the text that accompanies their integration table in their review article (Prochaska et al., 1992), and in their other writings about the model's relationships (e.g., Prochaska & Velicer, 1997a).

[4] Other researchers have also expected the processes to facilitate forward stage movement, in part because the items are all phrased positively (e.g., Sutton, 1996).

Finally, it is important to note that only nine of the ten processes have a place in the integration. One process, social liberation, was omitted for reasons that have not been explained. However, all recent depictions of the model indicate 10 processes of change (e.g., Prochaska & Velicer, 1997b). The hypothesized role for social liberation is therefore poorly understood.

In summary, Prochaska et al. have identified an integration of stages and processes that offers a rich source of testable hypotheses for the model[5]. It offers both descriptive hypotheses about how process use naturally differs by stage, and predictive hypotheses about how the processes might facilitate stage movement over time. The integration also offers an intuitive approach to intervention that would have meaning and appeal for practitioners and program planners who wish to help smokers quit.

There is, however, one aspect of the integration that has received very little explicit attention from Prochaska and his colleagues, but that has substantial implications for the model. That is the "stage-specificity" of the processes.

Stage-specificity of the processes refers to the degree of differentiation among the stages on the processes. At the "non-specific" end of this continuum, the processes would have undifferentiated relationships with stage. In cross-sectional, descriptive terms, non-specificity implies that the processes have an equal potential to be used by smokers in each of the stages. Any differences observed among the stages on their use of the processes would be primarily *quantitative* rather than qualitative. For example, smokers in several stages might use the process of consciousness raising, and would differ from each other primarily in the degree to which they use it. In longitudinal, predictive terms, non-specificity would imply that

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[5] It is important to caution the reader that a slightly different version of Prochaska et al.'s integration (Prochaska et al., 1992) has appeared in a more recent publication by Prochaska and Velicer (1997b). In this latter version, the processes of self-reevaluation and self-liberation are aligned directly *under* the contemplation and preparation stages respectively. In the original integration, reproduced here in Table 2, these processes are shown leading out of their respective stages as "bridges" into the next stage. It is assumed that this inconsistency between the two versions of the integration does not reflect a theoretical shift in thinking about the functioning of the processes by stage, but rather an error in the reproduction of the table. First, Prochaska et al., 1992, the review article in which the table originally appeared, is cited as the source for the latter depiction. Second, no qualifications or explanations were offered to explain the departures of this integration from the original.

the processes have a potential to facilitate change for several or all of the stages. For example, smokers in several stages might benefit significantly from the use of consciousness raising.

Toward the other end of this continuum is strong specificity, with the processes having highly differentiated relationships with stage. In cross-sectional, descriptive terms, strong specificity implies that smokers in different stages use different processes. Differences observed among the stages on their use of the processes would be primarily *qualitative*, and only to a lesser degree quantitative. For example, smokers in only one stage would tend to use consciousness raising while smokers in the other stages would either not use it, or use it to a lesser degree. In longitudinal, predictive terms, strong specificity would imply that the processes' potential to facilitate change is stage-specific. For example, smokers in contemplation might benefit from using self-reevaluation, but smokers in each of the other stages would not; instead, they would benefit from a different process or set of processes.

Of course, moderate levels of specificity are also possible, with the stages differing both quantitatively and qualitatively on their patterns of process endorsement. At moderate levels of specificity, some of the processes could have multiple roles, being used by smokers in more than just one stage, and facilitating change for smokers in more than just one stage, while other processes could function in a more stage-specific manner.

The degree of specificity in the processes' relationships with stage has important implications for Prochaska et al.'s claims of stage-matching. Recall that the primary goal of the model is to identify ways to develop stage-matched or "tailored" interventions. In the case of non-specificity, the issue of stage-matching would be moot. With strong commonalities across the stages in the processes that are used, and, by implication, with strong commonalities across the stages in the degree to which the processes are helpful, there would be little qualitative distinctiveness among the stages to which one could tailor an intervention. However, in the case of strong specificity, stage-matching would be important. The stages would represent meaningfully distinct profiles of process activity to which interventions could (and potentially should) be tailored. In its strongest form, stage-specificity implies that the processes would help smokers *only* if they were matched to stage. If applied in a mismatched manner, they might simply be irrelevant, or might even hinder smokers.

From this, it can be seen that strong specificity is required in order for Prochaska and his colleagues to make the two broad claims that they make for the model. It is necessary in order for them to assert that, cross-sectionally, process use varies as a function of stage, and it is necessary in order for them to assert that, longitudinally, the processes' effectiveness for facilitating change varies by stage.

Why is it *strong* specificity that is required, and not simply a more moderate degree? The answer to this question comes from three different sources.

The first source is the integration itself. As can be seen in Table 2, the integration proposes that the processes of change operate at a very high level of stage-specificity or differentiation because each process is assigned a role for *one* transition only. That is, in the integration, each stage transition is spanned by a unique set of processes; nowhere does consciousness raising, for example, appear other than in the precontemplation–contemplation transition.

The second source is the nature of the rhetoric – the language used by Prochaska and his colleagues to describe their model's concepts, and its potential contributions to the science and practice of health behaviour change. First, there is a substantial amount of certainty in the claims made for the process-by-stage relationships. As Prochaska and DiClemente put it, "Once it is clear what stage of change a client is in, the therapist would know which processes to apply in order to help the client progress to the next stage of change" (Prochaska & DiClemente, 1986, p. 8). Second, there is an expectation of powerful effects if stage-matched interventions are applied. The model's proponents expect that stage-matching will produce "unprecedented impacts on entire at-risk populations" (Prochaska & Velicer, 1997b, p. 38). In essence, the anticipated effect size is quite large; weaker forms of specificity would be unable to provide outcomes of such magnitude.

The third source is simply the nature of tailored interventions. "Tailoring" demands that there is something unique about the group of individuals being targeted. Market researchers carefully establish the characteristics and needs of the consumers or markets to whom they wish to sell a product. If different markets did not have sufficiently different needs, then only one sales pitch would be necessary. Consistent with this reasoning, Prochaska and his colleagues have encouraged health care practitioners to consider their own sales

pitches: Are they trying to speak only to those smokers who are most ready to quit? Are there smokers whose needs are so different from the ready-to-quit group that they have not been able to benefit from what practitioners have to say? The logic of "target marketing" demands that the stages have some qualitative differences among them on important dimensions. This demands a stronger rather than a weaker degree of specificity.

This "strong vs. weak" distinction has substantial implications for the model, and it will be an important focus throughout this thesis.

The stages and processes of change are the core elements of the model. There are other constructs, however, that have been researched alongside these elements; these are the variables of decisional balance and self-efficacy. There is no mention of these constructs in Prochaska et al.'s review of the TTM work (Prochaska et al., 1992). However, they have received attention in some empirical work with the stages of change (e.g., Prochaska, DiClemente, Velicer & Rossi, 1993; Fava, Velicer & Prochaska, 1995), and have been included in other descriptions of the model (e.g., Prochaska & DiClemente, 1986). In view of this, some attention to these variables is warranted. What is their place in the structure of the TTM, and how do they relate to the stages and processes of change?

Decisional Balance

Based on Janis and Mann's well-established decision-making model (1977), decisional balance represents the importance to the smoker of both the negative aspects or cons of smoking, such as the health risks to self and others, and the positive aspects or pros, such as the tension-relieving aspects of smoking. The TTM researchers hypothesize that these cost-benefit cognitions should have systematic cross-sectional relationships with stage membership.

The pros and cons of smoking are measured with a 20-item paper-and-pencil instrument consisting of 10 items each for the pros and cons (Velicer, DiClemente, Prochaska & Brandenburg, 1985). The items consist of statements about the consequences of smoking, including "Smoking cigarettes is pleasurable" and "Smoking cigarettes is hazardous to my health." Respondents rate the degree of importance of each statement on a 5-point scale from "Not important" to "Extremely important." These pro and con factors are considered orthogonal, such that respondents may score high on both, low on both, or high on one and low

on the other. Although a short-form version with 3 items per subscale is available, the 20-item version is more commonly used (Fava, Rossi, Velicer & Prochaska, 1991). The decisional balance scale items are presented on page 178 in Appendix B.

Self Efficacy

Prochaska and DiClemente expanded the TTM to include the self-efficacy construct from Bandura's work (1977), altering it to incorporate recent findings regarding efficacy and smoking (e.g., Condiotte & Lichtenstein, 1981). It represents smokers' perceived confidence in their ability to abstain from smoking in a variety of tempting situations and, in an accompanying scale that is infrequently used, smokers' perceived degree of temptation to smoke in each of those situations (DiClemente, Prochaska & Gibertini, 1985). In keeping with the view of the TTM as "transtheoretical," or able to integrate variables from other theories, the self-efficacy construct was added to help account for the differences between smokers in the stages of change.

The confidence and temptation scales have been through several changes. Initially, each scale consisted of 31 items and each had three subscales capturing the positive/social, negative/affective, and habit/addictive dimensions of smoking. The items consisted of sentences describing a variety of situations assumed to act as cues to smoking behaviour, including being with friends at a party, and feeling anxious or stressed. For the confidence scale[6], respondents were required to rate the degree of confidence they would feel in not smoking in those situations on a 5-point scale, ranging from "Not at all confident" to "Extremely confident." The Temptation scale included the identical items, except that the response options ranged from "Not at all tempted" to "Extremely tempted." In later work, DiClemente et al. reduced the 31-item scale to 20 items (1991); still later a 9-item short-form scale was developed (Fava et al., 1991). The 20-item version of the temptation scale is presented on page 182 in Appendix B, and the confidence scale can be seen on page 184.

If the processes of change are the independent variables in the model, what are the specific roles of decisional balance and self-efficacy? The TTM literature provides an unclear

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[6] Prochaska et al. usually refer to the confidence scale simply as "self-efficacy."

picture of these variables. Whereas Prochaska et al. routinely describe the processes as predictors of change, they describe self-efficacy and decisional balance as "dependent" or "intervening" variables within the structure of the model (Prochaska, DiClemente, Velicer & Rossi, 1992a; Velicer & DiClemente, 1993). However, they do not expand upon those statements in theoretical terms; if they are dependent variables, what are the independent variables that influence them? If they are intervening variables, what sets of variables do they link together? Prochaska and his colleagues have most often used decisional balance and self-efficacy to identify cross-sectional differences among the stages of change (e.g., DiClemente et al., 1985; Velicer et al., 1985; DiClemente et al., 1991; Fava et al., 1995). However, Prochaska has suggested that the processes of change could be used to enhance the pros of changing[7], implying that the pros should be used as dependent variables in this context (Prochaska, 1994b). This statement, combined with his earlier assertion that they are "intervening" variables suggests that he might be thinking of them as mediating the relationship between processes and stages. This remains guesswork, however, as such structural declarations are never explicitly made.

Do Prochaska et al. intend self-efficacy and decisional balance to serve as stage-matched causal agents in addition to the processes of change? The TTM literature offers conflicting guidance here as well. Decisional balance and self-efficacy have been used as independent variables to predict stage movement (Prochaska et al., 1985), and as tools upon which to build interventions (Prochaska et al., 1993; Velicer et al., 1993). However, a study of "doing the right thing at the right time" included only the processes, suggesting that decisional balance and self-efficacy should not function in a stage-matched capacity (Perz, DiClemente & Carbonari, 1996). Most importantly, the recent review written by Prochaska et al. offered only minor attention to these variables, and focused entire sections on the processes and their possible causal effects (1992). As this paper provides the most comprehensive account of the model to date, the absence of decisional balance and self-efficacy implies that their roles in the model are not yet fully understood.

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[7] The "pros of changing" do not technically exist in the TTM. In this paper, Prochaska considered the cons of smoking to be conceptually equivalent to the pros of changing, or quitting smoking. This is a highly questionable

In summary, the core constructs of the TTM include the five stages of change as a temporal organizing structure, and a set of tasks or change strategies, the processes of change, that are integrated with the stages. The processes identify the essential activities that should occur within each stage to facilitate movement between them.

The Impact of the TTM

The TTM has attained a significant level of familiarity and popularity. Researchers have used it to study a broad range of behaviours including condom use (e.g., Bowen & Trotter, 1995; Grimley, Prochaska, Velicer & Prochaska, 1995), exercise adoption (e.g., Marcus & Simkin, 1994; Cardinal & Sachs, 1995), dietary fat reduction (e.g., Rossi, Rossi, Velicer & Prochaska, 1996; Glanz et al., 1994), psychotherapy outcome (e.g., Prochaska, 1991; McConnaughy et al., 1983), and alcohol use (e.g., DiClemente & Hughes, 1990; Snow, Prochaska & Rossi, 1994), among others. The model has also caught the attention of public health at national and provincial levels in Canada and the United States. In the United States, the Surgeon General's report on smoking suggested that the TTM function as an organizing framework for intervention (USDHHS, 1990). In addition, the stages of change concept was considered one of the "essential elements" for organizing smoking cessation intervention efforts in a report from the National Cancer Institute (Glynn, Boyd, & Gruman, 1990). As well, the Centers for Disease Control and Prevention has approved its use in a multisite HIV prevention program targeting high-risk individuals (O'Reilly & Higgins, 1991).

Canadians are also enthusiastic. The Survey on Smoking in Canada, a four-phase study investigating smoking habits across the country, included items to assess stage of change; giving space to a model-based concept in a national health survey is a substantial vote of confidence (Health Canada, 1994). As well, the Ontario Tobacco Research Unit has recommended that stage-matched interventions be developed and tested in Eastern Ontario (Pickett & Bains, 1997). Regional health departments are heeding the message: a recent survey of 22 health departments in Ontario revealed that 98% of the respondents had heard of the model through continuing education and peer consultation. Almost all had elected to use it

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assumption.

in a current program, most often for smoking cessation (Hotz, Plotnikoff, Findlater & Boulet, 1995). A group of Canadian researchers has begun to construct a directory of researchers and practitioners who use the model in the hopes of building a network to foster collaborative work and resource-sharing (Hotz, Plotnikoff & Leonard, 1996). This is a significant amount of attention paid to a psychosocial model of change.

The range of reactions to the TTM has been as broad as its application. Some are emphatic in their admiration; one researcher asserted that the TTM "frees us up from old thinking, and enables us to do things that we could not do before" in the manner of a "paradigm shift" (Orford, 1992). Stockwell (1992) stated that he found it "immensely comforting," and valued its ability to help him to feel "clear, hopeful and up to date." When he lectured on the model in class, Stockwell indicated that one of his students likened the classroom's reaction to the excitement appropriate to an "evangelical religious meeting." O'Donnell (1997) ranked the model as the single most important innovation in health promotion in the past decade. He believes that it will encourage research-based practice in ways that more "esoteric" theories could not. Still another considers the use of the TTM to be nothing less than a "conceptual revolution" in the treatment of smoking (Schorling, 1995); this is strong phrasing, but Prochaska endorses it as well in his own writings (Prochaska, 1994a; Prochaska, in press).

Others are more critical of the TTM. Bandura (1997a, 1997b) has criticized stage models in general, emphasizing their inability to capture the multidetermined nature of human behaviour and their tendency to categorize individuals without an appreciation of context or diversity. Regarding the TTM in particular, Bandura has accused it of failing to meet the three basic criteria for stage models: qualitative transformations across stages, invariance of sequence, and nonreversibility. First, the requirement of qualitative transformations is violated as the stages are based upon continuous variables that are arbitrarily segmented. For example, in the case of the action stage, the mere passage of time is sufficient to move an individual along to the next stage. One of Bandura's more compelling arguments is his questioning of the degree to which the transitions between stages represent change points that would be recognized as meaningful by the individual. (Would a smoker recognize and celebrate the movement from contemplation to preparation?) Second, the invariance of sequence is

artificially built into the model as the order of stages is a logical necessity; one cannot, presumably, quit for a long time (maintenance) without having quit for a short time (action). Finally, nonreversibility is clearly violated. Smokers in contemplation and preparation can move to an earlier stage by reducing their intentions to change, and recent quitters and long-term quitters can move to an earlier stage by returning to smoking.

Sutton (1996) raised several concerns about the stages and the processes of change. First, he questioned the assumption that change, as captured by stage movement, involves a sequence of 'thresholds' of intention such as 30 days and 6 months. The threshold for the maintenance stage is particularly arbitrary, as it is doubtful that smokers will recognize a 6-month milestone and initiate the use of a different set of processes. Sutton contrasted this use of thresholds with the more common (and the more statistically powerful) practice of using continuous measures for variables relevant to decision-making. Regarding the processes of change, Sutton questioned several striking inconsistencies. Although they are meant to be strategies that individuals can use, some of the processes reflect passive states (e.g., "I am rewarded by others if I don't smoke"), and others reflect static rather than dynamic processes (e.g., "I have someone who listens when I need to talk about my smoking"). This observation weakens the assumption that process use, and therefore process-mediated change, can be a solely self-directed phenomenon. Finally, Sutton questioned the processes as facilitators of stage movement, stating bluntly that there is "no strong evidence that using particular processes in particular stages promotes movement to subsequent stages, and hence little reason to expect stage-matched interventions that encourage the use of these processes to be particularly effective" (Sutton, 1996, p. 203). I will explore this criticism in more depth later in this thesis. It is important to note, at this point, that Sutton is the only researcher to raise this particular concern in the years that the model has been in use.

Davidson has offered general criticisms of the scientific underpinnings of the model. He expressed concern about the TTM's testability and falsifiability, but was unfortunately unspecific about how the model lacked these important features. He regards the model's structure as purely descriptive, a cataloguing of within-stage characteristics rather than testable hypotheses about the variables' interrelationships (Davidson, 1992).

Extending the criticisms of unfalsifiability and circularity, Smedslund (1997) proposed that the TTM contains *only* a priori propositions, or logical relationships that must necessarily exist between the model's elements by virtue of their definitions and meanings. He believes that the stages are logically guaranteed; smokers cannot quit smoking, for example, without first forming the intentions to do so. That those intentions must build from weak (precontemplation) to stronger (contemplation) and to stronger still (preparation) is also a necessary fact. Smedslund therefore regards not only the stages, but also their sequence, as invariant, and any departure from the sequence likely reflects procedural or measurement error.

Smedslund's criticisms of the stages have merit. The measurement of stage movement necessarily reflects choices about frequency of observation; if we observe a smoker "skipping" a stage, we must allow for the possibility that the smoker passed through that stage between observation points. We therefore cannot know what stages the smoker navigated, or with what frequency, in the interval between measurements.

Smedslund extended his charge of unfalsifiability to the processes-by-stages relationships. He argued that smokers within specific stages must necessarily use specific processes of change by virtue of the meanings of stage and process. Thus, for example, the finding that precontemplators use very few processes is not an empirical discovery, but a condition of membership in the precontemplation stage: everyone in precontemplation, by definition, intends not to change. In addition, contemplators must use the process of consciousness raising more than must those in other stages because contemplation is the stage in which consciousness requires raising. Those in action must necessarily use behavioural strategies, as their task is relapse-prevention.

Smedlund's criticisms are serious, but he has neglected parts of the model in his analysis. First, while he rightfully criticized the model for making predictions that seem unfalsifiable (for example, the prediction that people in the contemplation stage will use the consciousness raising process frequently), he incorrectly implied that *all* predictions that the model makes are unfalsifiable. He neglected to notice the processes of change that are less linked to stage, operationally, than is consciousness raising. For example, the process of environmental reevaluation does not seem to belong necessarily or "logically," to use

Smedslund's term, to any particular stage. Its use might be equally relevant to contemplators as to preparers as they both consider the effects of their smoking on others. It might be even more relevant to those in action as they begin to develop a personal appreciation of what it is like to be a nonsmoker among smokers. Second, although some relationships in the model may be more likely than others, as Smedslund noticed, this does not render them "unempirical." There remains sufficient variability in the model to permit the testing of hypotheses. For example, because a process is more likely to be used in one stage than another, this fact does not make the process a logical necessity for that stage. Contemplators are likely to use consciousness raising; however, a contemplator who quits smoking because an aggravated non-smoking spouse has threatened divorce may never have "raised" his or her consciousness at all. It is possible, although perhaps not strongly probable, for the decision to have been made from an emotional standpoint ("I want to save my marriage") rather than a cognitive one ("I have weighed the information and believe my smoking harms me"). In addition, although a process may more likely be used in one stage than another stage, this fact does not mean that those in others stages will not use this process productively. Logic does not require those in preparation to cease reading about the risks associated with smoking (a contemplator task); continued use of this process may even bolster their motivation to change within the month. Those in contemplation are not forbidden to use counterconditioning; although they are, by definition, not trying to *quit* smoking, they may be trying to cut back, a goal for which behavioural strategies would be relevant[8]. Thus, there is sufficient variability in process use by stage to warrant its examination empirically.

Most importantly, Smedslund's argument completely neglects the prescriptive side of the model. Prochaska and DiClemente established not only a descriptive, static account of process use by stage, but a prescriptive formula to show when smokers *should* use the processes to reap the most benefit. The integration of processes with the stages shown in Table 2 recommends, for example, that precontemplators use three specific cognitive

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[8] Reduction in smoking has received far less attention than quitting, but several researchers argue that it can be an important preliminary target for change, or a viable alternative for those who refuse to quit completely (e.g., Kozlowski, 1989). The associations between the stages of change and smoking reduction have never been

processes in order to progress. Which one of those three, if any, will actually help precontemplators? Will they help precontemplators more than contemplators or preparers? Will they be sufficient to prompt stage movement? All of these are empirical questions, not a priori relationships. We do not necessarily know the answers in advance. Smedslund has not convincingly removed the TTM from the domain of empirical inquiry.

Virtually no one has criticized the TTM with the use of data. One exception is a study by Farkas et al. that promised a comparison of the TTM with addiction models. However, their analysis offered only an examination of the shared variance between the stages of change and four addiction items capturing current smoking and past quit attempts (Farkas et al., 1996). When the stages and these addiction constructs were compared on their ability to predict future quit attempts in a multiple regression framework, the stages of change failed miserably. Although this initially appears to be a threatening result, it is important to observe that Farkas et al. did not actually study the *model*. They used a single variable, stage of change, to predict behaviour when the model offers other variables, much less confounded with behaviour, that are meant for that purpose. The TTM's structure suggests that stage is not intended as a predictor, but as framework for stratifying smokers into meaningful segments for analysis. It is perhaps unsurprising that Farkas et al. use stage as a predictor variable in light of the tendency for Prochaska et al. to use it in the same manner (e.g., DiClemente et al., 1991). The proponents of the TTM, in their apparent desire to demonstrate the usefulness of the model, may have contributed to others' confusion about its structure.

Farkas et al. did acknowledge that they had plucked one construct from the TTM and neglected the others. This was due entirely to their use of archival data from a population survey that featured only the items for stage and not for the remaining TTM variables. In acknowledging this limitation in their study, they offered the speculation that the model would have performed better "... if all 15 constructs were used simultaneously to predict cessation" (Farkas et al., p. 1278). However, it is fervently hoped that such an approach will not be considered as "model testing." Pedhazur cautioned researchers to appreciate the distinction

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examined; data demonstrating that this kind of change activity does occur in early stages of the TTM will be presented later in this thesis.

between the goals of prediction and explanation, and not to use purely predictive methods (such as stepwise regression) to analyze data meant to help explain or understand a phenomenon. Because "explanation is inconceivable without theory," (Pedhazur, 1982, p. 174) a theory must be used to guide the analysis of the relationships between the TTM variables and cessation activity. Fifteen variables lined up, vying for their share of variance in an outcome variable as Farkas et al. suggest, cannot yield a compelling empirical test of a theory. To be informative, a test of the TTM must respect its structure as theory, and test its hypothesized relationships. Farkas et al.'s paper, in its limited focus on one construct from the model (and perhaps the one least useful for predicting cessation meaningfully), does not offer a comparative model test for the TTM.

Prochaska and his colleagues have had the opportunity to respond to a limited number of these criticisms, and some of their reactions have been unreassuring. In response to Bandura's criticism of the stages as arbitrary and circular segmentations of continuous variables, Prochaska and Velicer responded that the stages were "empirically discovered in studies of how people were applying (the) processes..." (1997a, p. 11). However, no references were offered to identify these studies. Earlier, Prochaska et al. stated that the stages were "... discovered in research with smokers..." (Prochaska et al., 1992, pp. 1103). However, the source upon which this assertion was based (DiClemente & Prochaska, 1982) did not discuss the discovery of the stages, and offered only the statement that the stages emerged in an unspecified pilot study that was undertaken before this work[9]. The empirical foundation for the stages is thus completely unavailable for scrutiny. Whether or not the empirical foundation is sufficiently solid, the complaints of circularity and arbitrariness remain unaddressed by the developers of the model.

In response to Davidson's criticisms of the testability of the model, Prochaska et al. asserted that it *is* falsifiable but that attempts to refute it had always failed (Prochaska, Velicer, DiClemente & Rossi, 1992b). Again, however, Prochaska et al. do not provide any references

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[9] In any case, the stages studied in this paper bear minimal resemblance to the current set. The first three stages in the current model were represented in this paper by a single "decision" stage with no time frame, and the time frame for action and maintenance was two weeks rather than six months. If stages were discovered in this paper, they have since been completely revised.

to support this important claim. No empirical studies with the explicit goal of refuting the model were encountered in the literature review for this thesis.

A more effective rejoinder was Prochaska and Velicer's protest that both Bandura's critique and Farkas et al.'s competitive model test (1996) selectively focused on the stages while excluding the remaining variables in the model. As they aptly put it, "Stage is a variable; it is not a model" (Prochaska & Velicer, 1996). While Farkas et al. chose to use archival data from a study that assessed only the stage construct, it is not clear why Bandura failed to consider the model in its entirety. Prochaska and Velicer noted his neglect of the entire TTM literature, and wondered how a theory could be evaluated on a purely rational basis without regard for the empirical process. Criticisms of the TTM will not be complete, or persuasive, without a consideration of all of its components and their interrelationships, or without detailed attention paid to the literature on the TTM that has emerged over the past decade.

Others have also come to the model's defense. Heather (1992) argued that the lack of scientific grounding for the TTM would do public health no harm as long as practitioners were not hurting anyone while using it. Stockwell (1992) maintained that the precise details of the model do not matter very much, as its contributions lie in reminding practitioners that patients need to decide to change before they will change. Samuelson (1997) echoed this idea, stating that public health practitioners tend to embrace action-oriented intervention strategies and measure success by "bottom line" outcomes (like smoking cessation) rather than smaller, gradual changes. Of the Farkas et al. study, both Hughes (1996) and Shiffman (1996) bemoaned the practice of pitting models against each other without regard for the more interesting and useful question of their interrelatedness.

The diversity of reactions to the TTM poses a dilemma. Its developers intend it to be a breakthrough approach to behaviour change with strong scientific support; however, practitioners and even some researchers reduce it to a useful heuristic for thinking about recalcitrant patients. It is meant to be transtheoretical, pulling together competing theories with a meaningful eclecticism, yet some have branded it "atheoretical" (Davidson, 1992) and "deserving of burial" (Bandura, 1997b). What should we think about this model?

Building Confidence in the TTM: What is Needed?

Before evaluating the strength of the evidence for the TTM, it will be helpful to review the central claims of the model. The TTM provides a system for categorizing smokers into groups along a continuum of readiness – the five stages of change. The 10 processes of change are strategies that smokers can use to modify their thoughts, cognitions, and smoking behaviour. Smokers tend to use the processes differently across the stages, with some processes more relevant to certain stages than others. As a result, smokers in each stage can be characterized by their stage-specific patterns of process endorsement. In addition, the patterns of process use that are associated with each stage provide information about the interventions needed to help smokers move to the next stage. Specifically, smokers can be urged to use the processes of the stage ahead, and to relinquish the processes of their current stage. Because each stage has a unique pattern of process use, the interventions are also unique, or stage-matched. It is not simply that we should educate smokers to use the processes; instead, we should direct them toward the processes that are most appropriate for their stage of change. Matching process-based interventions to a smoker's stage will produce superior results than will non-targeted or stage-mismatched interventions[10].

What are the key questions that must be answered in order to build confidence in these claims? Should one begin at the core of the model and investigate the validity of the stages of change? Bandura and others have convincingly argued that the stages are not "empirical" (Bandura, 1997a; Sutton, 1996; Smedslund, 1997). In spite of this, over the past decade the stages have attained a strong degree of acceptance; they have become part of the language of health communication and intervention in both scientific and applied spheres. Therefore, it may be less useful to strike out in search of a better set of stages than it is to examine the claims made for the current set.

The central claims outlined above lend themselves to two empirically testable questions. First, are the processes used differentially across the stages, with the processes receiving emphasis in certain stages but not in others? Support for this claim of cross-sectional

stage-specificity could come from the TTM work that has compared the stages on their patterns of process use. Second, do the processes of change, when matched to stage, lead to greater change than do mismatched or undirected efforts? Prochaska et al. claim stage-specificity here as well: that the processes of change will assist movement through the stages *if* smokers apply them in a stage-matched manner. An experimental framework would be best for addressing this important causal claim, although longitudinal correlational studies would also be appropriate.

How well does the TTM literature address these two questions? A brief review of the relevant work will provide a current reading of the success of the model in these areas. The support for the model's cross-sectional, descriptive claims will be considered first, followed by a review of the studies investigating the processes' longitudinal, predictive functioning.

The TTM and Smoking Cessation – A Review of the Literature

Is There Stage-specificity in Smokers' Use of the Processes of Change?

Prochaska and his colleagues have stated that there is stage-specificity in smokers' use of the processes of change; that is, that smokers in different stages will endorse the processes differently. This is a purely descriptive, cross-sectional assertion that is distinct from the longitudinal assertion that there is stage-specificity in the processes' predictive power. The following section will trace the development of, and the support for, the cross-sectional stage-specificity hypothesis in the TTM literature.

An important feature of the TTM literature to keep in mind while reviewing these studies is that Prochaska and his colleagues studied different sets of stages at different times in the developmental history of the model. Although only the "current" rendering of the stages concept was described above, there have been two versions of the stages through the model's history. The existence of these two broad categories, shown in Table 3, has implications for

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[10] This summary of the TTM's core concepts does not include decisional balance and self-efficacy. As detailed earlier, the developers of the TTM omitted these variables from their recent review of their model, and have failed to provide sufficiently clear structural statements regarding the roles of these variables in the model.

the generalizability of the earlier literature to the model as it is depicted currently. The limitations of this issue will be discussed as they arise.

Table 3

Phases In The Development Of The TTM Literature

Earlier Phase (1981 – 1991)		Current Phase (1991 - 1996)	
Stages	Definition/Time Frame	Stages	Definition/Time Frame
Immotive	not considering change within one year	Precontemplation	not considering change within six months
Contemplation	considering change within one year	Contemplation	considering change within six months
Short-Term Quitter/Action	quit for 6 months	Preparation	considering change within 30 days; had previous quit attempt within past year
Long-Term Quitter/Maintenance	quit for more than 6 months	Action	quit for six months
Relapse	resumed smoking after having quit in past year	Maintenance	quit for more than six months

Table 4 offers a summary of studies investigating cross-sectional relationships between the stages and processes[11]. Several of the earlier works listed in this table included the relapse stage. Specific results for that stage are not included here, in part due to the difficulties involved in the interpretation of findings for that stage, as will be discussed later. The proponents of the TTM have omitted the relapse stage in their research since approximately 1992.

[11] Several works by researchers outside of the model's developmental circle have been omitted from this summary because of substantive changes made to the components of the model. These omitted studies include Gottlieb, Galavotti, McCuan & McAlister, 1990; Biener & Abrams, 1991; Owen, Wakefield, Roberts & Esterman, 1992; Ahijevych & Wewers, 1992; Rohren et al., 1994; Dijkstra, Devries & Bakker, 1996. In most cases, researchers altered the meaning or measurement of these constructs to suit an applied setting. This tailoring, while appropriate for context-specific applications, renders these studies ungeneralizeable to the remainder of the literature. In addition, Prochaska, Crimi, Lapsanski, Martel and Reid (1982) was omitted because its processes of change represent a very early conceptualization that does not generalize to the current model. It is not the goal of this literature review to trace the developmental history of the processes, but rather to investigate the evidence for the current model's claims; thus this paper was omitted from the review.

Table 4

Studies Investigating Stage Differences on the Use of Processes of Change

Study	Stages	Stage Differences			
DiClemente & Prochaska, 1982.	D[a] / A / M	Verbal[b]: D > A, M Behavioural: D < A, M			
Prochaska & DiClemente, 1983.	PC / C / A / M	Cognitive/Experiential		Behavioural	
		CR:	PC < A, M < C	SL:	PC < C < A, M
		ER:	PC < C, A, M	CC:	PC < C < A, M
		SR:	PC < M < C, A	SC:	PC < C < A, M
		SO:	A < PC, C, M	RM:	PC < C, M < A
		DR:	unexamined	HR:	PC, C, M < A
DiClemente et al., 1991	PC / C / PREP	Cognitive/Experiential		Behavioural	
		CR:	PC < C < PREP	SL:	PC < C < PREP
		ER:	PC < C < PREP	CC:	PC < C < PREP
		SR:	PC < C < PREP	SC:	PC < C < PREP
		SO:	n.s.	RM:	PC < C < PREP
		DR:	PC < C < PREP	HR:	PC < C, PREP
Fava, Velicer & Prochaska, 1995.	PC / C / PREP	Cognitive/Experiential		Behavioural	
		CR:	PC < C < PREP	SL:	PC < C < PREP
		ER:	PC < C < PREP	CC:	PC < C < PREP
		SR:	PC < C < PREP	SC:	PC < C < PREP
		SO:	PC < C, PREP	RM:	PC < C < PREP
		DR:	PC < C < PREP	HR:	PC < C < PREP

Note. PC = Precontemplation; C = Contemplation; PREP = Preparation; A = Action; M = Maintenance. The full names of the processes of change are indicated with their abbreviations in Table 1. Stages that are separated from each other by < or > are significantly different at $p < .05$.

[a] This "decision to change" stage did not include a time limit for the decision, but it is roughly analogous to the contemplation stage. [b] These "verbal" processes are analogous to the cognitive/experiential processes.

The earliest work of Prochaska and his colleagues reflects their strategy of linking processes with particular stages of change. In a study of 63 former smokers, DiClemente and Prochaska gathered retrospective accounts of the use of 10 processes of change during three stages of change. These stages included a "decision to quit" period that preceded the quit attempt, an "action" stage that encompassed the two weeks after the quit attempt, and a "maintenance" stage that began after two weeks of cessation (DiClemente & Prochaska, 1982). DiClemente et al. used a 30-item "Change-Process Questionnaire" which has little overlap with the current scale as indicated by a table of sample items. Psychometric data for the scale were not reported.

DiClemente et al. reported that verbal (cognitive) processes were more important during the decision stage, and behavioural processes were more important during action and maintenance. Despite the circularity of this finding[12], Prochaska and DiClemente had begun to explore the level of specificity or differentiation that might be found in the processes' relationships with the stages. An isolated finding that would emerge more consistently in their later work was the observation that the process of self-liberation was strongly favoured in the action stage. This study of three stages and ten processes was limited by a small sample, but provided preliminary evidence that process use might differ according to the stage of change of the individual.

In the following year, Prochaska and DiClemente (1983) reported on the process use of 872 smokers. With this study, they began using the earlier stage algorithm that they would use through the 1980's. Thus, precontemplators were defined as having no intentions to change within the year, whereas contemplators did endorse such intentions. Action and maintenance were defined as they are currently, with a 6-month cut-off for the transition from action to

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[12] It seems obvious that behavioural processes would be more relevant to the stages in which behaviour change has occurred – action and maintenance – than to the early stages prior to the decision to change. Correspondingly, the cognitive processes would logically pertain more to the "deciding" stages than to the stages *beyond* the point of behaviour change.

maintenance (see Table 3). This paper marked the emergence of the current measure of the processes of change, referred to earlier in Table 1[13].

Prochaska and DiClemente hypothesized that the ten processes of change should "receive differential emphases during particular stages of change" (Prochaska & DiClemente, 1983, p. 390). Specifically, they expected that precontemplators would use all of the processes less than those in the other stages, and that contemplators would show the strongest use of consciousness raising. In addition, they hypothesized that self-reevaluation would be emphasized most in contemplation and action, with this process acting as a "bridge" between these two stages[14]. Finally, they expected that the behavioural processes of self-liberation, counterconditioning, stimulus control, and reinforcement management would characterize the activities of the action stage. Prochaska and DiClemente indicated that their past research did not suggest specific predictions for the maintenance stage. They did not offer predictions for the use of the processes of dramatic relief, environmental reevaluation, helping relationships, or social liberation.

As Table 4 shows, Prochaska and DiClemente obtained support for each of their hypotheses. However, some of these hypotheses warrant Smedslund's accusation of circularity (Smedslund, 1997). Specifically, Prochaska et al. predicted that smokers who were not thinking about quitting would not use many change processes. They predicted that those interested in quitting would demonstrate information-gathering behaviour, and they predicted that those who had recently quit would be using behavioural management strategies. The systematic fit observed between these processes and stages offers a degree of construct and measurement validation, but does not yet indicate a newly-discovered empirical relationship among variables that are conceptually distinct and free to vary.

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[13] From this point forward in their research, the TTM researchers consistently measured the processes of change with this 40-item scale, or with a 20-item short-form scale (Fava et al., 1991).

[14] This hypothesis is somewhat inconsistent with the reasoning used later in Prochaska et al.'s integration of the stages and processes (Prochaska et al., 1992). By their later logic, if this process is a bridge (or a transition mechanism) between contemplation and action, cross-sectionally we should see it emphasized *most* by those in action, and used only by those contemplators who are ultimately successful in moving into action. Given that most contemplators stagnate in contemplation for at least a year (DiClemente & Prochaska, 1985), the finding that self-reevaluation is emphasized in contemplation would suggest that it is associated with stagnation rather than advancement – a finding that would clearly contradict the notion of this process as a bridge.

It was argued earlier that there *are* possible process-by-stage relationships that are not as conceptually related to stage. In this study, Prochaska and DiClemente spent very little time attending to these relationships, and failed to discuss three of their ten processes at all. Social liberation, environmental reevaluation, and dramatic relief received no attention in contrast with the relationships that were more circular. Attention to the findings for these processes is important, particularly as environmental reevaluation and social liberation were each found to characterize more than just one stage. This pattern appears to violate the model's specificity hypothesis, but it is not discussed. The lack of attention paid to these issues leaves a gap in our understanding of the model.

Finally, it is important to note that the generalizability of this study to the current model is compromised by the differences in the nature and measurement of the stages. In this early study, the preparation stage is absent, the relapse stage is present, and the stages of precontemplation and contemplation featured one-year rather than six-month time boundaries. Only the action and maintenance stages are identical to those in the current model.

Almost a decade later, DiClemente et al. (1991) investigated the processes of change in relation to the first three of the current set of stages – precontemplation, contemplation, and preparation. Over 1400 smokers were assessed. Of the processes, DiClemente et al. offered vague expectations, stating that "significant differences across stages are hypothesized for ... process activity" (p. 296). It is surprising that their hypothesis did not offer speculations on the nature of these "significant differences." Their reticence to be more specific may have resulted from their lack of previous work with this set of stages.

The pattern of findings in DiClemente et al., shown in Table 4, is startling. For 80% of the processes, the results suggested that process use simply increases in frequency across the first three stages, with precontemplators using processes the least, those in preparation using them the most, and contemplators falling somewhere in between. This pattern of results sharply contradicts one of the central premises of the TTM: that smokers in different stages use *different* processes.

This surprising pattern of results also emerged four years later. Process-by-stage relationships were explored on a much larger scale in Fava et al.'s comprehensive study of a representative sample of over 4,000 smokers (1995). Using the current version of the stage

construct, and the 20-item short-form of the Processes of Change Scale, Fava et al. again observed this pattern of process use increasing across the stages, as can be seen in Table 4. For 90% of the processes, it was observed that preparers endorsed the processes more strongly than did contemplators, who, in turn, endorsed them more strongly than did precontemplators. Fava et al. termed this pattern of findings the "general ordering pattern" (p. 190).

How could such findings possibly support the model? Before considering the interpretations of these findings offered by DiClemente et al. and Fava et al., it is important to consider what the findings *should* look like. What kind of data could support the claim that the stages differ on the nature of the processes that they use? In the sections that follow, I will use the findings obtained by DiClemente et al. and Fava et al. to illustrate how different patterns of results could provide varying degrees of support for the concept of specificity of the processes to the stages.

What Kind Of Data Would Support Cross-Sectional Specificity?

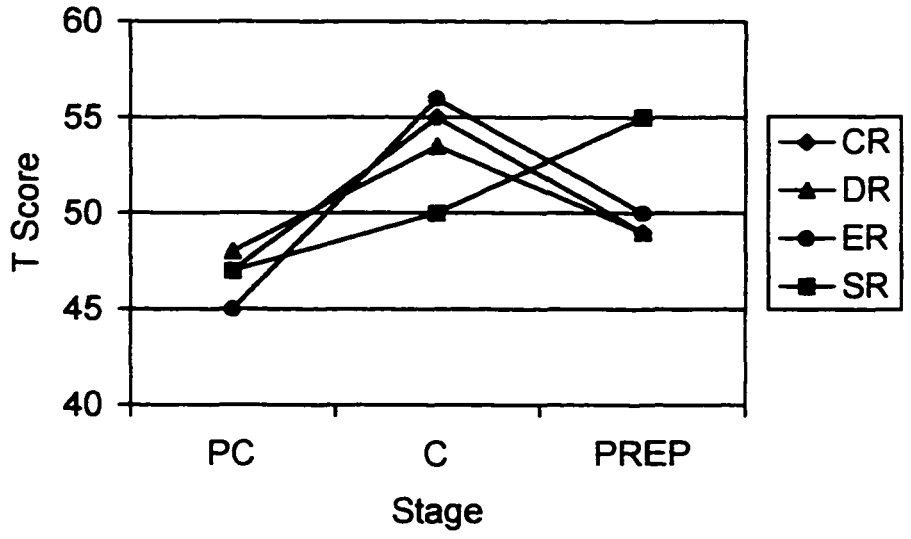
The statement that smokers in different stages use different processes implies that *each stage exceed the others on the use of at least one of the processes*[15]. Unless this were true, no *qualitative* differences would exist among the stages. What would such a finding look like? The specificity of processes to stages that is hypothesized in Prochaska et al.'s integration will be used for illustration.

If contemplators should be most "open to" (i.e., most likely to use) consciousness raising, dramatic relief, and environmental reevaluation (Prochaska et al., 1992, p. 1109), then the data should show that contemplators endorse these three processes more strongly than they do the remaining processes (a within-stage comparison), and more strongly than do either precontemplators or preparers (a between-stage comparison). In addition, if preparers should use self-reevaluation the most, then the data should show that smokers in preparation endorse this process more strongly than they do the others (a within-stage comparison), and more strongly than do smokers in contemplation and precontemplation (a between-stage comparison).

The within-stage comparison is important. The logic of stage-specificity demands that smokers in one stage be distinguished from those in another stage on a *subset* of the processes. If they were distinguished on their use of *all* of the processes, then the stage differences would be predominantly quantitative, with minimal or non-existent qualitative distinctions possible. It follows, therefore, that smokers in the stage of interest will use this subset of processes to a significantly greater degree than they do the remaining processes. Only in this regard could this subset of processes "stand out" as characteristic of that stage in relation to other stages.

These relationships are shown in Figure 1. Hypothetical data are used to illustrate the differentiated relationship between stage and process that Prochaska and his colleagues have hypothesized in their integration in Table 2. The pattern shown in Figure 1 is not the *only* pattern that could support the claim of strong stage-specificity, of course; it is merely the one offered in Prochaska et al.'s integration. For clarity, only the four processes that the integration indicates are relevant to the first three stages are shown on this graph[16].

Figure 1. Processes of Change by Stage: Hypothetical Data Illustrating Stage-specificity.



[15] The precontemplation stage is obviously an exception; this stage is characterized by its low endorsement of the processes rather than by unique patterns of process use.

As Figure 1 shows, the three processes that the integration suggests are characteristic of contemplators (i.e., CR: consciousness raising; DR: dramatic relief; and ER: environmental reevaluation) are endorsed to a greater extent by contemplators than by precontemplators or preparers. In addition, specificity also demands that contemplators endorse these three processes to a stronger degree than they do the remaining processes. In Figure 1, although only four of the ten processes are shown, contemplators' use of the three processes clearly exceeds their endorsement of the remaining process (i.e., SR: self-reevaluation).

Figure 1 also shows that the single process that the integration suggests is characteristic of preparers (i.e., SR: self-reevaluation) was endorsed to a greater extent by preparers than by precontemplators or contemplators. In addition, specificity also demands that preparers endorse this process to a stronger degree than they do the remaining processes. In Figure 1, preparers' use of self-reevaluation clearly exceeds their endorsement of the remaining processes.

Finally, as the integration specifies, Figure 1 shows precontemplators demonstrating the lowest levels of process use of all the stages.

As can be seen from the graph, stage-specificity of the processes demands a disordinal or cross-over interaction that shows, with the logical exception of precontemplation, that each stage exceeds the other stages on at least one process[17]. How would such an effect be tested? Clearly, an analytic method that could detect and test the presence of an interaction is necessary. Analysis of variance techniques would be well-suited to this goal. In particular, because there are numerous processes of change that should vary by stage, and because the processes are "within subject" (i.e., each process can be used by every smoker), then an analysis of variance technique that can address multiple within-subject dependent variables

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[16] Although omitted here for clarity, the remaining six processes do have an implicit place on this graph. The integration is clear that those six processes are not considered characteristic of the activities of the first three stages. On the graph, therefore, they would be shown as receiving very low endorsement across these stages.

[17] The slopes and the differences between processes within a stage could certainly take different values than those shown here. The integration does not specify how the processes that "belong" to a stage should relate to each other within that stage. In other words, the integration states only that contemplators, for example, will use their three processes more than they will the others; it does not offer speculation regarding how the three processes that characterize contemplation will vary in relation to each other.

and one independent or grouping variable (stage) would be required. The MANOVA method for analyzing repeated-measures designs will be presented in detail later in this thesis; at this point, it is sufficient to establish that interactions between process and stage are the effect of interest in a test of the TTM hypotheses pertaining to stage-specificity of the processes.

... and Have The TTM Researchers Found It?

The relationships among stages and processes that were obtained by DiClemente et al. (1992) are shown in Figure 2, and those of Fava et al. (1995) are shown in Figure 3. Again, the data in these figures are restricted, for clarity, to the four cognitive processes shown in the integration.

Figure 2. Processes of Change by Stage: Relationships from DiClemente et al., 1991.

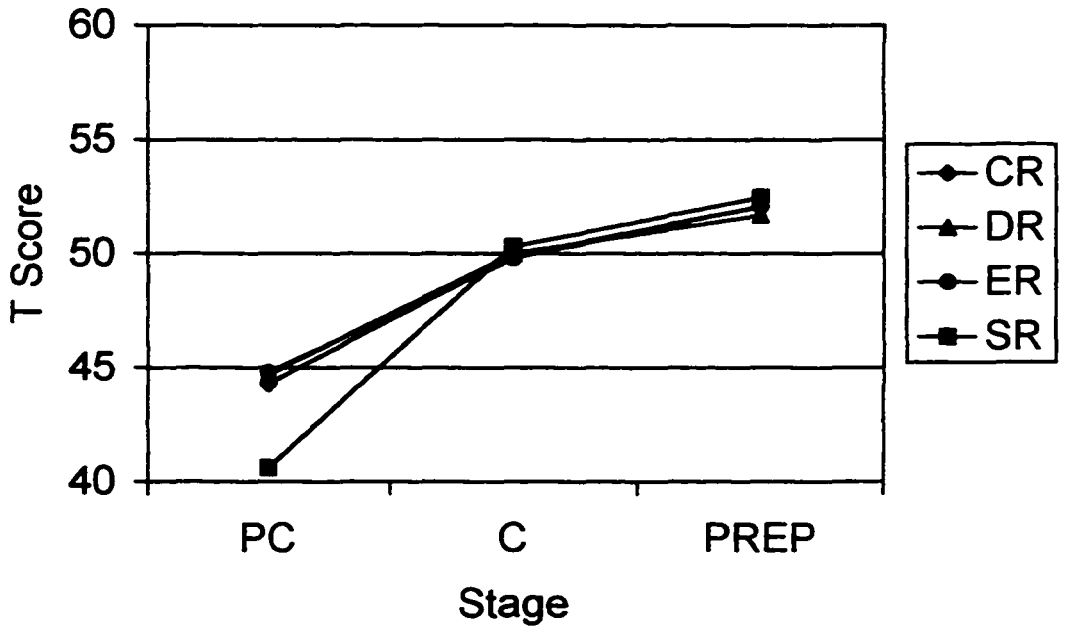
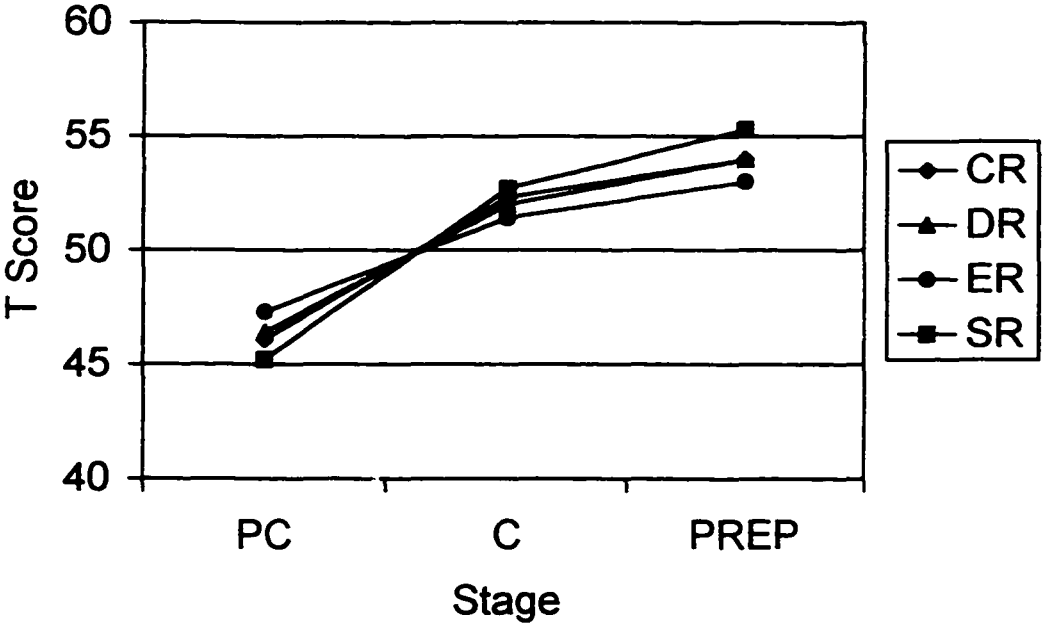


Figure 3. Processes of Change by Stage: Relationships from Fava et al., 1995.



Immediately apparent are the strong differences between these findings and the pattern illustrated in Figure 1. In both cases, none of the processes of change received more emphasis by contemplators than by preparers[18]. This finding strongly contradicts the integration, which shows contemplators as distinguished by their use of consciousness raising, dramatic relief, and environmental reevaluation in relation to the other stages. In addition, not only did contemplators *not* use these processes more than did preparers, but also they appear to have used all four processes to an equal degree[19].

The findings are equally disappointing for the preparation stage. Although preparers did use self-reevaluation more than did smokers in the other stages, the within-stage aspect of the hypothesis was not supported. The above figures and the findings in Table 4 showed that preparers used not just self-reevaluation, but virtually *all* of the processes more than did those in precontemplation and contemplation. Finally, although precontemplators were observed to use the processes less than did smokers in the remaining two stages, this finding is secondary

[18] The results for the remaining six processes can be seen in Table 4.

[19] Notably, this within-stage effect was not tested in either of these two studies. Therefore, the assumption that contemplators did not differ on their use of these processes is based only upon an examination of the figures.

in importance to the others; that is, the nature of the precontemplation stage is such that its patterns of process endorsement cannot speak either for or against the notion of specificity.

Thus, instead of *different* processes, what characterized the stages was their *level* of overall process activity, with smokers in successive stages demonstrating increasing use of almost all of the processes. Counter to what the integration and the concept of stage-specificity demand, these stage differences were primarily quantitative rather than qualitative.

Even though the findings of DiClemente et al. and Fava et al. did not support the model, it is puzzling that these researchers did not even examine their data for interactions. Instead, they tested only the between-stage differences on the 10 processes of change, summarizing their findings with post-hoc, between-stage comparisons analyzed by the Tukey procedure, as shown in the "Stage Differences" column in Table 4. As noted above, there are both between-stage *and* within-stage effects that need to be considered in order to fully test the specificity hypothesis. The lack of work directly targeting these relationships leaves us with an incomplete understanding of the process-by-stage relationships.

In addition, the analytic approach employed by the TTM researchers not only fails to test the claims of the model, but also it can lead to misleading conclusions when the results are considered only one process at a time. For example, in their integration, Prochaska and his colleagues hypothesize that the preparation stage will be distinguished from the other stages by its use of self-reevaluation. DiClemente et al. indeed demonstrated that preparers used self-reevaluation more than did contemplators or precontemplators. However, as evident from the findings summarized in Table 4, preparers also exceeded the other two stages on the use of almost every other process. In other words, while the use of self-reevaluation did distinguish preparers from the others, it did not *uniquely* distinguish them. To isolate self-reevaluation or any subset of processes in this data set as descriptive of the preparation stage would be highly misleading.

Yet it is exactly this type of misleading interpretation that appears in DiClemente et al.'s analysis of their own findings. For example, they interpreted the findings for contemplators as supporting the idea that smokers in this stage were "gathering information and evaluating their smoking habit." Although contemplators did perform those tasks through

their use of consciousness raising and self-reevaluation, such a conclusion implies that these tasks were characteristic of contemplators as compared to other stages – an assumption clearly contradicted by the fact that those in preparation used these processes significantly *more* than did contemplators (see again Figure 2). In addition, DiClemente et al. stated that the process use pattern observed for the preparation stage supported the notion that these smokers were "actively modifying their smoking habit" (p. 299). Although preparers may need to modify (in this case, reduce) their smoking, the concept of stage-specificity requires that only *some* of the processes be important to preparers in this task, not all of them. These conclusions imply a level of stage-specificity that was simply not present in these data. Rather surprisingly, DiClemente et al. (1991) stated that their results "overwhelmingly support the... Stage × Processes of Change *interactions*" (p. 301, italics added). DiClemente et al. reported no ANOVA interaction tests, and the interaction effects to which they referred were neither described nor explained. It is therefore not clear what was meant by this rather cryptic conclusion.

How did Fava et al. make sense of their findings? Like DiClemente et al., they cited them as supportive of the model, stating that there were "very clear and distinct patterned differences among the stages" (p. 197). There were indeed clear and distinct differences among the stages; however, these differences did not support the claim that smokers in different stages using different processes. In a very surprising turn, Fava et al. attempted to integrate these findings with the structure of the model by suggesting that the general ordering pattern has been characteristic of the process-by-stage relationships throughout the TTM literature. They stated that past research with the TTM has established a pattern of "... general ordering for use of the Processes of Change with subjects in Precontemplation making least use of them, those in preparation using them the most, while subjects in Contemplation are intermediate in their use of the Processes of Change" (p. 190).

First, a general ordering pattern has not been obtained in all past research, as the above statement implies; of the three cross-sectional studies reviewed here, Prochaska and DiClemente (1983) encountered a somewhat different pattern of results. Second, regardless of the history of a general ordering pattern in the TTM research, the desire to obtain support for such a pattern would resoundingly defeat the purposes of the model. Nowhere in the TTM

literature has there been the expectation that the processes, as an undifferentiated set, simply receive increased use across the stages. If this were so, the concept of stage-matching of treatments would need to be abandoned. It is baffling that the TTM's developers would now favour the general ordering pattern of results for the model.

Why might the TTM researchers have found this pattern of general ordering of processes? Smokers are assigned to stages based on a measure of current cognitive and behavioural activity. Five groupings of individuals that range from those "doing nothing and planning nothing" to those who are actively maintaining change will demonstrate, by definition, increasing activity of some kind along that continuum. It is unfortunate for the model that this pattern of increasing activity appears to apply equally well to all 10 of the processes. Perhaps smokers' use of the processes is not as stage-specific as theorized.

The available data have failed to support Prochaska et al.'s hypotheses for cross-sectional stage-specificity. Smokers in different stages appeared to differ more on their level of endorsement of the processes than on the nature of that endorsement. Does this mean that there is *no* specificity of processes to stages? A continuum of specificity, varying from primarily non-specific or quantitative distinctions to primarily specific or qualitative distinctions was discussed earlier (please refer back to page 10). The possibility of support for a weaker degree of specificity is considered in the next section.

Is a Weaker Degree of Cross-Sectional Specificity Present?

It was noted earlier that differing degrees of stage-specificity could be possible in an integration of the processes with the stages. Prochaska and his colleagues have suggested that a strong degree of cross-sectional stage-specificity exists in their model, with smokers in each stage presumed to endorse different sets of processes in comparison to the other stages. As discussed earlier, a strong degree of specificity is necessary in order to invoke the concept of stage-matching. Prochaska et al.'s integration in Table 2 demonstrates this specificity, showing smokers in each stage endorsing a unique set of processes in comparison to the other stages. However, it is clear from this review of the TTM literature that data are not available that could support this strong level of specificity. Weaker levels of specificity are certainly possible. Although they would clearly fail to support the claims of the model, they might provide *partial* support for the stage-specificity concept.

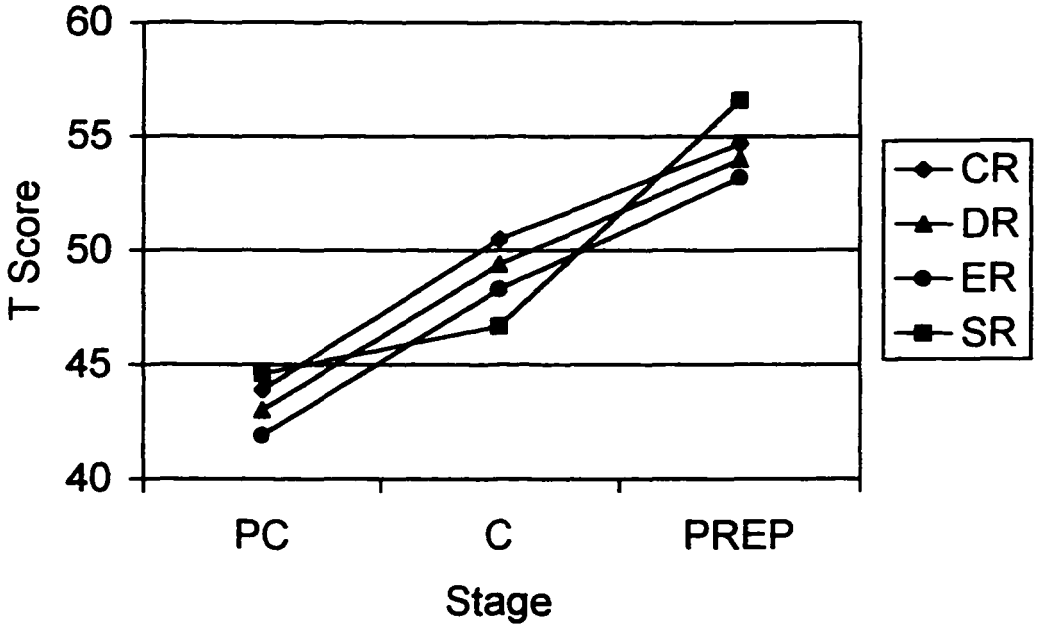
Past studies on the TTM have suggested a tendency for smokers across the stages to endorse all of the processes to increasing degrees; in other words, the stage differences are predominantly quantitative. However, this main effect of stage *may* be accompanied by minor qualitative differences – i.e., an interaction – whose means suggest a weak trend toward specificity.

Consider the following: even if contemplators were to exceed precontemplators on *all* of the processes (a strong main effect of stage), they might exceed them *most* on the three processes presumed to characterize contemplators (an interaction between process and stage). Correspondingly, even if preparers were to exceed contemplators and precontemplators on all of the processes, they might exceed them *most* on the one process presumed to characterize preparers.

This hypothetical pattern of findings is illustrated in Figure 4. As can be seen in this graph, contemplators are distinguished from precontemplators by their endorsement of all of the processes, but particularly so by their endorsement of the three "contemplation" processes, consciousness raising, dramatic relief, and environmental reevaluation. Preparers are distinguished from the earlier two stages by their endorsement of all of the processes, but particularly so by their endorsement of the "preparation" process, self-reevaluation.

It is evident from this figure, and from the descriptions of these effects provided above, that qualitative comparisons could only be made *downward*, from one stage to a stage earlier in the continuum. This is due to the "general ordering pattern." Because contemplators have not exceeded preparers on any process, there can be no qualitative distinctions to be made when comparing contemplators to preparers. Contemplators are best compared to preparers along quantitative lines – i.e., they used the processes less than did preparers. (Regarding the pattern shown in Figure 4, it would hardly be a qualitative distinction to say that "Contemplators used the processes less than did preparers, but used the process of self-reevaluation *particularly* less." Thus, qualitative comparisons "upward" from contemplation are clearly not tenable.)

Figure 4. Processes of Change by Stage: Weaker Support for Specificity.



Contemplators could, however, be characterized by the nature of their process use relative to precontemplators. It is clear from this figure that, while contemplators used the processes to a greater degree than did precontemplators, they were particularly characterized by their use of consciousness raising, dramatic relief, and environmental reevaluation.

In summary, this weaker degree of stage-specificity suggests that, while the stage differences on the processes are primarily quantitative, there can be a small degree of qualitative differentiation present as well. It must be acknowledged, however, that this weaker form of specificity is *far* less compelling theoretically than the stronger form, and would be of limited utility to practitioners wishing to target their interventions to stage. However, it remains worthy of examination in order to fully explicate the nature of the process-to-stage relationships.

Do the findings from the TTM literature offer support for this weaker type of specificity? The findings of DiClemente et al. (1991) were shown earlier in Figure 2, and those of Fava et al. (1995) were shown in Figure 3. They are somewhat difficult to interpret because they were not analyzed in a manner that would fully illuminate these relationships. The findings in Figure 3 do suggest that larger differences might exist between the preparation

stage and the other stages on the use of self-reevaluation as opposed to the other processes; however, this effect was not tested. It was noted earlier that nowhere in the TTM literature has there been an explicit examination of the nature of the interactions that emerged between process and stage. The favoured approach of examining only between-stage effects cannot address such questions. The degree to which these studies provide weaker support for process-to-stage-specificity is therefore unknown.

Conclusions

Although Prochaska and DiClemente initially found some evidence for differentiated process-by-stage relationships in their work with the early set of stages (Prochaska & DiClemente, 1983), more recent work with the current set of stages has completely failed to support the notion of stage-specific relationships (DiClemente et al., 1991; Fava et al., 1995). These latter two studies both showed the "general ordering" pattern, to use Fava's term, of all of the processes increasing in use across the stages from precontemplation to preparation[20]. Regardless, the findings for the current model are the more consequential, as the previous set of stages is no longer used.

In view of the lack of support for strong qualitative specificity, it appears that only weak specificity of the processes to the stages is likely. In some ways, the lack of strong specificity is not surprising; the demand for a unique correspondence of processes to stages places quite a burden on the model. Regardless, the claims for specificity, weak or strong, have not been tested properly in the TTM literature to date. Prochaska and his colleagues have favoured the use of one-way ANOVAs to examine stage differences on each process individually. However, the rather complex task of identifying qualitatively different patterns of endorsement of ten processes across three stages demands a more sophisticated analytic approach, as will be demonstrated later in this thesis.

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[20] It should be noted that no study has investigated all five of the current-model stages together. Thus, information about action and maintenance (stages that did not change across the two versions of the stage model) must be generalized where possible from the earlier works. Still missing is an understanding of how these two stages might differ from preparation.

In addition to specificity on a cross-sectional, descriptive level, Prochaska and his colleagues also regard their model as having process-by-stage-specificity on a longitudinal, predictive level. While cross-sectional specificity pertains to the nature of the process-by-stage relationships that occur naturally, longitudinal specificity concerns itself with the processes that will be most helpful to smokers in each stage of change. The model assumes that smokers in each stage must use *different* sets of processes – those matched to their stage – in order to maximize their outcomes (Prochaska et al., 1992). Although the data so far have failed to support the cross-sectional claim of specificity, it may be that there is specificity in the extent to which the processes can predict change over time. In other words, unaided, smokers might simply use "more of anything" as they move through the stages; however, from an intervention standpoint, they might benefit the most from a stage-matched strategy that encourages them to use some processes and abandon others. The evidence for this possibility is reviewed in the next section.

Is there Stage-specificity in the Processes as Predictors of Change?

Practitioners have been urged to understand that success in smoking cessation depends upon "what you do and when you do it" (Prochaska & Goldstein, 1991). As Prochaska and DiClemente put it, "Once it is clear what stage of change a client is in, the therapist would know which processes to apply in order to help the client progress to the next stage of change" (Prochaska & DiClemente, 1986, p. 8). A strong degree of stage-specificity for the processes' longitudinal, predictive functioning has been proposed. As concerns about the appropriate analytic strategy were paramount in the review of the cross-sectional findings, this important topic will be considered here as well. How should predictive specificity be sought?

What Kind of Data Would Support Longitudinal Specificity?

The identification of the processes' effects on stage movement or other outcomes requires, at a minimum, that researchers measure process use and outcome at two points in time. Longitudinal correlational designs and longitudinal experimental designs are therefore best, although experimental paradigms are clearly better than correlational ones for studying causal questions.

Correlational studies following smokers' change efforts over time would be able to support the model by documenting the eventual success of smokers who naturally make more use, at a baseline measure, of stage-matched processes and less use of the mismatched ones. Hierarchical regression techniques would be ideally suited for this type of analysis. Specifically, stage-by-stage regressions could be employed to test the degree to which sets of processes out-performed others in the prediction of outcome. For example, the integration indicates that three processes (consciousness raising, dramatic relief, and environmental reevaluation) should help precontemplators more than should the remaining processes. These "matched" processes should be observed to account for a significant proportion of variance in the outcome as compared to the "mismatched" processes. The test of the increment in the variance explained by sets of variables that a hierarchical regression framework can provide would be highly appropriate for examining this claim. Although unable to establish causal relationships, such an approach could offer correlational, predictive support for the model's longitudinal claims about the differential functioning of processes by stage.

Experimental evidence from an intervention study would be the strongest source of support for the causal effects of the processes. If stage-specificity exists, then smokers randomly assigned to a treatment that facilitates the use of stage-matched processes should demonstrate greater change than smokers in both a no-treatment control condition, and in a stage-mismatched treatment condition. A no-treatment control group alone would be insufficient for testing the claims of stage-specificity. The required comparison for the effect of process-to-stage matching is the effect of process-to stage *mismatching*.

... and Have The TTM Researchers Found It?

TTM studies attempting to identify the stage-based effects of the processes are summarized here. Both correlational and experimental studies are included. Two intervention studies have been omitted from this summary, because one (Goldberg et al., 1994) failed to make sufficient use of the processes of change in the intervention, and the other (Pallonen et al., 1994) failed to provide a reasonable control group for the protection of internal validity.

Longitudinal correlational studies. Prochaska and his colleagues examined the 10 processes of change, the pros and cons, self-efficacy, and temptation as predictors of stage

movement over a 6-month period (Prochaska et al., 1985). This study was based upon the early-phase set of stages, as described earlier in Table 3, and thus includes relapse and excludes preparation. For each stage, baseline scores on these 14 predictor variables were used to discriminate among smokers who advanced a stage, stagnated within a stage, and regressed a stage by the follow-up.

Among smokers who were in the contemplation stage at Time 1, those who advanced tended to have high baseline scores on the cons and on self-reevaluation, and low scores on consciousness raising compared to those who regressed. In addition, a discriminant function that distinguished contemplators who advanced from those who stayed in contemplation indicated that a high baseline self-efficacy score and a low score on pros and self-reevaluation were predictive of progression. Although the self-efficacy and decisional balance constructs behaved as one would expect, it is puzzling that self-reevaluation would have different effects depending upon the comparison group.

Among smokers in the action stage at Time 1, a low score in self-reevaluation and a high score on self-efficacy and helping relationships most strongly predicted advancement versus regression. The negative effect is interesting: those recent quitters who moved on to become long-term quitters were *less* likely to be reevaluating their quitting behaviour while in the action stage than those who eventually relapsed and regressed to an earlier stage. This finding suggests that continued questioning of oneself *after* having quit is a risky behaviour, while the absence of such questioning is predictive of continued success. This is an excellent example of predictive stage-specificity in the model, as self-reevaluation was found to be helpful for one stage (contemplation) but detrimental for another (action).

Because of the small sample size, Prochaska et al. collapsed the comparison group for Time 1 precontemplators; precontemplators who stagnated within that stage were compared to smokers who advanced *in some way*. The comparison group therefore included contemplators, relapsers, and those who moved into action. Precontemplators who advanced were characterized by high scores on self-reevaluation, a higher endorsement of the cons of smoking, a lower endorsement of the pros, and low scores on social liberation. The latter finding is interesting: the *less* precontemplators noticed the environment changing to support non-smokers, the better. Although Prochaska et al. did not speculate about this finding,

perhaps smokers in early stages experience social liberation as irritating rather than supportive. This is an additional example of stage-specificity that bears scrutiny.

Discriminant functions were also computed for smokers who were in the relapse stage at baseline. However, the interpretability of findings for those moving into or out of the relapse stage is questionable. "Relapse" is better described as an event than as a discrete stage. It is an occurrence that shifts a recent quitter into one of the earlier stages, in this case either precontemplation or contemplation[21]. Although one could certainly compute a discriminant function to predict the movement out of relapse into contemplation, for example, it is not clear how this function would be interpreted alongside the functions that would be calculated for precontemplators' movement into contemplation, or contemplators' stagnation there, since relapsers could be in either of these early stages at baseline. Prochaska et al. did not address the ambiguity that obtains when relapse is considered a stage akin to the others. In view of these concerns, the findings for this stage are not reviewed here.

Prochaska et al. summarized their findings by asserting that 13 of their 14 variables remained in at least one function across the analyses, lending support to the constructs in their model. Unfortunately, many of those functions pertained to the relapse stage, which is difficult to interpret as noted above. It is, regardless, no longer part of the model[22]. In addition, the presence of the decisional balance and self-efficacy variables compromises our ability to understand the influence of the processes. Studying all 14 variables as a set does provide more opportunity for effects to emerge; however, only the processes are understood to be the causal agents in the model. The authors of the study are limited in their ability to draw conclusions about the processes as so many of them were "bumped" out of significant functions by decisional balance and self-efficacy, variables that are not currently understood to function in a stage-matched manner. From this study, it appears that the processes do very little to predict change among smokers.

Despite this, Prochaska has relied on this study to support the claim that the processes function causally in a stage-specific manner. Although several of the processes were not

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[21] Recall that the preparation stage was not yet part of the model.

important to the prediction of stage transitions, and received little attention from the authors in their discussion, Prochaska later cited this study as showing that the process variables have "... been demonstrated to be good predictors of change in smoking status six months in the future" (Prochaska, Velicer, DiClemente & Fava, 1988, p. 526). This clearly implies a strong role for *all* of the processes, when in fact very few of them emerged in the discriminant functions. In another paper, we are told that this study shows, "... the ten change processes ... to be significant predictors of change in smoking behavior" (Prochaska et al., 1991, p. 86). Prochaska's representation of the findings from this study has a sweeping certainty that seems unwarranted. Even if these conclusions were more tentatively drawn, they would fail to support the model's central tenet – the *specificity* of the process-by-stage relationships. The conclusion that "all the processes were important" strips away all indications of specificity from the model. Oddly, the few examples of specificity that did emerge – including the differential effects of self-reevaluation and the negative effects of social liberation – received scanty attention. It is not clear why this should be so.

Aside from the justifiability of these conclusions, it is interesting to note that they do not appear to have influenced the structure of the model. For example, Prochaska et al. were impressed by the finding that self-reevaluation appeared in several of the significant functions across different stages. However, the demands of specificity require that the processes not be important to multiple stages; in addition, the integration of processes with stages shows this process to be important only to one transition, that from contemplation to preparation (Prochaska et al., 1992). In addition, self-reevaluation was observed to be a positive predictor of advancement from contemplation when compared to backward stage movement, but a negative predictor of advancement for this stage when compared to stagnation. How should the structure of the model integrate this puzzling finding? Prochaska et al. simply do not address it. As well, the process of social liberation emerged as a negative predictor of advancement out of both precontemplation and contemplation, which is compelling evidence that processes can be used at the "wrong" time. However, the integration depicts only the

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[22] The inclusion of an irrelevant stage influences our understanding of the findings for the remaining stages, as the effects for each stage are examined in the context of the others in the analysis.

positive effects of processes, and fails to explain why social liberation was dropped[23]. What we should conclude from this study, and how its conclusions should be incorporated in the process-by-stage integration, are murky issues that Prochaska and his colleagues unfortunately have not addressed.

Perz, DiClemente, and Carbonari (1996) published an article that seemed, by its title, to target directly the central hypothesis of the TTM: "Doing the right thing at the right time? The interaction of stages and processes of change in successful smoking cessation." The title deserves emphasis here, as just such a study has been lacking in the decade of TTM research published to date. Perz et al. identified this significant gap in the literature, indicating that no studies have investigated the causal effects of the processes used differentially across the stages[24]. They reiterated the belief that there should be stage-specificity in the model, stating that "each stage has its own 'work' to do, with some processes contributing differentially to the completion of that work" (p. 463). This paper promised to investigate these relationships.

Participants were selected from the sample used by DiClemente et al. in 1991 (reviewed above). Only those who were in the contemplation or preparation stages at baseline, and who had attempted to quit over a one-month period, were chosen for inclusion in this analysis. Data were available representing stage and process use at baseline, and at one- and six-month follow-ups.

Perz et al. chose not to examine the relationships posited in the still-untested integration. Instead, they hypothesized that success by the follow-up would be associated with a different "optimal" pattern of process use. They defined "optimal" as high use of cognitive and low use of behavioural processes in the contemplation and preparation stages at baseline, and high use of behavioural and low use of cognitive processes in the action stage at follow-

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[23] Sutton pointed out that the processes are understood to be positive mechanisms for change, yet functioned negatively in this study as often as they did positively. Prochaska's failure to integrate conflicting findings such as these was one of Sutton's strongest criticisms of the TTM (Sutton, 1996).

[24] This acknowledgment seems extraordinary in view of the claims that had been made for stage-matching to that point.

up[25]. It is not clear why Perz et al. reduced the 5-stage, 10-process model to two stages (smoking, not smoking) and two processes (cognitive, behavioural), and proposed only the most circular relationships between them. It is baffling that they would wish to remove all possibilities of higher-level differentiation in the model, as the specificity among the process-by-stage relationships is the cornerstone upon which the model's claims rest.

Nonetheless, this "optimal" pattern of process use was indeed found to be associated with success at the one-month follow-up on one of three behavioural measures: 7-day point prevalence abstinence, the smoking rate over the past week, and the length of the longest quit attempt over the time panel[26]. It must be noted that, instead of predicting follow-up stage movement from baseline process use, only participants who *demonstrated* this type of stage movement were included in the analysis and compared on their process use patterns at baseline and at follow-up. Perz et al. concluded that smokers should begin to reduce their use of cognitive processes and increase their use of behavioural processes when moving into action.

A serious flaw in the study throws the validity of this conclusion into question. Perz et al. referred to their participants as being "in action" at the follow-up, but a closer reading of this study reveals this statement to be incorrect. Recall that participants were selected for inclusion in the analysis if they were in contemplation or preparation at the baseline phase, and if they made a 24-hour quit attempt over the time panel. However, at both follow-ups, most participants were back in contemplation or preparation, *not* action. Perz et al. somehow considered their participants to be in the action stage at the follow-up simply by virtue of a single quit attempt. These attempts, however, could have been as short as 24 hours and could have happened at any time in the one-month period. Therefore, the process activity that was measured at the follow-up reflected smokers' efforts *after* a failed attempt, not during successful action as the study implies. To represent this follow-up stage as "action" and the follow-up processes measured at this time as being used "during action" is strongly misleading.

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[25] Again, the precontemplation and maintenance stages were not included in the analysis.

[26] Perz et al. did not use stage movement as their outcome indicator, perhaps because so little stage movement would occur over periods as short as one and six months.

Aside from this flaw, this study shows only that smokers who shift from cognitive to behavioural processes also have better success at quitting and/or reducing their smoking than those who do not. Essentially, those who stop 'thinking' and start 'doing' tend to 'do' more. This level of circularity does not respect the spirit of the model. Moreover, the effect of stage is completely absent, because participants from only two stages at baseline were selected (and then merged!). Even if the study featured a more appropriate definition of the action stage at follow-up, it could not address the specific claims about the interaction of stage and process.

Prochaska's emphatic message has been that smokers in different stages have different intervention needs. Not all smokers are the same, and not all processes are created equal; smokers in each of the early stages must use the cognitive processes best suited to them – not just *any* cognitive processes – in order to progress. The strategy that Perz et al. employed for testing the model, in view of its structure and its goals, seems a bizarre choice. Why the process-by-stage integration shown in Table 2 was not tested is unknown. At the very least, a higher level of differentiation in the process-by-stage relationships should be sought.

The studies reviewed so far have focused on the positive effects of the processes. Only one study has explicitly examined the negative effects the processes might have on progression through the stages. Using the sample upon which many of the earlier TTM works were based (e.g., Prochaska & DiClemente, 1983; Prochaska et al., 1985), Fitzgerald and Prochaska (1990) selected 49 contemplators who remained in that stage through the two-year period ("chronic contemplators"), and a subset of 10 contemplators who progressed from contemplation to action ("progressive contemplators")[27]. Measures of process use and stage membership were available for the baseline, and for 1- and 2-year follow-ups.

Two of the ten processes were able to distinguish between chronic and progressive contemplators: those who remained in contemplation tended to use dramatic relief and social liberation to greater degrees at one of the two follow-up points than did the contemplators who advanced. The failure to detect more relationships may have been due to the small sample

sizes. The association between dramatic relief and stagnation for contemplators is consistent with the integration, which assumes that smokers are unlikely to advance if they persist in using their "own" processes rather than those of the stage ahead. Echoing the findings from Prochaska et al., 1985, this study also identified a negative influence of social liberation on stage movement. The omission of this process from the integration is puzzling in light of such findings. It appears to be a process that hinders those in early stages, a piece of information that would be useful for intervention. It is uncertain why the TTM researchers have not paid more attention to the negative effects of the processes; while they describe their model as showing the need to "do the right thing at the right time," there must also be a "wrong thing at the wrong time" and the model has so far had little to say on this topic despite emerging evidence of such relationships.

It was noted earlier that correlational studies are less powerful than experimental studies for establishing the stage-based causal effects of the processes. The experimental efforts in the TTM literature are reviewed in the following section.

Longitudinal experimental studies. Are stage-matched smoking cessation interventions best? Using the same sample[28] as used by Perz et al. (1996), Prochaska et al. conducted an intervention study that examined the impact of four treatment conditions for smoking cessation, three of which were based on stage-matched TTM content (Prochaska et al., 1993). The one non-TTM condition was a treatment based upon the standard American Lung Association (ALA) intervention manuals. The three TTM-based conditions featured increasing degrees of contact with and feedback to participants: a TTM manuals-only condition, a condition with TTM manuals plus computer-based TTM feedback (e.g., participants' own decisional balance scores), and a condition with the TTM manuals, computer feedback, and

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[27] This does not signify a skipping of stages, as preparation was not part of the model at this early date. In addition, Fitzgerald and Prochaska also reported on groups that they called "chronic" vs. "progressive relapsers," but these findings are ungeneralizeable to the current model and are not discussed here.

[28] By this point, the reader will have noticed the extent to which the TTM researchers make use of single samples to support multiple findings for their model. Thus, care should be taken in interpreting claims that multiple studies have provided support for the concepts in the model. There may be a strong degree of dependence across these studies; however, a thorough accounting of this issue is beyond the scope of this thesis.

telephone counselling sessions based on TTM content. Abstinence measures were collected at six, 12, and 18 months.

The study demonstrated that the ALA self-help manuals were less helpful than were some of the more sophisticated programs built around stage-matched TTM materials. The most appropriate comparison to the ALA manuals-only condition, however, would be the TTM manuals-only condition, in order to avoid confounding treatments with attention and/or treatment dosage. It emerged that the TTM manuals-only condition failed to outperform the ALA manuals at six-month and at one-year follow-ups, demonstrating that the TTM content itself was *not* superior to the ALA content in this comparison.

The treatment condition featuring TTM manuals and computer-based feedback was found to be superior to the other treatments, a finding cited as strongly supportive of the model. However, a closer inspection of the results shows that *no* support is found either for the TTM-based content in the interventions, or for the stage-matching of that content. First, there was no indication that the TTM content was varied across the three TTM-based conditions. Second, there was no indication that stage-matching was varied across the TTM-based conditions. Amazingly, all three TTM-based conditions appear to have featured identical TTM content and identical stage matching. The only variant was the mode of presentation (manuals-alone, manuals + computer, and manuals + computer + counseling). Thus, the treatment effect found for the computer feedback condition may simply reflect the power of computer-based iterative feedback and not the TTM content, per se. A computer-based feedback condition based on *non*-TTM content would have been the proper comparison group for this condition. In addition, no conclusions can be drawn about stage-matching as matching did not vary across conditions. A computer feedback condition featuring *mismatched* TTM content would have been the proper control group for testing this question[29].

This study provided absolutely no attempt to address the two questions that pertain to the model – the efficacy of TTM-based interventions in general, and the efficacy of stage-

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[29] The nature of the TTM content, matched or not, is not quite clear. Details offered in the paper include mention of two processes encouraged for precontemplators, and a general statement that action and maintenance people were urged to use the change processes that are "predictive of success." This does not yet comprise a satisfactory account of the principles used to match processes to stages.

matched interventions in particular. It *did*, however, offer strong support for the use of computers and iterative feedback in smoking-cessation interventions, but such results simply provide an excellent answer to a different question.

Conclusions

Our knowledge about longitudinal, predictive process-to-stage-specificity is extremely weak. The developers of the TTM admit that the processes of change are the "least studied aspect of the model" (Velicer & Prochaska, 1997). It is odd, then, that they believe that "We have found that the most effective interventions are matched to the stage of the smoker" (Velicer & DiClemente, 1993, p. 95), and that "Our research clearly demonstrates the advantages of tailored interventions over standardized interventions" (Prochaska & Velicer, 1997a, p. 11). They have not provided the data that would permit us to develop confidence in such claims. Prochaska et al. hypothesize that there is differentiation in their model (i.e., that the processes' causal effects depend upon stage), yet, after more than a decade of research, we see only exploratory attempts to establish that processes affect stages even in an undifferentiated way.

Particularly confusing are the instances in which the TTM's developers appear to embrace findings for stage and process that are largely circular. The study by Perz et al. (1995) exemplifies this phenomenon; they hypothesized that cognitive processes should be helpful to smokers who are thinking about change, and that behavioural processes should aid those who are making a change and/or trying to maintain it. As stated earlier, it seems obvious that cognitive processes would be more relevant to the "still thinking" stages, and that the behavioural processes would be mostly helpful for those in the "behaving" stages.

The spirit of the model should be respected. Prochaska and his colleagues have taken pains to identify five distinct cognitive processes, five distinct behavioural processes, and five distinct stages. The integration that they have offered for the processes and stages suggests a level of differentiation that rises above the purely circular, and that can support the concept of "stage matching." If process-by-stage-specificity does not exist on a more differentiated level than cognitive vs. behavioural processes and pre-action stages vs. action stages, then the model effectively reduces to two stages and two broad sets of processes. We would be returned to the

dichotomous model that Prochaska and his colleagues wished, wisely, to supplant with a more complex view.

It has been demonstrated here that the crucial tests of longitudinal stage-specificity have not been conducted. The experiments to test hypotheses developed *a priori* from the presumed integration, featuring the appropriate no-treatment and crossed-treatment comparison groups, are completely absent from the literature. The strategic longitudinal correlational studies, focused on the functioning of certain sets of processes vs. others, have yet to be performed. It is not clear why the literature on the TTM is so lacking in studies that could provide support for its most important claims.

Some would argue that this problem need not concern practitioners and others who use the model. Samuelson (1997) regards the contributions of Prochaska and his colleagues as extending "beyond academic debate." He believes that public health can benefit from the model regardless of the empirical details or, as he put it, "arguments of intellectual interest" but "little practical value" (p. 14). However, in view of the public health dollars that might be (and have been) spent on TTM-based programs, the time and effort spent by health care professionals to learn the model, and the needs that smokers have for effective smoking-cessation guidance, Samuelson's view seems ill-advised. The TTM might be able to provide a meaningful intervention framework, but the specifics of this framework are neither known, nor empirically supported.

It is easy to understand the enthusiasm of practitioners who have adopted the model. The possibility of a systematic relationship between smoker readiness and type of treatment has intuitive appeal. The ability to assess a smoker's readiness to change and to use tailored intervention materials would be useful to physicians who have indicated that they have little time to examine their patients' smoking behaviour in detail. The notion of stage-matching is particularly compelling, as it is easy to believe that throwing all possible interventions at smokers would not be the most efficient way to meet their needs. If the TTM could clarify which processes should be used (and which avoided) by which smokers at which points in time, this would represent a significant advance for change programs, especially if strategies for engaging the "hard sells" among smokers could be made available. The popularity and

appeal of the TTM is easily understood in this context, and practitioners are indeed eager for guidance in the use of stage-matched intervention (Hotz et al., 1995). With the support of empirical efforts that target the essential relationships in the model, these practitioners could begin to apply the TTM in the public health domain with confidence.

The Goals of This Thesis

This review of the TTM literature has shown substantial gaps in the model's empirical foundations. The central claims of stage-specificity both cross-sectionally and longitudinally remain either unsupported or untested.

In the present study, these claims were empirically tested in a longitudinal survey study with 386 smokers. The cross-sectional claims of specificity were tested by examining whether smokers in different stages used different processes of change, and whether their patterns of use matched the patterns proposed by the integration. The longitudinal claims of specificity were tested by examining the degree to which the processes' predictive power varied by stage, and whether those patterns of differential predictability matched the patterns proposed by the integration.

Method

Participants

Three hundred and eighty-six volunteer participants (152 males and 234 females) between the ages of 18 and 66 participated in this study. For inclusion, participants satisfied the following inclusion criteria: they were current smokers who typically smoked on both weekdays and weekends, they were smoking a minimum of five cigarettes per day[30], and they were not receiving smoking cessation assistance from a formal treatment program, nicotine gum, or a nicotine patch.

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[30] There is little consensus in the literature regarding the minimum number of cigarettes per day that is advisable for categorizing someone as a "regular smoker." In the 10 studies of self-quitters that they reviewed, Cohen et al. noted that levels of one cigarette to 10 cigarettes per day have been used (1989). A minimum of five cigarettes per day was chosen for this study in order to ensure that participants were smoking heavily enough to make quitting a psychologically significant event.

Recruitment methods. Participants were recruited by a variety of methods. In the Kitchener-Waterloo region, participants were recruited through pamphlets in physicians' offices, advertisements placed in a university newspaper; direct mailings from the Lung Association of Kitchener-Waterloo, direct mailings to staff in the university community, and invitations to first-year university psychology students to participate for partial credit in their introductory course. Participants were also recruited from sources on the Internet, with invitations posted to relevant computer bulletin-boards, discussion newsgroups and web sites on health- and smoking-related topics. Finally, invitations to participate were extended by the "COMMIT to a Healthier Brant" program in Brantford, Ontario as part of their information kit for smokers. A sample of the recruitment brochure used for recruitment in the Kitchener-Waterloo region can be seen in Appendix C, and the recruitment notice placed on the Internet can be seen in Appendix D.

The majority of the sample, 81.3%, came from Internet sources (hereafter referred to as "Internet" participants). Participants recruited locally through advertisements, invitations, and pamphlets comprised 14.8% of the sample (hereafter referred to as "General" participants). A small proportion, 3.9%, was recruited from the COMMIT program ("COMMIT" participants).

Baseline Measures

A 26-page questionnaire was mailed to participants along with an introduction letter, an information sheet about the follow-up interviews, and a stamped, self-addressed envelope for the questionnaire's return. The questionnaire required approximately 30 to 40 minutes to complete, and consisted predominantly of closed-ended questions. Participant demographics were assessed, as were variables reflecting current smoking, smoking and quitting history, social smoking context, and feelings about smoking. The TTM variables were measured, as were intentions regarding smoking behaviour over the next month. Physical dependence was measured with the Revised Fagerström Tolerance Questionnaire (Tate & Schmitz, 1993). The questionnaire is presented in Appendix B. The introduction letter is presented in Appendix E, and the information sheet about the follow-up interviews is presented in Appendix F.

Demographics. Participants were asked to indicate their age, sex, marital status, and highest level of education completed. They also indicated their current use of cessation aids,

and participation in smoking-cessation programs. The demographics section of the questionnaire is presented on page 164 in Appendix B.

Current smoking. Participants were asked to confirm that they currently smoke, and to estimate the average number of cigarettes they smoke per day. They also estimated the length of time (in days, weeks, months, or years) that they had been smoking this number of cigarettes per day.

The revised Fagerström tolerance questionnaire. This 10-item scale (Tate & Schmitz, 1993) is considered a measure of physical dependence or addiction, but it also provides a detailed picture of current smoking behaviour. On a 5-point Likert scale, participants rated several aspects of their current cigarette consumption, including depth of inhalation, smoking the first cigarette of the day within 30 minutes of waking, the perceived difficulty in giving up the first cigarette of the day, and the fraction of each cigarette smoked, among others. Internal consistency has been reported as .83, with test-retest reliability of .88 over one to two months (Tate & Schmitz, 1993). In the current sample, internal consistency was .74. This scale can be seen in Appendix B on page 166.

Cessation history. Six items assess different aspects of participants' previous quitting attempts. Participants who indicated in the first question that they had ever had a quit attempt went on to respond to the remaining items; those without a quit attempt were routed to the next section. Participants were required to estimate the number of times a quit attempt had occurred within the past year, and to estimate the duration, in days, of the longest intentional quit attempt in their lives. Next, participants were asked whether they had ever enrolled in a formal cessation program, and, if so, the number of times. Finally, those who indicated that they had been in a formal cessation program were asked to estimate the longest period, in days, that they remained abstinent following such a program. These questions can be seen in Appendix B on page 168.

Feelings about smoking. Smokers were asked to discuss their feelings about smoking in an open-ended fashion. They were asked, "What are some of the things that you like most about smoking?" followed by the corresponding question about the elements that they dislike. A third item inquired whether participants have ever felt hassled by others about their smoking, and, if so, in what ways. Although this section of the questionnaire provides

valuable qualitative information about smoker-generated pros and cons, it was not included to fulfill any of the goals of the *current* study. With respect to this thesis, this section of the questionnaire was intended to function as a rapport-building tool. First, it was anticipated that the strictly closed-ended format of the questions might convey a lack of interest in smokers' own stories about smoking and quitting. Second, there was a concern that precontemplators might find the questionnaire overly focused on the desirability of change. This section was intended to balance the potentially one-sided feel of the questionnaire in terms of both the response formats and the implicit "message" that the items conveyed about smoking. Please see page 169 in Appendix B for this section of the questionnaire.

Social smoking context. A series of eight questions inquired about the participant's social context with respect to smoking. First, on a 1 to 7 Likert scale, participants were asked to estimate how many of their friends smoke (from "none at all" to "all of them"), how many of their co-workers smoke (from "none at all" to "all of them"), and the amount of time that they spend with others who smoke (from "none at all" to "a great deal"). An open-ended question asked participants to indicate the number of smokers who currently live in their household. Next, participants were asked to indicate whether they were exposed to others' cigarette smoke at work and, if they have a spouse or partner, whether that person smokes. If so, participants were asked to indicate whether this person lived in the same household, and to estimate the number of cigarettes per day that this person typically smokes. Finally, the presence of smoking behaviour in the participant's social life was measured with an item that required participants to estimate the percentage of their typical social activities that involve the presence of smokers. These questions can be seen on page 170 in Appendix B.

Stages of Change. The stages of change for smoking were assessed with the 5-question algorithm developed by Prochaska and DiClemente (1992). This question sequence requires participants to indicate whether they are currently smoking, and if not, how long they have been off cigarettes. As well, two questions about intention to quit smoking are asked of current smokers, with the first pertaining to the time frame of the next six months, and the second inquiring about intentions for the next 30 days. Finally, respondents are asked whether they have had a quit attempt of at least 24 hours duration in the previous year. All stages of change questions, with the exception of the time since quitting cigarettes, are offered in a

yes/no response format. The stages of change items are presented with their scoring algorithm in Appendix A. To view them as they appeared in the questionnaire, please see page 165 in Appendix B.

Processes of Change. The short-form (20-item) version of the original 40-item Processes of Change Questionnaire was used to assess this TTM construct in order to reduce the response burden on participants (Fava et al., 1991). Participants responded to two statements for each of the 10 processes, indicating the frequency of their use of that process on a 5-point Likert scale (1 = never; 5 = repeatedly). In the present study, internal consistency for the 10 subscales was variable, ranging from r = .36 to r = .80, as can be seen in Table 5. The processes of change scale is presented in Appendix B on page 180.

Table 5

Internal Consistency of the Processes of Change Subscales

Process	Pearson Correlation [a]
Cognitive	
Consciousness raising	.46
Dramatic relief	.69
Environmental reevaluation	.80
Self-reevaluation	.67
Social liberation	.36
Behavioural	
Self-liberation	.60
Reinforcement management	.69
Helping relationships	.77
Counterconditioning	.42
Stimulus control	.55

Note. All correlations are significant at $p \leq .001$.

[a] Because the 20-item Short Form of the processes scale was used, the Pearson correlation coefficient rather than coefficient alpha is used to indicate internal consistency.

The intercorrelations among the 10 processes of change for the present study can be seen in Table 6.

Intentions. Intentions to quit, to reduce, and to continue smoking over the next 30 days were each measured with a single item. On a 7-point Likert scale, (1 = no, definitely do not intend; 7 = yes, definitely do intend) participants indicated their responses to the statements "I intend to quit (reduce, continue) smoking in the next month." Participants also rated their expectation that they would follow through on their expressed intentions. The statements "I expect that I will quit (reduce, continue) smoking in the next month" were each endorsed on a 7-point Likert scale (1 = not at all likely; 7 = absolutely certain).

Table 6

Intercorrelations of the Processes of Change Subscales

	Behavioural Processes					Cognitive Processes				
	SL	RM	HR	CC	SC	CR	DR	ER	SR	SO
SL	1.00									
RM	.22***	1.00								
HR	.21***	.28***	1.00							
CC	.45***	.18***	.13**	1.00						
SC	.45***	.26***	.24***	.49***	1.00					
CR	.40***	.28***	.30***	.26***	.39***	1.00				
DR	.33***	.30***	.28***	.19***	.35***	.52***	1.00			
ER	.21***	.27***	.21***	.20***	.22***	.46***	.41***	1.00		
SR	.44***	.26***	.29***	.29***	.45***	.57***	.56***	.34***	1.00	
SO	-.01	.09	.03	.10*	.03	.17***	.03	.13**	.02	1.00

Note. The full names of the processes are indicated with their abbreviations in Table 1.
*$p < .05$. **$p < .01$. ***$p < .001$.

Additional variables beyond the scope of this thesis were also measured in the baseline questionnaire. These include the TTM self-efficacy and decisional balance constructs, as well as variables from the Theory of Planned Behaviour.

Follow-up Measures

Follow-up interviews occurred one and two months after the completion of the baseline questionnaire. The two interviews were identical, and required approximately 5 to 10 minutes to complete depending upon the method of administration. Internet participants recruited received their follow-ups by e-mail, whereas General and COMMIT participants received telephone follow-up interviews. The content of the follow-ups was as similar as possible across methods of administration, with minor differences in the instruction sets. The script for the follow-up interview administered by telephone can be seen in Appendix G, while the e-mailed version of the follow-up interview can be seen in Appendix H.

Each follow-up measured current smoking behaviour over the past week, cessation and reduction attempts over the month, changes in smoking topography, the use of stimulus control techniques, and intentions to quit, reduce, and continue smoking over the next month. These sections of the follow-up interview are described in general below; the exact wording and order of the items, as well as the instruction sets, are presented in Appendices G and H.

Current smoking behaviour. Participants were asked to estimate, in an open-ended fashion, the average number of cigarettes they smoked over the past week, considering first only the weekdays, then the weekends.

Cessation attempts. Smokers were asked to indicate whether there were any days in the past month during which they intentionally smoked no cigarettes. They were asked to exclude cessation days that were the result of circumstances beyond their control, including being ill, or being in a place where smoking was not permitted. If the participant indicated that there were cessation days over the past month, they were asked to estimate the number of cessation days they had, both in total, and the longest number in sequence. They were asked whether the desire to quit smoking was the reason for the cessation attempts; if not, the reason was solicited. Participants then rated, on a 7-point Likert scale, the degree to which they experience the cessation attempts as "easy" or "difficult." Finally, they were asked to share

their opinions, in an open-ended fashion, of the things that helped them to remain smoke-free on those days.

Reduction attempts. This section was identical to that measuring cessation attempts, with the substitution of "reduction" for "cessation." Participants were asked to indicate whether there were any days in the past month during which they intentionally cut back on the number of cigarettes that they normally smoke. They were asked to exclude smoking reductions that were the result of circumstances beyond their control. Again, they estimated the total and longest consecutive number of days reduced, provided the reason for the reduction attempts, rated the ease or difficulty of the attempts, and discussed what, if anything, had been helpful to them in their smoking reduction.

Changes in smoking topography. Participants were asked to indicate whether four aspects of their smoking had increased, decreased, or remained unchanged over the previous month. These aspects included the number of different places where they smoke, the amount of enjoyment that they derive from smoking, the amount of each cigarette that they smoke, and their inhalation rate.

Stimulus control efforts. The use of stimulus control methods to control smoking behaviour over the past month was assessed with four items to which participants responded either "yes" or "no." Participants were asked whether they had avoided places and situations where they knew they would want a cigarette; whether they removed things from home or work that remind them of smoking; whether they spent more time than usual in places that do not permit smoking; and whether they had planned in advance how to resist an urge to smoke. All of these are strategies that might be used to assist with both reduction and cessation efforts, and were derived from the behavioural processes of change subscales. In order to maintain rapport with precontemplators who did not express a desire to make changes in their smoking, several items reflecting likely precontemplator activity were alternated with the target items. These included questions about whether, over the past month, participants had felt bothered or angry about a look or a comment from a non-smoker; whether they had felt bothered or angry about non-smoking regulations; whether they had heard someone ask them why they smoke; whether they had felt guilty or defensive about their smoking; and whether they had thought about their freedom to choose whether they smoke or not.

Intentions. Finally, participants were asked to rate their plans to continue, reduce, and quit their smoking in the next 30 days on a 7-point Likert scale (1 = absolutely do not plan; 7 = definitely do plan). Additionally, in order to allow classification to stage of change at follow-up, participants were asked to estimate their quitting intentions over the next 6 months with the same response scale. This final question was inadvertently omitted from the first 168 of the completed follow-ups, but was included for the remaining 130.

Procedures

As outlined above, participants were recruited from different sources that demanded slightly different procedures for data collection. Efforts were made to preserve as much similarity in the procedures across recruitment sources as possible. Regardless of the recruitment source, the baseline survey package was mailed to all participants, who then completed the written consent form and the survey, and returned both by mail.

At the one-month follow-up, General and COMMIT participants were telephoned in the evening hours and asked whether it was convenient for the interview to proceed at that time. If so, the interview was initiated; if not, an alternate time was arranged for the follow-up call, or the participant's involvement was terminated at their request. At the end of the interview, participants were reminded of the second follow-up in one month's time. After the second follow-up was completed, participants were offered an opportunity to ask questions about the nature of the study, and were informed that they would receive a written debriefing in the mail. A copy of this debriefing letter can be seen in Appendix I.

For Internet participants, the one-month follow-up interview was sent in the form of an e-mail message that contained introductory text and the same follow-up questions as asked in the telephone interviews. Each question was followed by the appropriate prompts for open- and closed-ended responses. Participants were required to reply with the original message included, typing their answers into the appropriate spaces. The second follow-up was administered in the same manner. As in the telephone follow-ups, Internet participants were encouraged upon completion of the follow-ups to ask any questions they might have. An electronic version of the written debriefing letter sent to General and COMMIT participants was e-mailed to each Internet participant upon the completion of the final follow-up. Only two

of the 314 Internet participants had difficulty with the e-mail procedures, and chose instead to print out the e-mail interview, write in their responses, and return it by regular mail.

Results

Description of the Sample

Of the 538 surveys distributed, 397 (73.7%) were completed and returned. This sample of 397 (158 males and 239 females) was further reduced to 386 (152 males and 234 females) because one participant was unclassifiable to stage, five were inadvertently recruited despite being recent quitters, and five were using quit aids including nicotine gum and transdermal patches. Attrition occurred at both waves of the follow-up. Data for both follow-up phases were obtained from 164 participants (42.5% of baseline); an additional 134 (34.7%) provided data for the first follow-up but not the second. Eighty-eight participants (22.8%) failed to complete either follow-up phase. The final sample sizes were therefore 386 for the baseline survey, 298 (77.2% of baseline) for the first follow-up, and 164 (42.5% of baseline) for the second follow-up. As stated earlier, 81.3% of the baseline sample were Internet participants, 14.8% were General participants and 3.9% were COMMIT participants.

Participants provided basic demographic data, including their age, education level, and marital status. As Table 7 shows, their mean age was 37.9 years, the majority were educated at or just below the University level, and most were either married or single as opposed to cohabiting, divorced, or widowed.

Males and females did not differ significantly on age, but there were significant sex differences on education level, χ^2 (3, N=386) = 22.2, $p < .0001$, with more males than females reporting post-graduate level education, and on marital status, χ^2 (4, N=386) = 33.3, $p < .0001$, with more males than females reporting single status.

The three groups of participants from different recruitment sources also did not differ significantly on age. There were significant participant group differences on education level, χ^2 (6, N=386) = 38.4, $p < .0001$, with the Internet group reporting higher levels and the COMMIT group reporting lower levels of education. In addition, the participant groups differed moderately on marital status, χ^2 (8, N=386) = 15.9, $p < .05$, with the general group

Table 7

Means (Standard Deviations) and Frequencies of Demographic Variables by Sex and Participant Group

Variable	Whole Sample (N = 386)	Gender		Participant Group		
		Males (N = 152)	Females (N = 234)	Internet (N = 314)	General (N = 57)	Commit (N = 15)
Age	37.9	36.6	38.8	38.2	36.0	39.1
	(11.8)	(11.8)	(11.8)	(11.2)	(14.6)	(13.0)
Education [a]						
High School	13.7%	11.8%	15.0%	10.2%	26.3%	40.0%
College	20.5%	10.5%	26.9%	20.1%	15.8%	46.7%
University	44.8%	48.0%	42.7%	45.2%	52.6%	6.7%
Post-Grad	21.0%	29.6%	15.4%	24.5%	5.3%	6.7%
Marital Status						
Single	31.3%	46.7%	21.4%	29.9%	40.4%	26.7%
Married	39.9%	36.2%	42.3%	42.7%	28.1%	26.7%
Cohabiting	13.2%	9.9%	15.4%	13.1%	12.3%	20.0%
Separated	2.6%	0.7%	3.8%	2.5%	0.0%	13.3%
Divorced/Widowed	13.0%	6.6%	17.1%	11.8%	19.3%	13.3%

[a] Each level of education includes those with partial or complete attainment.

containing the highest percentage of single participants, and the Internet group containing the highest percentage of married individuals.

Participants provided information on their current and past smoking, as shown in Table 8. On average, participants were smoking 21 cigarettes a day, and had been doing so for an average of 11 years. In general, participants indicated that they have a few quit attempts each year, but tend to return to smoking again in less than a year. A third of the sample had tried to quit in the past with the help of a formalized treatment program, but those individuals reported experiencing only minimal success with such a program; on average, they had remained off cigarettes for only 2.5 months following treatment.

Males and females did not differ significantly on their current smoking rates, nor on the number of years they had been smoking at that rate. Females reported being more dependent on smoking than did males, as indicated by their slightly higher scores on the Fagerstrom Revised Tolerance Scale, t (382) = 2.38, $p < .05$. Females also had attempted to quit with the use of a formal treatment program more often than did males, χ^2 (1, N=338) = 7.59, $p < .01$. Males and females did not differ on any of the remaining smoking behaviour variables.

Participants from different recruitment sources differed on their current smoking rates, with general participants smoking less than Internet and COMMIT participants, F (2, 383) = 9.48, $p < .0001$. General participants had smoked at their current rates for fewer years than did Internet and COMMIT participants, F (2, 383) = 3.50, $p < .05$, and had a lower Fagerstrom score than those two groups, F (2, 381) = 12.39, $p < .0001$. General participants had also attempted to quit more often in the past year than did Internet and COMMIT participants, F (2, 332) = 7.42, $p < .001$. Participants from the different recruitment sources did not differ on any of the remaining smoking behaviour variables.

The survey also gathered information regarding the social context of participants' smoking. As Table 9 shows, one third of participants reported having a partner who smokes, with three-quarters of those partners living in the same home. On average, smokers reported that roughly half of their friends smoke, that they spend just over half of their time with smokers, and that approximately half of their social activities involve the activity of smoking.

Table 8

Means (Standard Deviations) and Frequencies of Smoking Behaviour Variables by Sex and Participant Group

Variable	Whole Sample (N = 386)	Gender		Participant Group		
		Males (N = 152)	Females (N = 234)	Internet (N = 314)	General (N = 57)	Commit (N = 15)
Current Smoking						
Cigarettes per day (CPD)	21.8 (11.3)	22.4 (11.9)	21.4 (10.9)	22.8 (11.4)	15.9 (9.2)	24.2 (9.6)
Duration (years) of current CPD	11.4 (10.7)	10.3 (9.9)	12.1 (11.1)	11.8 (11.0)	8.2 (8.2)	14.8 (12.1)
Fagerstrom Revised Tolerance Scale	3.4 (0.6)	3.3 (0.6)	3.5 (0.6)	3.5 (0.6)	3.1 (0.6)	3.7 (0.5)
Quitting History						
Number of quit attempts past year	1.9 (3.4)	2.1 (3.8)	1.8 (3.0)	1.7 (2.5)	3.6 (6.4)	1.2 (1.2)
Longest abstinence (years) after quit attempt over lifetime	0.7 (1.4)	0.7 (1.7)	0.6 (1.3)	0.7 (1.3)	0.9 (2.1)	0.4 (0.6)
Formal smoking cessation programs:						
Ever used	34.2%	25.0%	40.2%	34.4%	33.3%	33.3%
Number of times used	2.5 (1.9)	2.3 (1.7)	2.6 (2.0)	2.5 (1.8)	3.1 (2.6)	1.8 (0.8)
Longest abstinence (years) after program use	0.2 (0.6)	0.3 (0.5)	0.2 (0.6)	0.3 (0.6)	0.1 (0.2)	0.1 (2.2)

Table 9

Means (Standard Deviations) and Frequencies of Social Smoking Context Variables by Sex and Participant Group

Variable	Whole Sample (N = 386)	Gender		Participant Group		
		Males (N = 152)	Females (N = 234)	Internet (N = 314)	General (N = 57)	Commit (N = 15)
Have a partner who smokes	33.9%	32.2%	35.0%	34.4%	31.6%	33.3%
Smoking partner's cigarettes per day	22.2 (12.7)	18.3 (9.7)	24.5 (13.7)	22.9 (13.1)	16.9 (8.3)	26.2 (13.0)
Percentage of smoking partners that live in the same household	77.4%	68.6%	82.6%	77.2%	83.3%	60.0%
Number of friends who smoke [a]	3.9 (1.7)	3.7 (1.7)	4.0 (1.7)	3.7 (1.7)	4.6 (1.8)	4.3 (2.1)
Number of coworkers who smoke	2.9 (1.9)	3.1 (1.9)	2.7 (1.9)	2.8 (1.8)	3.1 (2.0)	3.4 (2.2)
Amount of time spent with smokers [b]	4.2 (2.1)	4.0 (2.1)	4.2 (2.2)	4.1 (2.2)	4.5 (2.0)	4.7 (2.2)
Percentage of one's social activities involving smoking	44.5% (32.2%)	47.3% (31.2%)	42.7% (32.8%)	44.4% (32.8%)	43.5% (28.9%)	49.3% (32.4%)

[a] Items about number of friends and coworkers who smoke were answered on a 7-point Likert scale (1 = none at all; 7 = all of them)

[b] Item about amount of time spent with smokers was answered on a 7-point Likert scale (1 = none at all; 7 = a great deal)

Males and females did not differ on having a smoking partner, but females' reports of their partners' smoking rates were higher than males' reports, t (129) = 2.73, $p < .01$. Females were more likely than males to have their cigarette-smoking partner live in the same household, χ^2 = (1, N=137) 3.5, $p < .06$. Males and females did not differ on the number of friends who smoke, but males reported having more co-workers who smoke than did females, t (381) = 2.11, $p < .05$. Males and females did not differ from each other on the amount of time they spend with smokers, nor on the degree to which smoking permeates their social activities.

Participants from different recruitment sources differed on the reported number of friends who smoke, such that general participants reported more friends who smoke than did Internet participants, F (2, 383) = 6.67, $p < .001$. No differences were observed among the participant groups on any of the remaining social smoking context variables.

The Stages of Change

Participants were classified into one of three stages of change: precontemplation, contemplation, and preparation. The stages of action and maintenance were not represented, because only current smokers were investigated in this study, and the act of quitting smoking marks the entry into the action stage. As shown in Table 10, membership in the precontemplation and preparation stages was roughly equal, with 23.3% of the sample in the former and 25.4% in the latter. The majority of the sample, 51.3%, was in the contemplation stage. This distribution of smokers across stages varies from the distributions obtained in other TTM studies (DiClemente et al., 1991; Fava et al., 1995); however, those prior studies were also inconsistent with each other regarding stage distribution. In those studies, the precontemplation stage comprised 12.3% and 42.1% of the sample respectively, the contemplation stage 57.5% and 40.1%, and the preparation stage 30.2% and 17.6%.

The stages differed by sex, as contemplation and preparation had more females than males, and precontemplation showed the reverse pattern, χ^2 = (2, N=386) 11.2, $p < .01$. The stages also differed on age, with those in precontemplation being younger than those in the

contemplation and preparation stages, F (2, 382) = 12.35, $p < .0001$. There were no relationships between stage and participant group[31], nor between stage and education level.

The stages were examined on their current smoking behaviour and quitting history variables. As shown in Table 11, some stage differences were observed on current daily cigarette consumption, with contemplators smoking more than those in the remaining two stages, F (2, 383) = 6.24, $p < .01$. Contemplators exceeded precontemplators in their degree of physical dependence on cigarettes as measured by the Fagerstrom Revised Tolerance Scale, F (2, 381) = 5.01, $p < .01$. As well, contemplators reported smoking longer at their current rate than did precontemplators, F (2, 383) = 5.22, $p < .01$. Those in preparation reported the greatest number of quit attempts over the past year, F (2, 332) = 19.02, $p < .001$. The stages did not differ from each other on the length of their longest-ever quit attempt.

Finally, it can be seen that smokers in different stages differed little from each other on the social smoking context variables examined in this study. The only difference observed was that precontemplators reported a significantly higher proportion of their social activities as involving smoking compared with the remaining stages, F (2, 383) = 3.89, $p < .05$. These findings support Prochaska et al.'s belief that the stages do not vary according to "subject" characteristics that are often not amenable to intervention (Wilcox, Prochaska, Velicer & DiClemente, 1985).

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[31] Although the participant groups differed on variables such as smoking level and past quit attempts, only differences on stage would have had an impact on the interpretability of the main analyses. Because stage of change did not vary by participant group, the latter will not receive further attention.

Table 10

Stages of Change – Demographic and Participant Characteristics

		n (%)		
	N	Precontemplation	Contemplation	Preparation
Whole Sample	386	90 (23.3)	198 (51.3)	98 (25.4)
Age:	386	M = 32.7	M = 39.9	M = 38.7
		SD = 11.7	SD = 10.9	SD = 12.4
Sex:				
Males	152	49 (54.4)	68 (34.3)	35 (35.7)
Females	234	41 (45.6)	130 (65.7)	63 (64.3)
Participant Group:				
Internet	314	72 (80.0)	161 (81.3)	81 (82.7)
General	57	14 (15.6)	31 (15.7)	12 (12.2)
Commit	15	4 (4.4)	6 (3.0)	5 (5.1)
Education:				
High School	53	17 (18.9)	21 (10.6)	15 (15.3)
College	79	10 (11.1)	49 (24.7)	20 (20.4)
University	173	44 (48.9)	89 (44.9)	40 (40.8)
Post-Grad	81	19 (21.1)	39 (19.7)	23 (23.5)

Table 11

Stages of Change – Smoking-related Variables

	Mean (Standard Deviation)		
	PC	C	PREP
Current Smoking			
Cigarettes per day	20.3 $_a$	23.7 $_b$	19.3 $_a$
	(11.5)	(11.8)	(9.4)
Fagerstrom score [a]	3.3 $_a$	3.5 $_b$	3.4 $_{a,b}$
	(0.6)	(0.6)	(0.6)
Duration (years) of CPD	8.7 $_a$	12.9 $_b$	10.8 $_{a,b}$
	(8.8)	(10.4)	(12.1)
Quitting History			
# 24-hr quit attempts, past year	1.3 $_a$	1.2 $_a$	3.6 $_b$
	(3.6)	(1.9)	(4.5)
Longest quit ever (years)	0.6	0.8	0.6
	(1.6)	(1.5)	(1.3)
Social Smoking Context			
Have partner who smokes	28.9%	35.4%	35.7%
Smoking partner's CPD	21.7	22.6	21.7
	(8.6)	(12.6)	(15.5)
% of smoking partners in same household	74.1%	80.0%	74.3%
Number of friends who smoke [b]	3.9	3.9	3.8
	(1.8)	(1.7)	(1.7)
Number of coworkers who smoke	2.9	2.8	3.0
	(1.8)	(1.9)	(1.9)
Amount of time spent with smokers [c]	4.4	4.0	4.2
	(2.2)	(2.1)	(2.2)
Percentage of one's social activities involving smoking	52.7% $_a$	42.4% $_b$	41.2% $_b$

Note. Values in the same row that have different subscripts differ significantly at $p < .05$ by Tukey HSD comparisons.

[a] Measured on a 5-point scale. [b] Items about number of friends and coworkers who smoke were answered on a 7-point Likert scale (1 = none at all; 7 = all of them). [c] Item about amount of time spent with smokers was answered on a 7-point Likert scale (1 = none at all; 7 = a great deal).

The Processes of Change

Means for processes of change for the entire sample are shown in Table 12[32]. In general, participants showed moderate use of the majority of the behavioural and cognitive processes of change, with only three of the processes (stimulus control, reinforcement management, and environmental reevaluation) receiving relatively low levels of use. The process receiving the most use, social liberation, has been unaccountably discarded from most recent applications of the TTM, as noted earlier.

Table 12

Scale Means of the Processes of Change

Scale	Mean	SD
Behavioural		
Self-liberation (SL)	3.3	1.1
Reinforcement management (RM)	2.0	1.1
Helping relationships (HR)	2.5	1.3
Counterconditioning (CC)	2.5	0.9
Stimulus control (SC)	1.8	0.9
Cognitive		
Consciousness raising (CR)	3.2	1.1
Dramatic relief (DR)	2.6	1.2
Environmental reevaluation (ER)	2.2	1.2
Self-reevaluation (SR)	3.3	1.3
Social liberation (SO)	4.2	0.9

Note. All variables were measured on a 5-point Likert scale.

[32] Processes will be analyzed by stage in later sections of this thesis.

Behaviour Changes at Follow-up

The stages were examined on several behaviour change variables at the one-month follow-up. As shown in Table 13, the stages did not differ on the total number of smoke-free days, or 24-hour quit attempts, over that month. They did differ, however, on reductions in their smoking; those in preparation reported more days of cutting back than did precontemplators, $F(2, 137) = 3.11$, $p < .05$. In addition to having the most days of reduction, preparers also reported reductions of greater magnitude[33] than did precontemplators, $F(2, 295) = 6.15$, $p < .01$. When the two types of behaviour change were combined, with smokers reporting quitting *or* reducing, contemplators and preparers had more days of change than did precontemplators, $F(2, 158) = 4.72$, $p < .01$. Participants reported on other behavioural changes as well. Preparers and contemplators indicated that they smoked in fewer places over the month, $F(2, 285) = 8.28$, $p < .001$, and got less enjoyment from cigarettes, $F(2, 285) = 13.04$, $p < .0001$, than did precontemplators. The stages did not differ on the amount of each cigarette smoked, nor on the depth of inhalation.

For the most part, smokers in the three stages differed from each other in predictable ways, with the somewhat surprising exception of contemplators' higher smoking rates. Most importantly, follow-up changes in smoking behaviour were in the direction that one would expect, as smokers in preparation exceeded the others on their reduction activity, and smokers in precontemplation reported the least change overall. In addition, although contemplators reported smoking more heavily than did precontemplators at the baseline, their follow-up change efforts tended to exceed those of precontemplators; where these differences were not significant, the trends were typically in the direction expected, with contemplators showing the greater effort toward change.

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[33] The percent reduction in smoking from baseline to follow-up was computed from participants' reports of cigarettes consumed per day over the past week.

Table 13

Stages of Change – Follow-up Behaviour Change

	Mean (Standard Deviation)		
	PC	C	PREP
Number of smoke-free days	4.2 $_{a}$	8.1 $_{a}$	6.2 $_{a}$
	(3.5)	(6.5)	(5.9)
Number of reduced-smoking days	6.1 $_{a}$	9.7 $_{a,b}$	11.1 $_{b}$
	(4.7)	(7.6)	(8.6)
Percent reduction in smoking	4.0 $_{a}$	12.0 $_{a,b}$	22.3 $_{b}$
	(24.3)	(28.7)	(44.7)
Total days quit or reduced	6.5 $_{a}$	11.1 $_{b}$	12.7 $_{b}$
	(4.6)	(8.6)	(9.7)
Number of places in which one smoked [a]	0.1 $_{a}$	-0.2 $_{b}$	-0.3 $_{b}$
	(0.5)	(0.5)	(0.5)
Enjoyment from smoking	-0.1 $_{a}$	-0.4 $_{b}$	-0.5 $_{b}$
	(0.4)	(0.6)	(0.6)
Amount of each cigarette smoked	-0.1 $_{a}$	-0.1 $_{a}$	-0.2 $_{a}$
	(0.4)	(0.5)	(0.5)
Depth of inhalation	0.0 $_{a}$	-0.0 $_{a}$	-0.1 $_{a}$
	(0.2)	(0.3)	(0.4)

Note. Follow-up data were collected one month after the baseline data. Means in the same row that have different subscripts differ significantly at $p < .05$ by Tukey HSD comparisons.

[a] This and the remaining three items were measured on a three-point scale (1 = increased; 0 = remained the same; -1 = decreased); thus, lower scores indicate positive behaviour changes.

In the present study, both the cross-sectional and the longitudinal claims for stage-specificity of the processes were tested. Cross-sectionally, the process-use patterns of the smokers in precontemplation, contemplation, and preparation were compared[34]. The degree to which the stages differed qualitatively vs. quantitatively on these patterns was explored, and the specific cross-sectional hypotheses offered in Prochaska et al.'s integration were tested. Longitudinally, the power of the processes to predict changes in stage and in smoking-related outcomes over time was examined. The degree to which these effects were stage-specific, or stage-based, was explored, and the specific longitudinal hypotheses offered in Prochaska et al.'s integration were tested. The findings from the cross-sectional analyses will be presented first, followed by the longitudinal findings.

Cross-Sectional Analyses: Is there Stage-Specificity in Smokers' Use of the Processes of Change?

Prochaska and his colleagues believe that smokers in different stages of change have different feelings, thoughts, and behaviours relevant to their smoking. As a result, they will tend to use the processes of change differently – that is, in ways that reflect their stage of change. This claim implies qualitative differences across the stages rather than merely quantitative ones, although the latter might exist. In other words, smokers in different stages are expected to use *different* processes, not just to use the processes to different degrees. Each stage will therefore endorse some processes strongly – those most relevant to their stage – and will endorse others to a significantly lesser degree.

Prochaska et al.'s hypotheses about what these process-to-stage relationships should look like are offered in their integration, shown in Table 2. First, they specify that contemplators should demonstrate strong endorsement of three processes: consciousness raising, dramatic relief, and environmental reevaluation. For convenience, in the present study these are termed the contemplator processes. If contemplators are likely to use these processes, it follows that they should be less likely to use the remaining seven processes (a

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[34] As noted earlier, the present study is restricted to current smokers who, by definition, can only occupy one of

within-stage comparison). In addition, individuals in other stages should be less likely than contemplators to use the contemplator processes (a between-stage comparison).

Second, the integration suggests that preparers are likely to endorse one process, self-reevaluation. In the present study, this is termed the preparation process. If preparers are likely to use this process, it follows that they should be less likely to use the remaining nine processes (a within-stage comparison). In addition, individuals in other stages should be less likely than preparers to endorse the preparation process (a between-stage comparison).

The first stage, precontemplation, is a special case to which the above reasoning about cross-sectional stage-specificity does not apply. The integration shows only longitudinal, predictive information for precontemplators (i.e., that three processes will help them move to contemplation), not cross-sectional, or descriptive information about their process activity. In contrast with the other stages, Prochaska et al. consider precontemplators to be characterized by their *lack* of endorsement of the processes. Therefore, while precontemplators can be used as a point of comparison for the other stages, they are not considered by the integration to have any characteristic pattern of process use.

It is clear that, in order to fully test the cross-sectional claims about process-to-stage-specificity, both the within- and the between-stage comparisons must be examined. However, throughout the TTM literature, these relationships have been only examined with the use of one-way ANOVAs with Tukey post-hoc test. For purposes of comparison, Prochaska et al.'s approach was repeated for the present study. One-way ANOVAs with Tukey post-hoc tests were computed on each of the processes of change for the stages of precontemplation, contemplation, and preparation. As can be seen in Table 14, the same "general ordering pattern" obtained by DiClemente et al. (1991) and Fava et al. (1995) was obtained in the present study. One cognitive and three behavioural processes received significantly increasing degrees of endorsement across the three stages. For five of the remaining six processes, a trend of increasing means across the stages was observed, with a significant difference obtained for one pair of adjacent stages rather than for two. Finally, the process of social liberation did not distinguish among any of the three stages.

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these three stages of change.

Table 14

Stage Comparisons on the Processes of Change

	PC (n = 90)	C (n = 198)	PREP (n = 98)	F (2, 383)
Cognitive Processes				
Consciousness raising	2.5 $_a$	3.4 $_b$	3.5 $_b$	32.00 ***
Dramatic relief	1.9 $_a$	2.7 $_b$	2.9 $_b$	23.16 ***
Environmental reevaluation	1.9 $_a$	2.3 $_b$	2.3 $_b$	4.27 **
Self-reevaluation	2.2 $_a$	3.5 $_b$	4.1 $_c$	74.18 ***
Social liberation	4.4 $_a$	4.1 $_a$	4.1 $_a$	3.08
Behavioural Processes				
Self-liberation	2.4 $_a$	3.4 $_b$	3.9 $_c$	59.62 ***
Reinforcement management	1.7 $_a$	1.9 $_a$	2.5 $_b$	14.20 ***
Helping relationships	2.3 $_a$	2.4 $_a$	2.9 $_b$	6.71 ***
Counterconditioning	2.1 $_a$	2.4 $_b$	2.9 $_c$	18.24 ***
Stimulus control	1.2 $_a$	1.8 $_b$	2.3 $_c$	32.02 ***

Note. All variables were measured on a 5-point Likert scale. Means in the same row that have different subscripts differ significantly at $p < .05$ by Tukey HSD comparisons.

*$p < .05$. **$p < .01$. ***$p < .001$.

These findings, like those of Prochaska et al. and Fava et al., strongly refute the claim of stage-specificity that is offered in the integration. Qualitative or "strong" specificity demands that both contemplators and preparers endorse unique sets of processes in relation to the other stages; however, it can be seen simply in the pattern of means that contemplators failed to exceed preparers in their endorsement of *any* of the processes. The expectation that

the stages should endorse different sets of processes has thus failed to receive support in any study to date, including the present one.

However, as discussed earlier, it is possible that a weaker form of specificity might exist that could provide partial support for some of the hypotheses in the integration. Specifically, within the context of the strong quantitative distinctions among the stages, some weaker qualitative differences might emerge that could discriminate smokers qualitatively from smokers in a stage *below* them in the continuum (as described earlier on page 39). Compared to the strong qualitative specificity hypothesized by Prochaska et al., weaker degrees of specificity would be far less compelling theoretically, and would be much less useful to practitioners wishing to target their interventions to stage. However, this issue remains worthy of examination in order to fully explicate the nature of the process-to-stage relationships.

In the search for a weaker degree of specificity among the first three stages, three hypotheses could be tested. First, although contemplators in the present study endorsed seven of the ten processes more strongly than did precontemplators, as shown in Table 14, it may be that this effect was strongest for the three contemplator processes. Second, although smokers in preparation exceeded contemplators on their endorsement of six of the ten processes in the present study, it may be that this effect was strongest for the preparation process, self-reevaluation. Finally, smokers in preparation can be compared to those in precontemplation; although preparers exceeded precontemplators on their endorsement of nine of the ten processes in the present study, it may be that this effect was strongest for the preparation process.

How should these questions be tested? In the present study, both the between-stage and the within-stage relationships were examined from a multivariate perspective. Repeated-measures MANOVA (O'Brien & Kaiser, 1985) was used to conduct a series of multivariate contrasts comparing pairs of stages on their patterns of process use[35]. Each stage that is

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[35] The more traditional mixed-model ANOVA approach would be unsuitable for this analysis as its assumptions of sphericity among the repeated measures (here, the processes of change) would be violated. The MANOVA

expected to endorse a particular set of processes (i.e., contemplation and preparation) was compared to the stages below them in the continuum, one at a time, on their use of those processes. Coded vectors were used to indicate the sets of processes under examination. For example, for testing hypotheses related to the endorsement of the contemplator processes, the weights of the contrast indicated that the three contemplator processes should be compared to the remaining seven.

A significant effect for a given contrast would indicate an interaction between stage and process – specifically, that the stages differed in their use of the sets of processes specified by the contrast. For example, in a comparison of contemplators with precontemplators, a significant effect on the contemplator process contrast would suggest that contemplators and precontemplators differed in the levels of endorsement that they gave to the three contemplator processes vs. the seven non-contemplator processes.

A significant interaction, however, indicates only that there is *some kind* of difference between individuals in each stage on the pattern of process use in question. To support the hypothesis, the interaction must take the form specified by the integration – that is, contemplators must exceed precontemplators most on their endorsement of the contemplator processes, and preparers must exceed smokers in precontemplation and contemplation most on their endorsement of the preparer process. Each of the analyses that follow will be accompanied by a graphical depiction of process use by stage in order to permit a full understanding of the nature of the effects that emerged.

It should be noted that this analytic approach, while more complicated than the one-way ANOVAs favoured by Prochaska and his colleagues, is more consistent with their assertions about the model. Their hypotheses in the integration involve statements about *sets* of processes rather than single processes in isolation; if multiple dependent variables need to be considered simultaneously, a multivariate approach is indicated. In addition, Prochaska et

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method for analyzing repeated measures handles the dependent measures in a manner that is free of these assumptions (O'Brien & Kaiser, 1985).

al. speculate on both between-stage and within-stage effects; an approach that can analyze both types of effect simultaneously is required[36].

Are contemplators distinguished by their use of the "contemplator processes?" A multivariate contrast was conducted to compare contemplators to precontemplators on their endorsement of the three contemplator processes vs. the remaining seven. The mean processes of change for contemplators and precontemplators are shown in Figure 5. Because this analysis considers all 10 processes simultaneously, this and the following figures will show all of the processes rather than the subset that was used earlier for illustrative purposes in Figure 1 through Figure 4. For clarity, the processes are plotted on the × axis, and the lines represent the two stages being compared. The three contemplator processes are marked with a star (★), while the remaining seven processes, presumed *not* to be associated with contemplators, are unmarked. The stage of interest, contemplation, is represented by a solid line while the comparison stage, precontemplation, is represented by a dotted line.

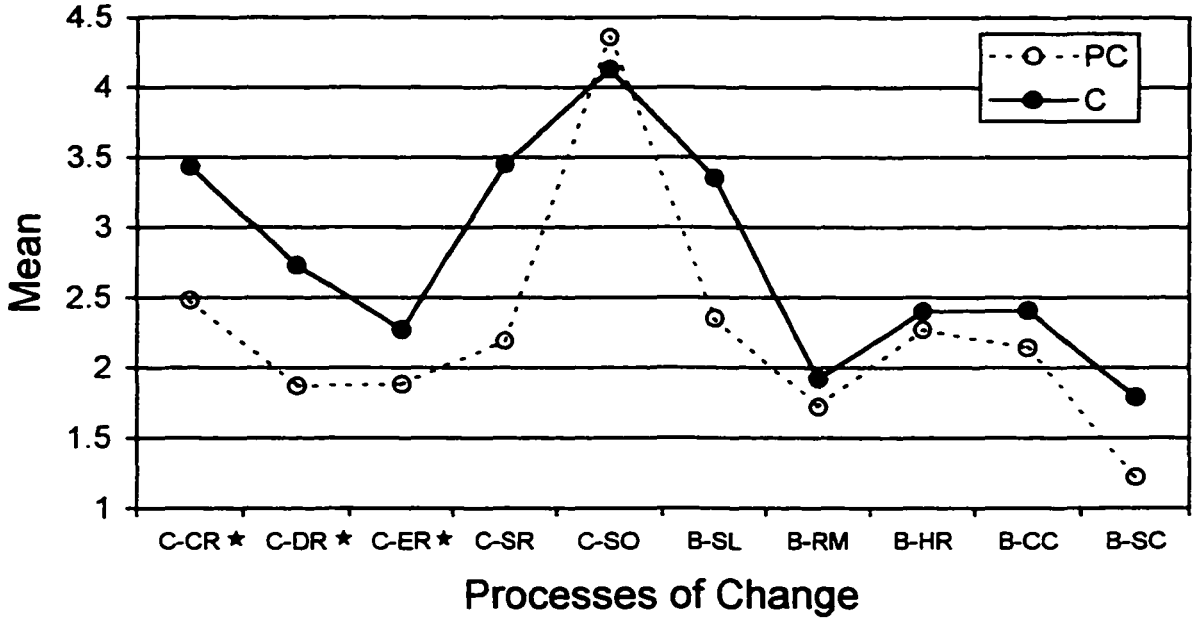
The contrast compared the mean of the vertical distances between the "contemplator" line and the "precontemplator" line on the three contemplator processes to the mean of the vertical distances between these lines on the seven remaining processes. This effect was significant, indicating that contemplators and precontemplators varied in their use of these two sets of processes, $F(1, 285) = 9.48$, $p < .01$.

This significant stage by contemplator-process contrast merely indicates the presence of an interaction; as can be seen in the figure, the lines depart significantly from parallel. However, in order to determine whether the interaction supports the claims of the TTM, it is necessary to examine the nature of the interaction. For support of the model, the interaction should show that contemplators exceeded precontemplators *more* on the use of the contemplator processes than on the remaining seven.

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[36] In fact, while this repeated-measures MANOVA strategy is being employed here to test the degree of weaker support for specificity, it would also have been required for testing the original, stronger claims of specificity had the one-way ANOVAs not refuted the claim of specificity at the level of each process (i.e., had contemplators exceeded preparers on some of the processes).

Figure 5. Mean Processes of Change for Precontemplators and Contemplators.



How can this be determined? The computed value of the contrast will indicate whether the stages differed more on the contemplator processes than on the remaining seven. It was noted above that the contrast compared the mean of the vertical distances between the two lines on the three contemplator processes to the mean of the vertical distances between these lines on the seven remaining processes. The *value* of the contrast equals the difference between these two mean distances. The coded vectors for all contrasts were such that, if the hypothesis were to be supported, the value of the contrast would be positive. For example, if the largest contemplator–precontemplator difference was found on the contemplator processes, as the hypothesis suggests, the value would be positive. If the results indicated a pattern counter to the hypothesis (i.e., if these stages differed most on the seven non-contemplator processes), then the value of the contrast would be negative.

The computed value of this contrast was positive, indicating an effect in the direction of the hypothesis. Specifically, contemplators exceeded precontemplators more on their endorsement of the three contemplator processes than on the remaining seven.

How strongly does this significant interaction support the model? Figure 5 suggests a rather equivocal pattern of results. Although the contrast did indicate that contemplators exceeded precontemplators more on their endorsement of the contemplator processes than on the remaining seven, as the hypothesis suggests, the data also show that the stage differences on the remaining processes were not small, particularly in the case of self-reevaluation. The simple effects analyses presented earlier in Table 14 indicated that contemplators exceeded precontemplators on four of the seven processes that are supposedly not associated with contemplation. Thus, while the results are consistent with Prochaska et al.'s hypothesis, they are not *strongly* so. Endorsement of the contemplator processes may not be the only way to describe the differences between contemplators and precontemplators.

In fact, the means shown in Figure 5 suggest that contemplators could also be distinguished from precontemplators on their endorsement of the cognitive vs. behavioural processes. A post-hoc contrast comparing these two stages on their use of the cognitive vs. behavioural processes was indeed significant, $\underline{F}\,(1, 285) = 6.07$, $\underline{p} < .01$. The value of the contrast was positive, indicating that contemplators exceeded precontemplators more on their use of the cognitive than the behavioural processes.

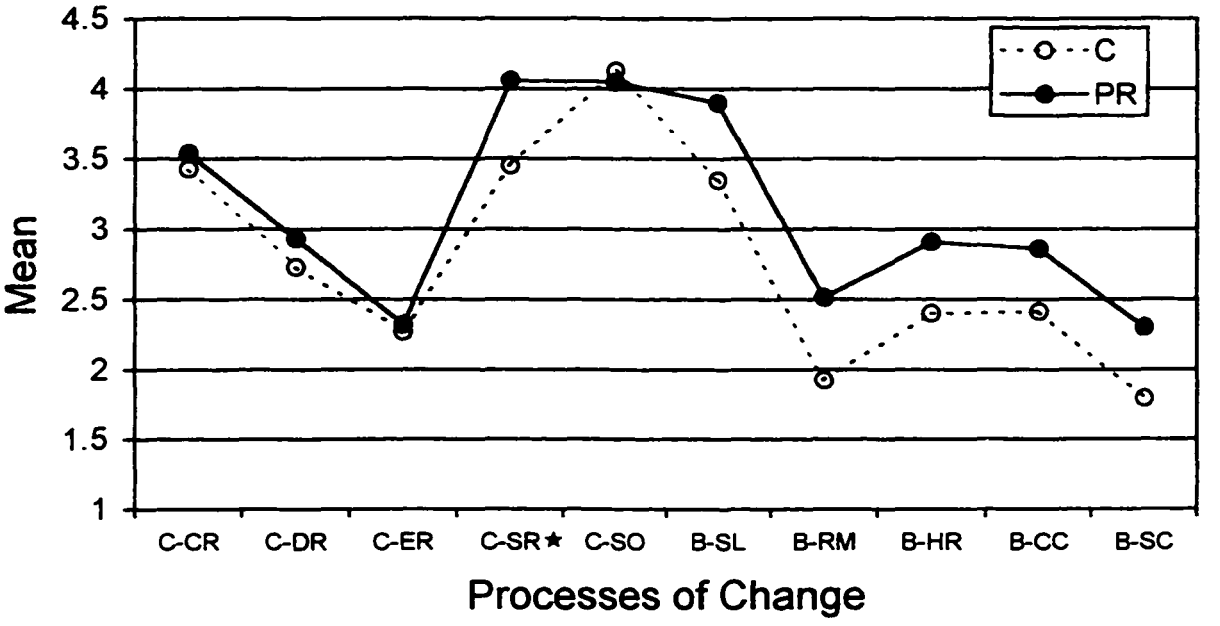
Which is the "better" representation? This would be more easily answered if the finding in support of the integration (i.e., the contemplator processes) had been stronger. The integration proposes a differentiated view of contemplators in relation to precontemplators – that they are characterized by the endorsement of a subset of cognitive process. However, the support available here for the cognitive vs. behavioural distinction was equally strong, suggesting only a broad level of stage-specificity – that contemplators can be distinguished from precontemplators mainly on their use of the entire set of cognitive vs. behavioural processes. This latter finding speaks against the notion of a finer-tuned matching to stage, and it is unfortunate for the model that it may be an equally valid way to explain contemplator–precontemplator differences.

Are preparers distinguished by their use of the "preparation process?" A multivariate contrast was conducted that compared preparers to contemplators on their use of the preparation process. Figure 6 shows the mean processes of change for these two stages. The

preparation process, self-reevaluation, is marked with a star (★), and the stage of interest, preparation, is represented by a solid black line.

The stage-specificity hypothesis from the integration suggests that, compared to contemplators, preparers should be characterized by a strong endorsement of the process of self-reevaluation, and lesser endorsement of the remaining nine processes. This stage by preparation-process contrast was significant, $F(1, 293) = 6.23$, $p < .01$, with the positive value of the contrast indicating that the largest difference between the stages emerged for the process of self-reevaluation. This is consistent with the hypothesis.

Figure 6. Mean Processes of Change for Contemplators and Preparers.



However, as is evident from the figure and from the one-way ANOVAs reported in Table 14, preparers exceeded contemplators on *all* of the behavioural processes, an important effect that is lost in the MANOVA when the contrast specified by the integration is tested. Specifically, the interaction tested here was significant in the direction proposed by Prochaska et al. because the integration considers the five mismatched behavioural processes to be *equally* as uncharacteristic of preparers as the four mismatched cognitive processes, something that certainly is not supported by these data. When the mean differences between the stages on

these nine processes were averaged together, the strong difference between them on the behavioural side was cancelled out by their lack of differentiation on the cognitive side.

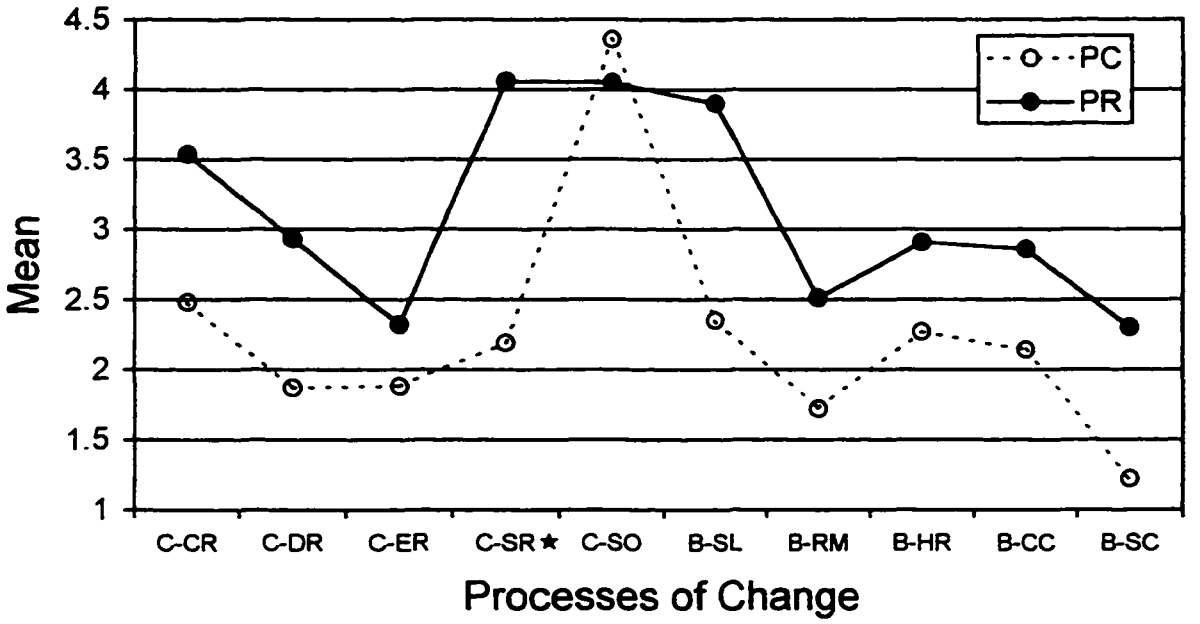
This pattern of means suggests that, rather than self-reevaluation alone, preparers are more strongly distinguished from contemplators by their use of self-reevaluation *and* the remaining behavioural processes. A post-hoc contrast examining this set of six processes vs. the remaining four was highly significant, $F(1, 293) = 30.34$, $p < .0001$, with the positive value of the contrast indicating that preparers exceeded contemplators more on their endorsement of the six processes than of the four.

The six-vs.-four pattern of process endorsement received stronger support than did the integration hypothesis. However, the analysis of this pattern was post-hoc; further studies would be needed to replicate this effect. Prochaska et al.'s a priori hypothesis in the integration did identify the one cognitive process that most distinguished preparers from contemplators; however, the strong distinction between these stages on the behavioural processes cannot be ignored. Thus the support available for the integration hypothesis – the preparers should be characterized primarily by their use of self-reevaluation – was extremely weak in the present study.

Preparers were also compared to precontemplators on their use of the preparation process. The process use patterns of these two stages are contrasted in Figure 7. As before, the stage of interest, preparation, is shown by a solid black line and the comparison stage, precontemplation, is indicated by a dotted line. Self-reevaluation, the process presumed to characterize preparation, is marked with a star (★).

The effect was highly significant, $F(1, 186) = 76.35$, $p < .0001$, indicating that these two stages differed in their pattern of responses to self-reevaluation vs. the remaining nine processes. The positive value of the contrast indicated that the difference between the stages on the process of self-reevaluation was larger than the mean of the differences across the remaining nine processes, consistent with the hypothesis.

Figure 7. Mean Processes of Change for Precontemplators and Preparers.



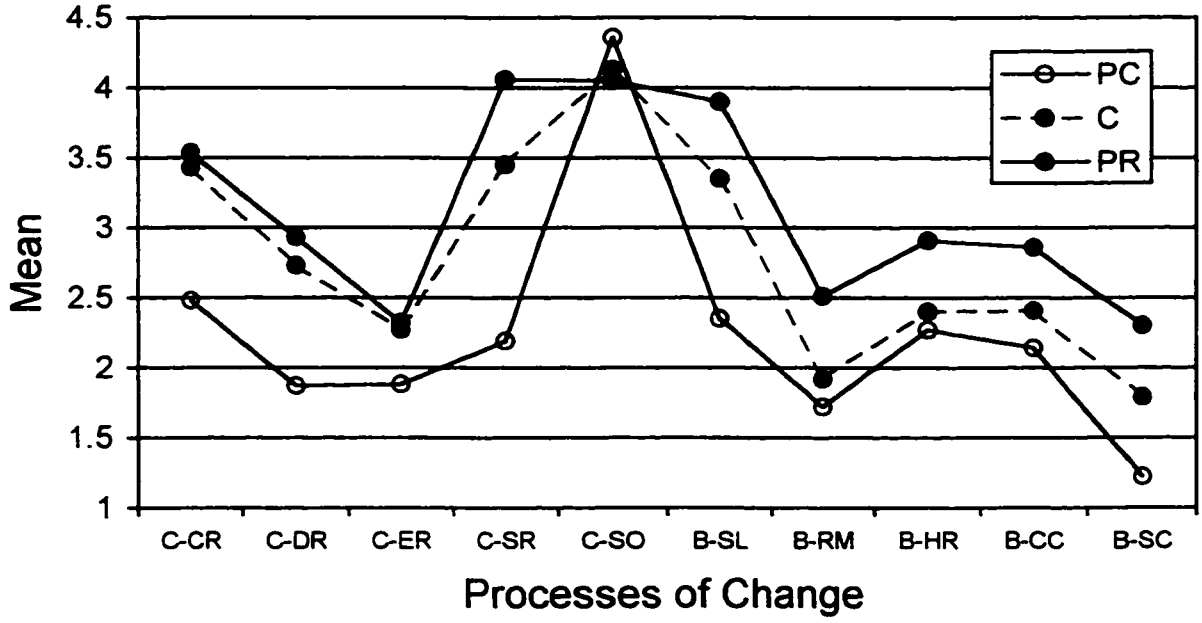
This result appears to offer some support for the specificity hypothesis for preparation. When compared to precontemplators, preparers' use of self-reevaluation stood out to a greater degree than did their use of the remaining processes considered as a set. In particular, when only the cognitive processes are considered, preparers were clearly distinguished by their use of self-reevaluation, as Prochaska et al. hypothesized.

However, this support for the integration is strongly tempered by the fact that preparers exceeded precontemplators on their endorsement of no fewer than *eight* other processes. Figure 7 suggests that the difference between these two stages lies predominantly in the main effect: preparers simply used the processes more than did precontemplators. However, if one were to look for qualitative differences between the stages despite this main effect, then these data would suggest a combination of self-reevaluation and self-liberation, rather than self-reevaluation alone. A post-hoc contrast comparing these stages on their endorsement of those two processes vs. the remaining eight was highly significant, $F(1, 186) = 118.53$, $p < .0001$, with the positive value of the contrast indicating that preparers exceeded precontemplators more in their endorsement of self-reevaluation and self-liberation than in their endorsement of the remaining eight processes. Thus, while the integration suggests that only self-reevaluation

characterizes the change activity of preparers, the present study indicates that, within a very strong main effect of stage, there is support for the view that preparers can be distinguished from precontemplators on their use of self-reevaluation *and* self-liberation.

Summary. Can the stages be distinguished from each other on the nature of their process activity? The hypothesis of stage-specificity of the processes proposes that both contemplators and preparers should endorse different sets of processes in relation to the other stages. However, the one-way ANOVAs presented in Table 14 were sufficient to refute the specificity hypothesis; the mere fact that contemplators never exceeded preparers on any of the processes was sufficient to invalidate the claim of qualitative differences among the stages. There can be no strong specificity of processes to stages if there is a main effect of stage, or a trend toward a main effect of stage, for virtually *every* process. This pattern of effects is illustrated for all three stages in Figure 8.

Figure 8. Mean Processes of Change for Precontemplators, Contemplators, and Preparers.



A search for a weaker form of specificity was therefore initiated. Although the general ordering pattern refuted the notion of purely qualitative specificity, it was suggested earlier that a weaker form of qualitative specificity might exist alongside the strong quantitative

differences. This weaker form of stage-specificity could only emerge for comparisons of a particular stage with the stages *earlier* in the continuum. For example, while the process activity of contemplators could not be distinguished qualitatively from that of preparers due to the fact that preparers equaled or exceeded contemplators on every process, contemplators *could* be characterized by the nature of their process use relative to precontemplators. Although contemplators exceeded precontemplators on seven of the ten processes in the present study, weaker specificity would be present if contemplators exceeded precontemplators *most* on the three contemplator processes. This weaker form of qualitative specificity, accompanied by the strong main effect of stage across all of the processes, was illustrated earlier in Figure 4 on page 40.

However, the analyses detailed above provided only minimal support for this weaker degree of stage-specificity in the model. Contemplators, relative to precontemplators, were equally well distinguished by a larger set of processes (cognitive vs. behavioural) as by the smaller, specific set proposed in the integration (consciousness raising, dramatic relief, and environmental reevaluation). Preparers, relative to contemplators, were characterized by self-reevaluation, as the integration suggests, but *also* by the entire set of behavioural processes. Finally, preparers, relative to precontemplators, were primarily characterized by the intensity of their change efforts, and only secondarily by the nature of those efforts. Even within this large stage effect, the nature of preparers' process endorsement suggested that they were discriminated as much by their use of self-liberation as they were by their use of the preparation process, self-reevaluation.

These analyses suggest that, even when a weaker degree of specificity of processes to stages is tolerated, the evidence for the cross-sectional hypotheses in the integration is minimal. Smokers in different stages of change are characterized primarily by their quantitative differences on the processes of change. The minor qualitative differences that were observed either failed to match the relationships specified in the integration, or were based upon large rather than small sets of processes.

Longitudinal Analyses: Is there Stage-specificity in the Processes as Predictors of Change?

Although the present study did not obtain support for stage-specificity of processes cross-sectionally, it may be that there is specificity in the extent to which the processes can

predict change over time. That is, whether or not the stages differ on the nature of the change activities that they usually engage in, perhaps they differ on the kinds of processes that are most helpful. The cornerstone of the model, according to its developers, is that it provides a framework for maximizing outcome by targeting interventions to the needs of the smoker. "Once it is clear what stage of change a client is in, the therapist would know which processes to apply in order to help the client progress to the next stage of change" (Prochaska & DiClemente, 1986, p. 8). The degree of support for this claim was investigated in the present study.

Predicting Stage Movement With The Processes Of Change

The stage-specificity hypothesis predicts that, for each stage, there should be a set of facilitative processes that will assist with the task of stage movement, and a set of irrelevant or unhelpful processes that will not facilitate stage movement. In the present study, smokers were coded according to their stage movement by the one-month follow-up[37]. They were coded as "advanced" if they moved ahead at least one stage, and "not advanced" if they either remained in the same stage or regressed to an earlier stage by the follow-up[38]. Within each stage, t-tests were used to compare individuals demonstrating each type of stage movement on their use of the processes of change. The question of interest was the degree to which the processes were associated with stage advancement. In the following analyses, a positive mean difference between advancers and non-advancers on a given process would suggest that the process was associated with advancement. Correspondingly, a negative mean difference would suggest that a process was associated with non-advancement. A mean difference near zero would indicate that a process failed to discriminate between advancers and non-advancers.

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[37] Data were collected for two follow-up phases, at one month and at two months; however the drop-out rate of 30% per wave resulted in an insufficient sample size for the detection of stage movement. Thus, the data from the second follow-up were not used.

[38] The TTM literature does not offer guidance about which of the two types of "failed" stage movement, stagnation within a stage, or regression to an earlier stage, should provide the best comparison for stage advancement in tests of the effects of the processes. Therefore, both types of failed movement were combined here in order to maximize power. Because the only type of failed movement that precontemplators can experience is

Among precontemplators, the nine individuals who did not change stage were compared with the 5 individuals who advanced on their use of the 10 processes of change[39]. Table 15 shows the processes ranked in order of mean differences between the two groups; those processes with higher mean differences were those that were used more (at the baseline) by precontemplators who eventually advanced than by those who did not advance.

Table 15

Mean Processes of Change By Type of Stage Movement for Precontemplation

(N = 14)

Process of Change	Advancers (n = 5)	Non-Advancers (n = 9)	Difference	t
Dramatic Relief (C)★	2.30	1.72	.58	1.00
Self-Reevaluation (C)	2.90	2.39	.51	.65
Stimulus Control (B)	1.70	1.28	.42	1.04
Counterconditioning (B)	2.60	2.22	.38	.82
Reinforcement Management (B)	1.80	1.44	.36	1.10
Environmental Reevaluation (C)★	2.00	1.67	.33	.52
Self-Liberation (B)	2.40	2.17	.23	.48
Consciousness Raising (C)★	2.70	2.50	.20	.41
Social Liberation (C)	4.40	4.33	.07	.15
Helping Relationships (B)	2.70	2.78	-.08	-.10

Note. (C) = Cognitive process of change; (B) = Behavioural process of change; ★ = Process matched to precontemplation stage.

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stagnation within a stage, this combination of stagnation and regression was used only in the analyses for the contemplation and preparation stages.

[39] Due to a clerical error, of the 298 individuals who provided data at the one-month follow-up, only 140 were assessed on variables that permitted assignment to a stage at follow-up. The precontemplation stage is the least well represented of the stage as a result of this error. Stage-movement analyses for this stage are therefore tentative.

The processes that the integration suggests should most help precontemplators – consciousness raising, dramatic relief and environmental reevaluation – are marked with a star (★). None of the comparisons reached statistical significance, an unsurprising result given the very low power of this analysis. Despite this, a trend can be observed: because almost all of the mean differences are positive, those who advanced tend to use the processes more than did those who did not advance. The processes of dramatic relief and self-reevaluation showed the highest mean differences between advancers and non-advancers; although highly speculative, it may be that these processes are particularly helpful to precontemplators in their efforts to change stages.

Among contemplators, the 76 individuals who did not change stage were compared with the 10 individuals who advanced at least one stage on their use of the processes of change. Table 16 shows the processes ranked in order of mean differences, with the process matched to contemplation marked with a star (★). Two of the effects approached significance: the behavioural process of self-liberation, $t(84) = .170$, $p < .10$, and the cognitive process of social liberation, $t(84) = 1.88$, $p < .10$ were marginally associated with stage advancement for contemplators. These results tentatively suggest that the more contemplators told themselves they could change their smoking habits, and the more they noticed the support that the environment offers for these changes, the more likely they were to advance. For seven of the remaining eight processes, a trend emerged that suggests that contemplators who advanced tended to endorse these processes to a greater degree than did contemplators who did not advance. One process, dramatic relief (feeling emotionally moved by the hazards of smoking), demonstrated a sizeable negative mean difference, suggesting that it may be associated with a failure to advance among contemplators. This finding is consistent with the model; dramatic relief is a process that smokers are presumed to use while in the contemplation stage, and Prochaska et al. (1992) have suggested that the continued use of processes associated with one's own stage, instead of the stage ahead, will lead to detrimental outcomes.

Table 16

Mean Processes of Change By Type of Stage Movement for Contemplation

(N = 86)

Process of Change	Advancers (n = 10)	Non-Advancers (n = 76)	Difference	t
Self-Liberation (B)	3.80	3.23	.57	1.70†
Social Liberation (C)	4.60	4.04	.56	1.88†
Stimulus Control (B)	2.15	1.72	.43	1.43
Environmental Reevaluation (C)	2.50	2.11	.39	1.05
Counterconditioning (B)	2.60	2.36	.24	.82
Self-Reevaluation (C)★	3.70	3.51	.19	.49
Reinforcement Management (B)	2.05	2.00	.05	.14
Consciousness Raising (C)	3.50	3.48	.02	.06
Helping Relationships (B)	2.25	2.40	-.15	-.35
Dramatic Relief (C)	2.10	2.63	-.53	-1.35

Note. (C) = Cognitive process of change; (B) = Behavioural process of change; ★ = Process matched to contemplation stage.

† Effect was marginally significant ($p < .10$).

Finally, among smokers in the preparation stage, the process use of the 32 non-advancers was compared with that of the eight advancers. Although none of the comparisons reached statistical significance, the pattern of findings presented in Table 17 is suggestive of an interesting trend: it appears that fewer of the processes are associated with advancement for preparation than for the previous two stages. Among preparers, only dramatic relief, self-liberation (the matched process, marked with a star), and consciousness raising were used to somewhat stronger degrees by advancers than non-advancers. One process, reinforcement management (experiencing rewards for nonsmoking behaviour), may be negatively associated with advancement for preparers. The positive effect of dramatic relief for preparers is particularly surprising, as it is a process that the integration recommends for precontemplators, two stages earlier in the continuum. In addition, while reinforcement management was not

recommended for preparers in the integration, it is odd that a behavioural process rather than a cognitive one should have the strongest negative effect for this stage. Preparers, of all the stages examined in the present study, are the most ready to begin changing their behaviour.

Table 17

Mean Processes of Change By Type of Stage Movement for Preparation

(N = 40)

Process of Change	Advancers (n = 8)	Non-Advancers (n = 32)	Difference	t
Dramatic Relief (C)	3.50	2.83	.67	1.43
Self-Liberation (B)★	4.13	3.66	.47	1.36
Consciousness Raising (C)	3.94	3.53	.41	1.05
Helping Relationships (B)	3.44	3.28	.16	.30
Self-Reevaluation (C)	4.19	4.14	.05	.18
Stimulus Control (B)	2.38	2.34	.04	.08
Environmental Reevaluation (C)	2.38	2.39	-.01	-.04
Social Liberation (C)	4.06	4.16	-.10	-.34
Counterconditioning (B)	2.75	2.88	-.13	-.38
Reinforcement Management (B)	2.13	2.83	-.70	-1.33

Note. (C) = Cognitive process of change; (B) = Behavioural process of change; ★ = Process matched to preparation stage.

Summary

What do the above analyses suggest about process use and stage movement? Low power for the precontemplation and preparation stage analyses permits only the most tentative speculations; these effects must be tested on a larger number of participants in order to clarify the relationships that may be present. The trends in the data, however, suggest that precontemplators might be helped by several of the processes of change in their efforts to shift stages; for this stage, several of the comparisons resulted in a positive mean difference

between advancers and non-advancers. The data for preparers, on the other hand, suggested a more differentiated picture, with some positive and some negative values emerging. It may be that smokers in this stage need to take greater care to use certain processes and to avoid others, a differentiated relationship of the sort that Prochaska et al. would wish to find. Finally, the analysis of 86 contemplators provided only marginal support for the notion that certain processes "stand out" as facilitative of change for this stage. This was also a relatively low-power analysis. However, despite the failure of the effects to reach statistical significance, there is tentative evidence that the processes might function differentially for this stage, as the mean differences varied in size and featured both positive and negative influences.

The above analyses explored the possibility that the processes might be associated with stage advancement. However, the model makes specific claims about *which* processes should be helpful to each stage. As detailed earlier, these relationships are shown in the integration of the processes with the stages in Table 2. The processes that are shown "spanning" two stages are considered to be "matched" or helpful to the smokers moving from the earlier stage to the later one. The processes that do not appear in a particular span are "mismatched" to that transition, and are presumably irrelevant or even detrimental to smokers in that stage.

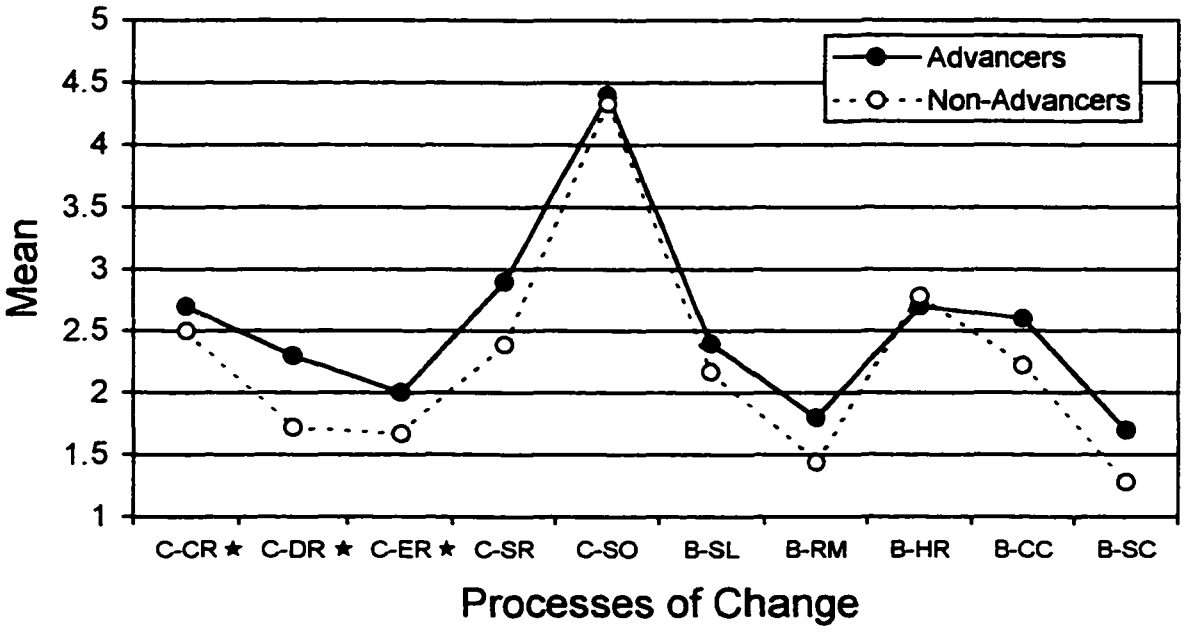
Three specific hypotheses therefore pertain to the stages investigated in the present study. First, the processes of consciousness raising, dramatic relief, and environmental reevaluation are matched to precontemplation; they are expected to be more strongly associated with stage movement for precontemplators than are the remaining seven processes. Second, for contemplators, the matched process of self-reevaluation should be more strongly associated with change than should the remaining nine mismatched processes. Third, for those in preparation, the matched process of self-liberation should be more helpful than the mismatched processes.

These hypotheses were tested in the present study using repeated-measures MANOVA. Multivariate contrasts were conducted to compare advancers with non-advancers within each stage on their use of the matched vs. mismatched processes of change. Coded vectors were used to indicate which sets of processes were considered matched and which were considered mismatched for each stage. Note that these are the same data examined in the series of t-tests

above; in the present analyses, however, more focused contrasts were conducted in order to test the more specific claims that the model makes about which processes should be facilitative of change for each stage.

Among precontemplators, a multivariate contrast compared the five smokers who advanced with the nine non-advancers on their use of matched processes (consciousness raising, dramatic relief, and environmental reevaluation), vs. the mismatched processes (the remaining seven). The means for each group were presented earlier in Table 15, and are shown graphically in Figure 9. The processes that are matched to precontemplation (i.e., presumed to facilitate movement out of this stage) are marked with a star (★), while the seven mismatched processes are unmarked.

Figure 9. Mean Processes of Change by Type of Stage Movement for Precontemplators



In order to obtain support for the stage-matching hypothesis for precontemplators, the difference between the advancers' and non-advancers' use of the matched processes would need to exceed that for the mismatched processes. The contrast therefore compared the mean of the vertical distances between the solid black "Advanced" line and the dotted black "Not Advanced" line on the three matched processes to the mean of the vertical distances between these lines on the seven unmatched processes. A positive value for the contrast would provide

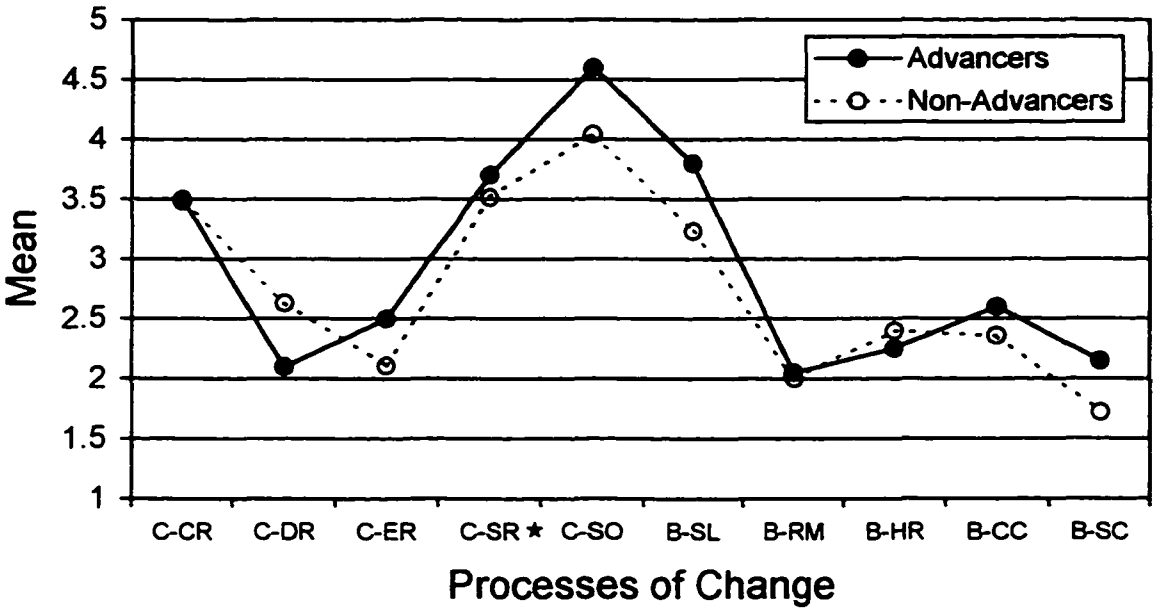
support for the hypothesis, indicating that the largest difference between advancers and non-advancers fell on the "matched" side of the graph. Correspondingly, a negative value would indicate support for the opposite effect – that the stronger between-group differences were found in their use of the mismatched processes.

For precontemplators, this contrast was not statistically significant, $\underline{F}$ (1, 12) = .06, n.s., as could be expected from the low power problem discussed earlier. However, the computed value of the contrast comparing the two groups on the matched vs. mismatched processes was positive, indicating that a weak trend was present in the data in the direction of the hypothesis. In other words, the observed trend suggested that the matched processes were more associated with stage movement for precontemplators than were the mismatched processes. The individual t-tests, shown earlier in Table 15, indicate that only one of the three matched processes, dramatic relief, likely contributed to this weak effect. Thus, for precontemplators, there is some tentative evidence that feeling emotionally impacted by health messages on the hazards of smoking may be predictive of movement to the next stage.

Among smokers who were in contemplation at baseline, a multivariate contrast was conducted to compare the 10 who advanced by the follow-up with the 76 non-advancers on their use of the matched process (self-reevaluation) vs. the mismatched processes (the remaining nine). Means for each group were presented earlier in Table 16, and are shown graphically in Figure 10. The matched process, self-reevaluation, is marked with a star (★).

In order to support the hypothesis, the advancers would have to exceed the non-advancers more on their use of self-reevaluation than on their use of the mismatched processes. This contrast was not statistically significant, $\underline{F}$ (1, 84) = .00, n.s. Contemplators who advanced did not differ in their use of this process from contemplators who did not advance, a finding that clearly fails to support the hypothesis proposed in the integration. However, the tests of the simple effects, shown earlier in Table 16, suggest that a different subset of processes may be important; self-liberation (recommended for preparers) and social liberation (excluded from the integration) were both weakly associated with stage movement for contemplators. It may be that contemplators should strive to remind themselves of their capabilities for change, and should notice how the environment around them supports such

Figure 10. Mean Processes of Change by Type of Stage Movement for Contemplators

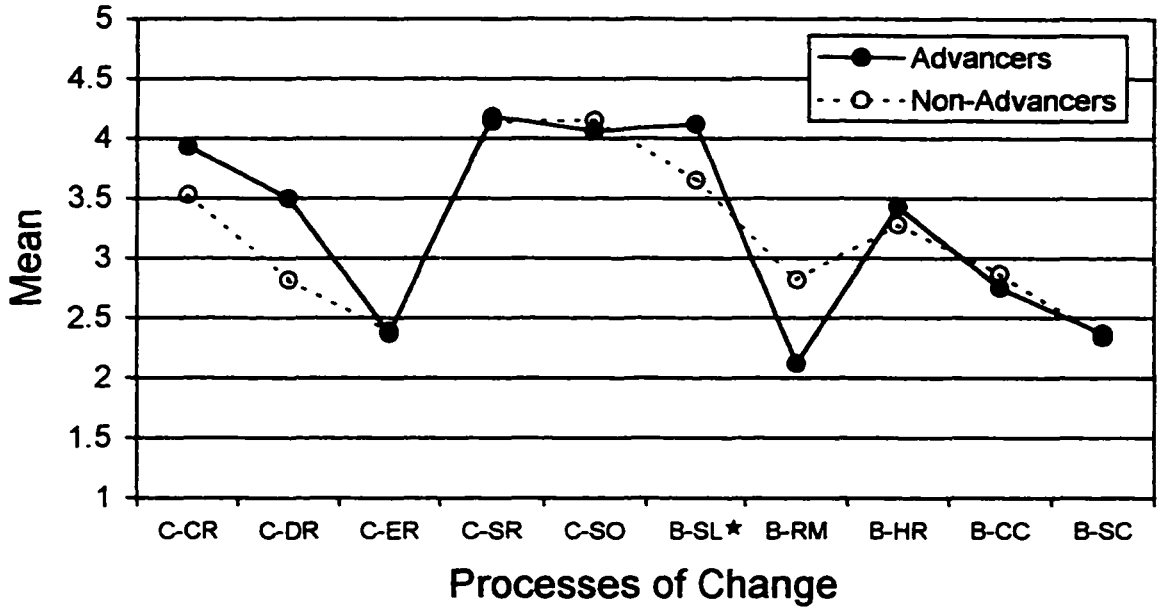


changes, rather than focus on the disappointment they feel in themselves for their smoking behaviour.

Among preparers, a multivariate contrast was conducted to compare 8 advancers with 32 non-advancers on their use of the matched process (self-liberation), vs. the mismatched processes (the remaining nine). Means for each group on all processes were presented earlier in Table 17, and are shown graphically in Figure 11. The matched process, self-liberation, is marked with a star (★).

In order to support the stage-matching hypothesis for preparers that Prochaska et al. proposed in their integration, advancers would have to exceed non-advancers more on their endorsement of self-liberation than on their endorsement of the mismatched processes. This contrast did not reach statistical significance, $F(1, 38) = 1.38$, n.s. The mean differences for the nine processes, when averaged, were roughly equal to that observed between the stages for self-liberation. Thus, there is no evidence that self-liberation was more helpful to preparers than were the other nine processes.

Figure 11. Mean Processes of Change by Type of Stage Movement for Preparers



However, the analysis of simple effects, presented earlier in Table 17, suggested that advancement for preparers *was* associated, to a weak degree, with a *set* of processes rather than a single one. As can be see in the figure, the means for dramatic relief, self-liberation and consciousness raising were higher for advancers than for non-advancers. Also notable, but not proposed by the integration, was the trend toward a negative effect of reinforcement management for preparers.

The failure of this contrast to reach statistical significance does not indicate that there is *no* interaction present between stage and process; instead, it indicates that the specific pattern of the interaction was not as would be predicted by the integration. Recall that these effects were coded to reflect the combination of processes that the integration suggests are important. For preparers, a different set of processes than the one proposed may be important to stage movement. Prochaska et al. chose self-liberation as the process likely to help smokers in the preparation stage; however, these data suggest that it does not stand alone in this function. A trend was evident that suggested that preparers in the present sample were most aided by a combination of three processes, *and* by the avoidance of one behavioural process.

In summary, the above analyses of stage movement provide little support for the hypotheses proposed in Prochaska et al.'s integration. For precontemplators, the three matched processes did not stand out as more strongly predictive of stage movement than did the remaining processes. In fact, only one of these, dramatic relief, showed any tendency toward assisting precontemplators in their change efforts. For contemplators, the matched process was clearly unrelated to advancement; instead, self-liberation and social liberation appeared most likely to be of assistance to smokers in this stage. Finally, for preparers, while the single matched process of self-liberation was associated with change, it could not carry this burden alone; additional processes were used by preparers who moved into action over the time frame of this study. An important caveat, however, is the low power for these analyses. Because stage movement is a low-probability occurrence, and because data reflecting stage membership at follow-up were not available for all participants in the present study, the effects obtained for precontemplators and preparers in particular must be interpreted with caution.

Aside from the problems introduced by the power problem in the present study, there are additional problems associated with the use of stage movement as an outcome indicator. In particular, the degree of stage movement that will be observed may depend upon the frequency of measurement in ways that are not yet understood. Although Prochaska and his colleagues have used follow-up intervals of one month (e.g., DiClemente et al., 1991), six months (e.g., Prochaska et al., 1985), and one year (e.g. Prochaska et al., 1993), the appropriateness of such intervals for the detection of stage movement has not been researched. Too-short measurement intervals run the risk of failing to detect any movement, while too-long intervals raise the possibility that individuals will skip through multiple stages without detection. This problem may also vary by stage; smokers in preparation who intend to change within the next month are more likely to be active during the time between measurements than are precontemplators who do not intend to change in the foreseeable future[40]. A series of

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[40] The propensity for smokers to relapse within the first one to four months after quitting (Marlatt, Curry & Gordon, 1988; Hughes et al., 1992) is pertinent. Smokers in preparation who make a quit attempt but relapse by the six-month or one-year follow-up would be classified at follow-up as unchanged.

short-interval measures over a lengthy period is undoubtedly best, but potentially expensive for researchers and burdensome for participants.

Also unresolved is the interpretation of different patterns of stage movement. Is the stage continuum considered to represent an interval level of measurement? That is, is the transition from precontemplation to contemplation empirically equivalent to the transition from preparation to action? In addition, how should one conceptualize shifts of more than one stage? If an individual shifts from precontemplation to preparation over the course of the measurement interval, will the processes used in precontemplation be considered predictive of movement into contemplation or into preparation?

Finally, it is important to note that, for a subset of smokers, sequential movement through some of the stages is impossible. Specifically, those smokers in contemplation who have not had a quit attempt within the past year *cannot move directly into the preparation stage*; they must enter it via the action stage because of the requirement that smokers in preparation have a quit attempt within the past year. This fact has never been acknowledged or addressed by the developers of the TTM

In the present study, the problems inherent in the study of stage movement were addressed by the use of other indicators of change. The variables that underlie the stage construct, intentions and behaviour, were measured continuously to provide a more sensitive measure of progress among smokers. Continuous measures of outcome are used in numerous models of behaviour change and may provide a more powerful framework for testing the processes' effects on smoking outcomes.

Intentions to change were measured both for the target of quitting, and for reducing smoking[41]. At the one-month follow-up, participants' intentions to quit smoking within the

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[41] Although smoking reduction is not part of the stages construct operationally, the TTM's developers have described cutting back as an important component of movement into and out of the preparation stage (e.g., Perz et al., 1996). Others have pointed to the importance of smoking reduction as a target for change. Millatmal et al. urged researchers to acknowledge that many smokers will not quit, and to consider reduction a worthwhile goal for reducing disease risk (Millatmal et al., 1994). Kozlowski (1989) also pointed to the fact that many smokers enjoy smoking, and that a degree of reduction is possible without invoking withdrawal effects and the compensatory smoking that often results.

next month were measured on a 7-point scale (1 = no, definitely do not intend; 7 = yes, definitely do intend). Intentions to reduce smoking were measured in the same manner.

Two continuous measures of behaviour change were computed. First, although smokers in the first three stages are unlikely to *quit* smoking, they may reduce their smoking. To measure the degree of smoking reduction that occurred over the month, the difference in daily cigarette consumption between the baseline and the follow-up was computed from participants' self-reported estimates of smoking. At baseline, participants reported the number cigarettes they usually smoke per day (CPD). At follow-up, they estimated their CPD over the past week, estimating weekdays and weekends separately in order to aid recall. The follow-up rate was subtracted from the baseline rate to create a difference score, as recommended by Wainer (1991)[42]. Thus, positive values indicate smoking reduction, and negative values indicate an increase in CPD from baseline to follow-up. Because this measure of changes in smoking is coded in the direction of reduction, it is termed "smoking reduction" in the present study.

The second continuous measure of behaviour change was the sum of the number of days over the month that smokers tried to change in some way. At the follow-up, smokers provided estimates of the number of days over the month that they had smoked less than they normally would, and the number of days during which they smoked no cigarettes (these days were not necessarily consecutive). These two estimates were summed, with no values exceeding 30 days. This measure of behaviour is somewhat unusual; however, in order to maximize the possibility of detecting the effects of the processes on outcome, and with the understanding that little behaviour change should occur in the early stages, a liberal index of change was desired. Summing these two types of change attempts provided not only an index

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[42] In his discussion of methods of adjusting for differential base rates across groups, Wainer recommends subtracting the base rate from the follow-up rate when it can reasonably be assumed that the rate would remain stable over time. The intransigence of the smoking habit permits this assumption to be made; thus, in the present study, difference scores are used to reflect changes in smoking behaviour from baseline to follow-up. For the sake of thoroughness, the covariance method, also discussed by Wainer, was also employed in the present study. Any analysis involving a difference score was repeated using the base rate of smoking as a covariate and the follow-up smoking rate as the dependent variable. The pattern of findings for the covariate method were strongly similar to those obtained using the difference score method; therefore, only the difference score analyses will be presented.

of participants' total change efforts, but also an increase in power over that which would be present in an analysis of either type of behaviour alone.

Would Prochaska and his colleagues recommend the use of continuous measures of behaviour in the TTM? Perz, DiClemente, and Carbonari (1996) recognized the importance of using continuous measures of behaviour change for the study of smoking, making use of measures including the duration of the longest quit since the baseline assessment, and the rate of smoking during the past week. In fact, it seems odd that the developers of the TTM, despite their expressed concern over researchers' tendencies to dichotomize smoking behaviour, have dichotomized smoking outcomes in the TTM[43]. The use of continuous measures of behaviour change respects one of the major goals of the model – appreciating the gradual nature of change. Of particular importance to this thesis is the fact that these smaller-scale changes in smoking might be related to strategic (i.e., stage specific) use of the processes of change.

Predicting Intentions And Behaviour With The Processes of Change

Before testing the stage-specific relationships among the processes and these continuous measures of outcome, it will be fruitful to assess the degree of association between the processes and these continuous variables irrespective of stage. These relationships were tested with hierarchical multiple regression. Participants from all three stages were combined, and each of the four outcomes, measured longitudinally at the one-month follow-up, was regressed on the processes of change. The five cognitive processes were entered into the regression equation first, in keeping with Prochaska et al.'s belief that the cognitive processes are more important to smokers in the early stages than are the behavioural processes (Prochaska et al., 1992; Prochaska & Velicer, 1997b). The behavioural processes were added second, to test the degree to which these processes could explain additional variance over that accounted for by the cognitive processes[44].

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[43] Although the TTM features five stages, there remains an abrupt behavioural shift in the model between preparation and action.

[44] In addition, a measure of physical addiction (participants' baseline scores on the Fagerström Revised Tolerance Scale) was added to every regression model in this thesis. In no case did it predict significant or even near-significant proportions of variance in the dependent measures in the context of the other variables. It was therefore excluded from all analyses.

Participants' intentions to quit smoking within the next month were predicted from the 10 processes of change. As shown in Table 18, eight of the ten processes had significant zero-order correlations with intentions to quit smoking, with one cognitive process, self-reevaluation, and two behavioural processes, stimulus control and self-liberation, showing particularly strong relationships.

Table 18

Predicting Intentions to Quit Smoking with the Processes of Change

(N = 287)

Step	Variable	r[a]	β Step 1	β Step 2
1	Cognitive Processes			
	Consciousness raising	.19***	.01	-.03
	Dramatic relief	.11*	-.12	-.14*
	Environmental reevaluation	.14**	.04	.02
	Self-reevaluation	.34****	.39****	.33****
	Social liberation	.04	.05	.05
2	Behavioural Processes			
	Counterconditioning	.19***		.04
	Reinforcement management	.16**		.07
	Stimulus control	.24****		.08
	Helping relationships	.08		-.03
	Self-liberation	.23****		.09
R^2			.13	.15
$F(R^2)$			8.27	5.05
$p(R^2)$			< .0001	< .0001
ΔR^2				.02
$F(\Delta R^2)$				1.71
$p(\Delta R^2)$				n.s.

[a] Zero-order correlation between predictor variable and intentions to quit smoking

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

The cognitive processes of change, entered into the regression equation on the first step, accounted for a highly significant 13% of the variance in intentions to quit, F (5, 281) = 8.27, $p < .0001$, with self-reevaluation emerging as the only significant predictor ($\beta = .39$, $p<.0001$). The addition of the behavioural processes on the second step added a nonsignificant 2% to the explanation of intentions to quit.

Participants' intentions to reduce their smoking within the next month were also predicted from the 10 processes of change. The five cognitive processes were entered into the equation first, with the behavioural processes entered on the second step. As shown in Table 19, the same eight processes that were correlated significantly with intentions to quit had, for the most part, even stronger significant zero-order correlations with intentions to reduce smoking.

In the first step of the regression equation, the cognitive processes of change accounted for a highly significant 17% of the variance in intentions to reduce, F (5, 281) = 11.51, $p<.0001$, with self-reevaluation again emerging as the strongest significant predictor ($\beta = .31$, $p<.0001$). In addition, social liberation was found to be a significant negative predictor of intentions to reduce ($\beta = -.12$, $p<.05$). When added to the equation on the second step, the behavioural processes explained an additional 5% of the variance in intentions to reduce smoking, F (5, 276) = 3.74, $p<.01$, with counterconditioning emerging as a significant predictor ($\beta = .17$, $p<.01$), and self-reevaluation ($\beta = .25$, $p<.0001$) and social liberation ($\beta = -.11$, $p<.05$) remaining in the model. Overall, the 10 processes of change explained a highly significant 22% of the variance in participants' intentions to reduce their smoking, F (10, 276) = 7.90, $p < .0001$.

Table 19

Predicting Intentions to Reduce Smoking with the Processes of Change

(N = 287)

Step	Variable	r[a]	β Step 1	β Step 2
1	Cognitive Processes			
	Consciousness raising	.25****	.04	.02
	Dramatic relief	.24****	.01	.02
	Environmental reevaluation	.24****	.12	.11
	Self-reevaluation	.38****	.31****	.25****
	Social liberation	-.09	-.12*	-.11*
2	Behavioural Processes			
	Counterconditioning	.29****		.17**
	Reinforcement management	.10*		-.05
	Stimulus control	.25****		.03
	Helping relationships	.05		-.08
	Self-liberation	.30****		.10
R^2			.17	.22
$F(R^2)$			11.51	7.9
$p(R^2)$			< .0001	< .0001
ΔR^2				.05
$F(\Delta R^2)$				3.74
$p(\Delta R^2)$				< .01

[a] Zero-order correlation between predictor variable and intentions to reduce smoking

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

In summary, these results show that the processes of change were significant predictors of smokers' intentions to quit and to reduce their smoking. Self-reevaluation was the strongest positive predictor for both outcomes. As smokers began to feel disappointed and upset about their smoking behaviour, their intentions to change that behaviour increased. There were some differences between the predictors important for quitting vs. reduction. Social liberation was a negative predictor of intentions for reduction only, suggesting that the more smokers noticed that their environment favoured non-smoking, the less they felt inclined to cut back. Finally,

only for intentions to reduce did the behavioural processes contribute significant explanatory power; in particular, the use of counterconditioning (engaging in a different behaviour when the urge to smoke strikes) was associated with increased intentions to cut back.

The ability of the processes of change to predict the continuous measures of behaviour were also investigated. First, the number of cigarettes by which participants cut back their smoking by the follow-up ("smoking reduction") was regressed on the 10 processes. As shown in Table 20, five of the ten processes (two cognitive and three behavioural) had significant positive zero-order correlations with smoking reduction. In addition to being fewer in number, these significant coefficients were generally smaller than those obtained between the processes and the measures of intention.

In the regression analysis, the cognitive processes, added to the equation on the first step, contributed a nonsignificant 3% to the prediction of smoking reduction, $\underline{F}$ (5, 291) = 1.94, n.s. The behavioural processes, added on the second step, incremented the variance explained by a nonsignificant 2%, $\underline{F}$ (5, 286) = .80, n.s.

The second index of behaviour, the measure of total days of change activity over the follow-up phase, was also regressed on the processes of change, as shown in Table 21. Although only two zero-order correlations were significant, these coefficients were more sizeable than those obtained in the analysis of smoking reduction.

The cognitive processes, entered first in the regression equation, explained a nonsignificant 5% of the variance in the outcome, $\underline{F}$ (5, 154) = 1.50, n.s., while the behavioural processes, incremented on the second step, explained only an additional and nonsignificant 4% of the variance, $\underline{F}$ (5, 149) = 1.37, n.s.

In summary, these results suggest that the processes of change are poor predictors of behavioural outcomes for smoking among the first three stages of change. However, it may be that collapsing the stages had different effects for the prediction of behaviour than for the prediction of intentions. The stages were collapsed in order to obtain an initial impression of the relationships between the processes and these continuous outcomes. However, it may be that the relationships between the processes and intentions are so robust that collapsing across stage has little effect, whereas the relationships between the processes and behaviour may be

Table 20

Predicting Smoking Reduction (CPD) with the Processes of Change

(N = 297)

Step	Variable	r[a]	β Step 1	β Step 2
1	Cognitive Processes			
	Consciousness raising	.17**	.12	.10
	Dramatic relief	.09	-.02	-.04
	Environmental reevaluation	.08	-.01	-.01
	Self-reevaluation	.15**	.09	.07
	Social liberation	.05	.03	.04
2	Behavioural Processes			
	Counterconditioning	.04		-.06
	Reinforcement management	.10*		.04
	Stimulus control	.08		-.02
	Helping relationships	.11*		.05
	Self-liberation	.14**		.11
R^2			.03	.05
$F(R^2)$			1.94	1.37
$p(R^2)$			n.s.	n.s.
ΔR^2				.02
$F(\Delta R^2)$				.80
$p(\Delta R^2)$				n.s.

Note. Smoking reduction was computed as the average CPD at the follow-up subtracted from the average CPD reported at baseline. Higher scores represent greater reduction.

[a] Zero-order correlation between predictor variable and smoking reduction (CPD)

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

Table 21

Predicting Total Days of Change with the Processes of Change

(N = 160)

Step	Variable	r[a]	β Step 1	β Step 2
1	Cognitive Processes			
	Consciousness raising	.11	.01	-.02
	Dramatic relief	.12	.01	-.01
	Environmental reevaluation	.11	.04	.04
	Self-reevaluation	.21**	.19*	.18
	Social liberation	-.01	-.02	.01
2	Behavioural Processes			
	Counterconditioning	.06		-.01
	Reinforcement management	.07		-.02
	Stimulus control	.03		-.12
	Helping relationships	.10		.03
	Self-liberation	.23**		.22**
R^2			.05	.09
$F(R^2)$			1.50	1.45
$p(R^2)$			n.s.	n.s.
ΔR^2				.04
$F(\Delta R^2)$				1.37
$p(\Delta R^2)$				n.s.

Note. "Total days of change" comprises the number of days over the one-month follow-up period that smokers either did not smoke, or smoked a reduced number of cigarettes.

[a] Zero-order correlation between predictor variable and total days of change.

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

more stage-specific, requiring the stratification by stage in order for the effects to emerge. Prochaska and his colleagues would certainly argue that this should be so. In general, while these analyses provide an optimistic first impression of the processes' relationships with continuous measures of intention, the stage-by-stage analyses, required for testing the

integration's specificity hypotheses, will be necessary to clarify their relationships with behaviour.

Predicting Intentions And Behaviour By Stage With The Processes of Change

Prochaska et al.'s integration in Table 2 offers a series of specific hypotheses about how the processes should be related causally to stage. Their view of these relationships is highly stage-specific, as completely unique sets of processes are presumed important to each stage. That is, each process is understood to play a role in only one transition rather than in multiple transitions.

Specifically, the integration suggests that precontemplators should be aided more by the use of consciousness raising, dramatic relief, and environmental reevaluation than by the remaining seven processes. In addition, these processes, "matched" as they are to precontemplation, should not be significantly predictive of change for the other two stages. For contemplation, the integration suggests that the process of self-reevaluation will be most strongly predictive of change in comparison to the remaining nine processes. In addition, it should be more helpful to contemplators than to smokers in any other stage. Finally, the process matched to the preparation stage is self-liberation. This process should be more strongly associated with change for preparers than are the remaining processes. Correspondingly, self-liberation should not play a significant role in the prediction of change for precontemplators or contemplators.

These hypotheses about the stage-specificity of the processes' effects on outcome were tested with a series of hierarchical multiple regression analyses. Each stage was investigated individually with respect to the four continuous outcome measures described above: intentions to quit smoking, intentions to reduce smoking, smoking reduction, and total days of change activity over the one-month follow-up interval. The stage-matched processes were added to the analysis on the first step, the mismatched cognitive processes of change added on the second step, and the mismatched behavioural processes were added on the third step. For support of the hypothesis of stage-specificity depicted in the integration, the matched processes should explain significant proportions of variance in the outcome variables while the mismatched processes, added to the equation in the later steps, should not explain significant increments in variance. Although the comparison of interest was the explanatory power of the

matched vs. the mismatched processes, the mismatched processes were entered in two steps (mismatched cognitive, then mismatched behavioural). This strategy is in keeping with Prochaska's view that, in general, the cognitive processes should be more relevant than the behavioural ones to the "pre-action" stages of change (Prochaska & Velicer, 1997a).

Predicting intentions among precontemplators. Precontemplators' intentions to quit smoking, measured at the one-month follow-up, were predicted by the processes of change, as shown in Table 22. None of the matched processes had significant zero-order correlations with intentions to quit. However, counter to the model, an unmatched cognitive process, self-reevaluation, showed a significant positive relationship, and an unmatched behavioural process, helping relationships, showed a significant negative relationship with intentions to quit.[45]

When entered into the regression equation on the first step, the matched processes were virtually unrelated to intentions to quit, explaining only 1% of the variance. The addition of the two mismatched cognitive processes on the second step incremented the variance explained by a marginally significant 6%. Of these, self-reevaluation was a significant positive predictor of intentions to quit ($\beta = .31$, $p<.05$), consistent with its zero-order relationship. The addition of the mismatched behavioural processes incremented the variance explained by a nonsignificant 8%, $F(5, 73) = 1.43$, n.s.

[45] Although the mismatched processes should be unrelated to the outcome for this stage, the direction of their effects is consistent with the model. That is, the cognitive process has a positive coefficient and the behavioural process a negative one. This is consistent with the view that behavioural processes, used too early, can be detrimental to change (Prochaska et al., 1992).

Table 22

Predicting Precontemplators' Intentions to Quit Smoking

(N = 84)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Consciousness raising	.11	.09	.01	.01
	Dramatic relief	.08	.05	-.04	-.11
	Environmental reevaluation	.05	-.01	-.08	-.11
2	Mismatched Cognitive Processes				
	Self-reevaluation	.25**		.31*	.26
	Social liberation	-.06		-.03	.03
3	Mismatched Behavioural Processes				
	Counterconditioning	.17			.15
	Reinforcement management	.15			.13
	Stimulus control	.17			.06
	Helping relationships	-.20*			-.22
	Self-liberation	.10			.04
R^2			.01	.07	.15
F (R^2)			.34	1.24	1.35
p (R^2)			n.s.	n.s.	n.s.
ΔR^2				.06	.08
F (ΔR^2)				2.58	1.43
p (ΔR^2)				< .10	n.s.

[a] Zero-order correlation between predictor variable and intentions to quit

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

The relationships between precontemplators' matched and mismatched process use and their intentions to reduce their smoking were also investigated. As shown in Table 23, six of the ten processes were significantly correlated with intentions to quit, with two mismatched processes, self-reevaluation and counterconditioning, showing the strongest relationships.

The processes that the integration recommends for the precontemplation stage were unable to explain a significant proportion of the variance in precontemplators' intentions to reduce their smoking. The matched processes, entered into the regression equation on the first step, explained a nonsignificant 4% of the variance in intentions. The effect of environmental reevaluation, significant at the zero-order level, disappeared when considered in the context of the other matched predictors. Contrary to expectations, the mismatched cognitive processes, entered on the second step, significantly increased the prediction of intentions to reduce smoking a further 10% over that accounted for by the matched processes, $F(2,78) = 4.45$, $p < .01$, with self-reevaluation emerging as a positive predictor ($\beta = .28$, $p<.05$). The addition of the remaining behavioural processes, presumed in the integration to be unimportant to early stages of change, increased the variance explained by another 11%, a marginally significant increase, $F(5, 73) = 2.21$, $p < .10$. Self-reevaluation remained a significant predictor at this final step ($\beta = .29$, $p<.05$), and both counterconditioning ($\beta = .27$, $p<.05$) and reinforcement management ($\beta = .23$, $p<.05$) emerged as important predictors. By the final step, 25% of the variance in precontemplators' intentions to reduce their smoking over the next month was explained by the full set of 10 processes, $F(10, 73) = 2.44$, $p < .001$.

Predicting behaviour among precontemplators. Smoking reduction over the month between the baseline assessment and the follow-up was regressed on the processes of change among precontemplators, as shown in Table 24. None of the processes had significant zero-order correlations with smoking reduction. Consequently, the processes were unable to predict smoking reduction at any step in the regression analysis. The matched processes, entered first, explained only 1% of the variance, $F(3, 80) = .05$, n.s., with the remaining mismatched cognitive processes, entered second, explaining a nonsignificant increment of 3%, $F(2, 78) = 1.67$, n.s.. Finally, the behavioural processes were able to add only a nonsignificant 7% to the prediction of smoking reduction among precontemplators, $F(5, 73) = 1.06$, n.s..

Table 23

Predicting Precontemplators' Intentions to Reduce Smoking

(N = 84)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Consciousness raising	.09	.01	-.04	-.08
	Dramatic relief	.15	.05	-.01	-.11
	Environmental reevaluation	.19*	.16	.10	.02
2	Mismatched Cognitive Processes				
	Self-reevaluation	.32**		.28*	.29*
	Social liberation	-.19*		-.18	-.17
3	Mismatched Behavioural Processes				
	Counterconditioning	.32**			.27*
	Reinforcement management	.23*			.23*
	Stimulus control	.17			-.06
	Helping relationships	-.09			-.06
	Self-liberation	.21*			.06
R^2			.04	.14	.25
F (R^2)			1.08	2.49	2.44
p (R^2)			n.s.	< .05	< .05
ΔR^2				.10	.11
F (ΔR^2)				4.45	2.21
p (ΔR^2)				< .01	< .10

[a] Zero-order correlation between predictor variable and intentions to reduce

* p < .05, ** p < .01, *** p < .001 **** p < .0001

Table 24

Predicting Precontemplators' Smoking Reduction (CPD)

(N = 84)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Consciousness raising	.01	.03	-.05	-.01
	Dramatic relief	-.02	-.01	-.09	-.06
	Environmental reevaluation	-.03	-.04	-.08	-.08
2	Mismatched Cognitive Processes				
	Self-reevaluation	.06		.18	.13
	Social liberation	.15		.19	.26*
3	Mismatched Behavioural Processes				
	Counterconditioning	.03			.02
	Reinforcement management	-.11			-.14
	Stimulus control	-.02			.02
	Helping relationships	-.16			-.24*
	Self-liberation	.03			.11
R^2			.01	.04	.11
F (R^2)			.05	.70	.88
p (R^2)			n.s.	n.s.	n.s.
ΔR^2				.03	.07
F (ΔR^2)				1.67	1.06
p (ΔR^2)				n.s.	n.s.

Note. Smoking reduction was computed as the average CPD at the follow-up subtracted from the average CPD reported at baseline. Higher scores represent greater reduction.

[a] Zero-order correlation between predictor variable and smoking reduction (CPD)

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

The second behavioural measure, the total days of change activity reported over the month, could not be examined for the precontemplation stage because only 26 individuals in this stage made either a quit attempt or a reduction attempt over that time.

Summary. The processes of change were used to predict changes in precontemplators' intentions and behaviour according to the structure proposed in Prochaska et al.'s integration. Specifically, the predictive power of the processes matched to this stage, consciousness raising, dramatic relief, and environmental reevaluation, was compared to that of the seven mismatched processes, with the expectation that the matched would outperform the mismatched.

In the three analyses above, the matched processes were unable to offer any predictive power. Contrary to the model, however, both cognitive and behavioural mismatched processes were effective in predicting changes in precontemplators' intentions. Specifically, intentions to quit smoking were positively associated with precontemplators' use of self-reevaluation, while intentions to reduce smoking were positively associated with self-reevaluation, counterconditioning, and reinforcement management. According to the model, these mismatched processes, particularly the behavioural ones, should not be relevant to smokers in precontemplation.

How did the processes' predictive power differ across the dependent variables? In general, the processes were more effective for predicting intentions to reduce than intentions to quit. This finding is inconsistent with the model; changes in intentions to quit underlie the transition out of precontemplation, so it is therefore surprising that the processes were not predictive of this variable when it is measured continuously. On the other hand, precontemplators may more readily change their intentions to reduce smoking than their intentions to quit, as reduction is a less drastic change. In contrast with intentions, the behavioural outcome, even when measured continuously to maximize power for the analysis, was not associated with any processes of change, matched or mismatched. As shown earlier in Table 13, precontemplators made minimal changes in their smoking behaviour over time. Prochaska and his colleagues have stated that precontemplators are the most "inactive" of the stages (Prochaska et al., 1992); this analysis supports this contention.

Predicting intentions among contemplators. Contemplators' intentions to quit smoking, measured at the one-month follow-up, were predicted by the processes of change, as shown in Table 25. The process that the integration recommends for this stage, self-reevaluation, demonstrated a significant zero-order correlation with intentions to quit. The

only other significant correlation was that between intentions and a mismatched cognitive process, environmental reevaluation.

Table 25

Predicting Contemplators' Intentions to Quit Smoking

(N = 142)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Self-reevaluation	.14*	.14	.24*	.23*
2	Mismatched Cognitive Processes				
	Consciousness raising	-.01		-.18	-.19
	Dramatic relief	-.10		-.21*	-.21*
	Environmental reevaluation	.18*		.25**	.25**
	Social liberation	.10		.06	.07
3	Mismatched Behavioural Processes				
	Counterconditioning	.00			-.07
	Reinforcement management	.01			-.02
	Stimulus control	.09			.10
	Helping relationships	.03			.05
	Self-liberation	-.05			-.08
R^2			.02	.11	.13
$F(R^2)$			2.70	3.27	1.84
$p(R^2)$			n.s.	< .01	< .10
ΔR^2				.09	.02
$F(\Delta R^2)$				3.36	.47
$p(\Delta R^2)$				< .01	n.s.

[a] Zero-order correlation between predictor variable and intentions to quit

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

When entered into the regression equation on the first step, the matched process was unable to account for significant variance in intentions, explaining only 2% of the variance, $F(1, 140) = 2.70$, n.s. Contrary to the model, the addition of the four mismatched cognitive

processes on the second step incremented the variance explained by a significant 9%, $F(4, 136) = 3.36$, $p < .01$. An examination of the regression coefficients shows that the mismatched processes of environmental reevaluation ($\beta = .25$, $p<.01$), and dramatic relief ($\beta = -.21$, $p<.05$) were important predictors of intentions to quit. The matched process, self-reevaluation, also emerged as a significant predictor ($\beta = .24$, $p<.05$). However, the strength of these relationships is due, to some degree, to suppression effects; it can be seen that the partial coefficients are larger than the respective zero-order coefficients. Finally, the addition of the mismatched behavioural processes only added a nonsignificant 2% to the variance explained, $F(5, 131) = .47$, n.s.

The relationships between the processes and intentions to reduce smoking were also investigated for contemplators. As shown in Table 26, only the unmatched processes demonstrated significant zero-order relationships with intentions; these included one cognitive process, environmental reevaluation, and two behavioural processes, counterconditioning and reinforcement management. Entered into the regression equation on the first step, the matched process, self-reevaluation, could not account for significant variance in intentions, explaining only 1%, $F(1, 140) = 1.87$, n.s. On the second step, the remaining cognitive processes also did not add significantly to the prediction of intentions to reduce, explaining only an additional 3%, $F(4, 136) = .90$, n.s. Surprisingly, on the third step, the mismatched behavioural processes explained an additional 8% of variance in contemplators' intentions to reduce smoking over and above that account for by all of the cognitive processes, $F(5, 131) = 2.32$, $p < .05$. At this final step, reinforcement management emerged as a significant negative predictor of intentions ($\beta = -.22$, $p<.05$), and environmental reevaluation was a significant positive predictor ($\beta = .21$, $p<.05$); however, the latter effect emerged only when the remaining predictors were in the model.

Table 26

Predicting Contemplators' Intentions to Reduce Smoking

(N = 142)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Self-reevaluation	.12	.12	.07	.10
2	Mismatched Cognitive Processes				
	Consciousness raising	.10		-.02	-.03
	Dramatic relief	.09		.01	.10
	Environmental reevaluation	.18**		.17	.21*
	Social liberation	.02		-.03	-.06
3	Mismatched Behavioural Processes				
	Counterconditioning	.14*			.15
	Reinforcement management	-.15*			-.22*
	Stimulus control	.08			.02
	Helping relationships	-.07			-.09
	Self-liberation	-.01			-.08
R^2			.01	.04	.12
$F(R^2)$			1.87	1.09	1.73
$p(R^2)$			n.s.	n.s.	< .10
ΔR^2				.03	.08
$F(\Delta R^2)$				.90	2.32
$p(\Delta R^2)$				n.s.	< .05

[a] Zero-order correlation between predictor variable and intentions to quit

* p < .05, ** p < .01, *** p < .001 **** p < .0001

Predicting behaviour among contemplators. Smoking reduction over the month between the baseline assessment and the follow-up was regressed on the processes of change among contemplators, as shown in Table 27. As was the case for precontemplators, none of the processes had significant zero-order correlations with smoking reduction for contemplators. Consequently, the processes were unable to predict smoking reduction at any

step in the regression analysis. The matched process of self-reevaluation, entered first, explained only 1% of the variance, F (1, 143) = 1.07, n.s., with the remaining four mismatched

Table 27

Predicting Contemplators' Smoking Reduction (CPD)

(N = 145)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Self-reevaluation	.09	.09	.04	.03
2	Mismatched Cognitive Processes				
	Consciousness raising	.13		.16	.15
	Dramatic relief	.06		.01	-.04
	Environmental reevaluation	-.01		-.09	-.09
	Social liberation	-.04		-.06	-.04
3	Mismatched Behavioural Processes				
	Counterconditioning	-.12			-.19*
	Reinforcement management	.09			.07
	Stimulus control	.04			.06
	Helping relationships	.11			.05
	Self-liberation	.08			.08
R^2			.01	.03	.06
F (R^2)			1.07	.76	.93
p (R^2)			n.s.	n.s.	n.s.
ΔR^2				.02	.03
F (ΔR^2)				.68	1.10
p (ΔR^2)				n.s.	n.s.

Note. Smoking reduction was computed as the average CPD at the follow-up subtracted from the average CPD reported at baseline. Higher scores represent greater reduction.

[a] Zero-order correlation between predictor variable and smoking reduction (CPD)

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

cognitive processes, entered second, explaining a nonsignificant increment of 2%, F (4, 139) = .68, n.s.. Finally, the behavioural processes were able to add only a nonsignificant 3% to the prediction of smoking reduction among contemplators, F (5, 134) = 1.10, n.s..

Contemplators' total days of change activity, including both quit attempts and reduction attempts, were also examined in relation to the processes of change, as shown in Table 28. The process matched to contemplation, self-reevaluation, had a significant zero-order correlation with days of change activity, as did the mismatched behavioural process of self-liberation. Self-reevaluation, entered first in the regression equation, accounted for a marginally significant 3% of the variance in days of change activity, F (1, 81) = 2.70, p < .10. On the second step, the remaining four cognitive processes were unable to provide any explanatory power, adding a nonsignificant 3% of variance, F (4, 77) = .55, n.s. The remaining mismatched behavioural processes, added to the equation on the third step, explained an additional 11% of the variance in days of change activity, although this effect was only marginally significant, F (5, 72) = 1.82, p < .12. This finding tentatively suggests that reinforcement management might be negatively related to contemplators' behaviour.

Summary. The processes of change were used to predict changes in contemplators' intentions and behaviour according to the structure proposed in Prochaska et al.'s integration. Specifically, these regressions tested whether the process matched to this stage, self-reevaluation, would be a better predictor of change than the remaining nine mismatched processes.

In the above analyses, the matched process performed somewhat poorly; self-reevaluation was a significant predictor only of intentions to quit, and could only weakly predict contemplators' total days of change activity. Contrary to the model, however, one mismatched process, environmental reevaluation, was important to the prediction of *both* types of intention.

The processes' predictive power differed across the dependent variables. Intentions to quit and intentions to reduce smoking were equally well predicted by the processes of change, with 11% and 12% of the variance explained respectively. However, different sets of

Table 28

Predicting Contemplators' Total Days of Change

(N = 83)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Self-reevaluation	.18*	.18	.20	.23
2	Mismatched Cognitive Processes				
	Consciousness raising	.07		-.02	-.04
	Dramatic relief	.10		.07	.03
	Environmental reevaluation	.01		-.05	-.04
	Social liberation	-.12		-.15	-.11
3	Mismatched Behavioural Processes				
	Counterconditioning	-.02			-.07
	Reinforcement management	-.19			-.25*
	Stimulus control	-.07			-.13
	Helping relationships	.09			.07
	Self-liberation	.21*			.23
R^2			.03	.06	.17
$F(R^2)$			2.70	.97	1.42
$p(R^2)$			$p < .10$	n.s.	n.s.
ΔR^2				.03	.11
$F(\Delta R^2)$				.55	1.82
$p(\Delta R^2)$				n.s.	$p < .12$

[a] Zero-order correlation between predictor variable and total days of change

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

processes were important for these two outcomes. Intentions to quit were associated only with cognitive processes, while intentions to reduce smoking were associated with both cognitive and behavioural processes. In contrast with intentions, behavioural outcomes were rather poorly predicted by the processes. As shown earlier in Table 13, contemplators reduced their smoking by 12% and made either a quit attempt or a reduction attempt on 11 of the 30 days in the follow-up time period. It is surprising that contemplators' use of the processes was not

related to these changes, particularly in the case of smoking reduction; the number of participants was quite sufficient to show an effect if one were present.

Predicting intentions among preparers. Intentions to quit smoking, measured at the one-month follow-up, were predicted by the processes of change for smokers in preparation, as shown in Table 29.

Table 29

Predicting Preparers' Intentions to Quit Smoking

(N = 61)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Self-liberation	.03	.03	.04	.02
2	Mismatched Cognitive Processes				
	Consciousness raising	.12		.04	.07
	Dramatic relief	-.02		-.01	-.04
	Environmental reevaluation	-.08		-.12	-.11
	Self-reevaluation	-.04		.02	.01
	Social liberation	.25*		.25	.28
3	Mismatched Behavioural Processes				
	Counterconditioning	.13			.20
	Reinforcement management	-.04			-.23
	Stimulus control	-.01			-.10
	Helping relationships	.10			.15
R^2			.00	.08	.14
$F(R^2)$			.05	.77	.82
$p(R^2)$			n.s.	n.s.	n.s.
ΔR^2				.08	.06
$F(\Delta R^2)$				.92	.89
$p(\Delta R^2)$				n.s.	n.s.

[a] Zero-order correlation between predictor variable and intentions to quit

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

The process that the integration recommends for this stage, self-liberation, had a minimal zero-order correlation with intentions to quit. The only significant correlation was that between intentions and a mismatched cognitive process, social liberation. Consequently, when entered into the regression equation on the first step, the matched process was unable to account any variance in intentions, $F(1, 59) = .05$, n.s. The addition of the five mismatched cognitive processes on the second step incremented the variance explained by a nonsignificant 8%, $F(5, 54) = .92$, n.s. The process of social liberation, which had a significant zero-order relationship with intentions, did not demonstrate a significant relationship in the context of the other predictors. The addition of the four mismatched behavioural processes only added a nonsignificant 6% to the variance explained, $F(4, 50) = .89$, n.s.

The relationships between the processes and intentions to reduce smoking were also investigated for smokers in preparation. As shown in Table 30, the process considered helpful to this stage, self-liberation, was significantly correlated with intentions to reduce at the follow-up. In addition, one mismatched cognitive process, environmental reevaluation, and two mismatched behavioural processes, counterconditioning and helping relationships, were significantly and positively correlated with intentions. Entered into the regression equation on the first step, the matched process, self-liberation, accounted for a marginally significant 5% of the variance in intentions, $F(1, 59) = 3.41$, $p < .10$. On the second step, the five mismatched cognitive processes explained an additional 7%, but this effect did not reach significance. The remaining mismatched behavioural processes, entered on the final step, incremented the variance explained by a nonsignificant 8%, $F(4, 50) = 1.26$, n.s.

Predicting behaviour among preparers. Smoking reduction over the month between the baseline assessment and the follow-up was regressed on the processes of change among smokers in preparation, as shown in Table 31. Self-liberation, the process expected to be helpful to the preparation stage was completely unrelated to smoking reduction at the zero-order level. Contrary to the model, two mismatched cognitive processes and one mismatched behavioural process were significantly correlated with behaviour among preparers.

Table 30

Predicting Preparers' Intentions to Reduce Smoking

(N = 61)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Self-liberation	.23*	.23*	.25*	.28
2	Mismatched Cognitive Processes				
	Consciousness raising	.06		-.01	.02
	Dramatic relief	.04		-.12	-.17
	Environmental reevaluation	.21*		.25	.26
	Self-reevaluation	.12		.11	.01
	Social liberation	-.06		-.03	-.05
3	Mismatched Behavioural Processes				
	Counterconditioning	.23*			.11
	Reinforcement management	.04			-.21
	Stimulus control	.09			.02
	Helping relationships	.22*			.29
R^2			.05	.12	.20
F (R^2)			3.41	1.22	1.25
p (R^2)			p < .10	n.s.	n.s.
ΔR^2				.07	.08
F (ΔR^2)				.79	1.26
p (ΔR^2)				n.s.	n.s.

[a] Zero-order correlation between predictor variable and intentions to reduce

* p < .05, ** p < .01, *** p < .001 **** p < .0001

The matched process of self-liberation, entered first, explained none of the variance in smoking reduction, F (1, 66) = .01, n.s. The five mismatched cognitive processes, entered second, added 10% to the explanation of variance, but failed to reach statistical significance, F (5, 61) = 1.36, n.s. The failure of this step to reach statistical significance likely reflects the low power of the analysis; had there been as many participants in the preparation stage as there were in contemplation (N = 145), this effect would have reached significance. At this step,

Table 31

Predicting Preparers' Smoking Reduction (CPD)

(N = 68)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Self-liberation	-.01	-.01	.00	.04
2	Mismatched Cognitive Processes				
	Consciousness raising	.15		.01	.02
	Dramatic relief	.02		-.04	-.06
	Environmental reevaluation	.24*		.24	.18
	Self-reevaluation	-.05		-.06	-.10
	Social liberation	.22*		.18	.13
3	Mismatched Behavioural Processes				
	Counterconditioning	.05			.02
	Reinforcement management	.14			.01
	Stimulus control	-.09			-.12
	Helping relationships	.25*			.26
R^2			.00	.10	.15
$F(R^2)$			.01	1.14	1.04
$p(R^2)$			n.s.	n.s.	n.s.
ΔR^2				.10	.05
$F(\Delta R^2)$				1.36	.90
$p(\Delta R^2)$				n.s.	n.s.

Note. Smoking reduction was computed as the average CPD at the follow-up subtracted from the average CPD reported at baseline. Higher scores represent greater reduction.

[a] Zero-order correlation between predictor variable and smoking reduction (CPD)

* $p < .05$, ** $p < .01$, *** $p < .001$ **** $p < .0001$

there was a trend for the two cognitive processes that had significant zero-order relationships with behaviour, environmental reevaluation and social liberation, to remain important to the prediction of smoking reduction. Finally, the behavioural processes were able to add only a

nonsignificant 5% to the prediction of smoking reduction among preparers, F (4, 57) = .90, n.s..

Preparers' total days of change activity, including both quit attempts and reduction attempts, were also examined in relation to the processes of change, as shown in Table 32.

Table 32

Predicting Preparers' Total Days of Change

(N = 51)

Step	Variable	r[a]	β Step 1	β Step 2	β Step 3
1	Matched Processes				
	Self-liberation	.08	.08	.17	.13
2	Mismatched Cognitive Processes				
	Consciousness raising	.02		-.19	-.22
	Dramatic relief	-.04		-.20	-.17
	Environmental reevaluation	.23*		.35*	.32
	Self-reevaluation	-.01		.12	.15
	Social liberation	.14		.21	.20
3	Mismatched Behavioural Processes				
	Counterconditioning	.09			.05
	Reinforcement management	.17			.12
	Stimulus control	-.06			-.06
	Helping relationships	-.01			-.11
R^2			.01	.12	.14
F (R^2)			.29	1.03	.64
p (R^2)			n.s.	n.s.	n.s.
ΔR^2				.11	.02
F (ΔR^2)				1.18	.18
p (ΔR^2)				n.s.	n.s.

[a] Zero-order correlation between predictor variable and total days of change

* p < .05, ** p < .01, *** p < .001 **** p < .0001

The process matched to preparation, self-liberation, did not have a significant zero-order correlation with days of change activity. Only one process, environmental reevaluation, was significantly related to change activity at the zero-order level. Self-liberation, entered first in the regression equation, accounted for only 1% of the variance in days of change activity, F (1, 49) = .29, n.s. On the second step, the additional 11% of variance explained by the five mismatched cognitive processes did not reach statistical significance, F (5, 44) = 1.18, n.s. Again, this step of the analysis suffered from low power, as only 50 participants were available for the analysis. With an additional 50 participants, this step would have reached significance. Thus it is possible to suggest, very tentatively, that environmental reevaluation might be an important positive predictor of change activity for preparers (β = .35, p<.05) . The remaining mismatched behavioural processes, added to the equation on the third step, did not significantly increment the variance explained in days of change activity, F (4, 40) = .18, n.s.

Summary. The processes of change were used to predict changes in preparers' intentions and behaviour according to the structure proposed in the integration. Hierarchical multiple regressions tested the degree to which the matched process (self-liberation) vs. the remaining nine mismatched processes could predict changes in intentions and behaviour.

The matched process, self-liberation, emerged as a positive predictor of change in only one of the four analyses, and only to a marginally significant degree. It was positively associated with intentions to reduce and, although the first step of that regression was only marginally significant, it must be acknowledged that this analysis was conducted on a small sample of 61 smokers. With 10 more individuals in the analysis, this effect would have been significant at the .05 level. Although speculative, this result provides initial support of the importance of self-liberation; as smokers in preparation told themselves that they were capable of changing their smoking, their intentions to reduce increased. Its relationships with intentions to quit and with the two behavioural outcomes, however, were virtually nonexistent, irrespective of the problems associated with low power in these analyses. Also contrary to the model, several of the mismatched processes had significant zero-order relationships with outcomes for preparers. In particular, there was a nonsignificant trend for environmental reevaluation, a process recommended for precontemplators, to play a role in helping preparers

to smoke fewer cigarettes, and to have more days of change of any kind. Given the low power in these analyses, however, this remains speculative.

The processes' relationships with outcome for preparers differed somewhat across the four dependent variables analyzed here. The processes had fewer significant zero-order relationships with intentions to quit and total days of change activity compared to intentions to reduce and smoking reduction. It is somewhat surprising that the processes were more relevant to preparers' intentions than to their behaviour; when considered in stage-movement terms, the task for preparers is to initiate behaviour changes rather than to strengthen intentions. In general, the small effects that emerged for the preparation stage were surprising. Of all the stages, associations between processes and outcome should be strongest for preparers, as these are the smokers most likely to be active in their change efforts.

Discussion

"I sometimes wish nicotine was outlawed so I would have no other choice..."

(participant in the preparation stage in the present study)

"How can I beat this thing? Send help ASAP!"

(participant in the contemplation stage in the present study)

Smokers and the people who try to help them quit smoking both experience an enormous amount of frustration with this seemingly simple task. Former First Lady Nancy Reagan told children in the United States to "Just Say No" if someone offered them drugs. Such reasoning would seem to apply to cigarette smoking as well. Why not just *quit*?

Prochaska and his colleagues believe that those who develop and deliver smoking-cessation programs erroneously regard smokers as ready to quit smoking with a minimal level of action-oriented intervention. The Transtheoretical Model is intended to rectify this thinking by offering a more complex view of smokers and the task of quitting smoking. The stages of change are meant to describe how smokers can vary in their readiness to change, and how quitting smoking should be seen as a series of tasks rather than a unitary event. The processes of change are meant to encompass all possible change efforts that could be applied to the problem of smoking. The proposed relationships between the stages and processes of change are meant to guide practitioners toward highly effective treatments. Prochaska et al. believe that, if practitioners target their interventions to smokers' stage of change, they will meet smokers' needs in a manner that is more relevant, more engaging, and ultimately more helpful.

The TTM has been received with intense enthusiasm, and its terms have become embedded in the lexicon of health communication in the United States, Canada, and Britain. The developers of the model feel strongly about their creation. They offer it as a "revolution" in health care (Prochaska, 1994a), and vow that health promotion programs based on its principles – i.e., the processes of change, which "create successful modification of a problem behavior" (DiClemente et al., 1991, p. 295) – will produce "unprecedented impacts on entire at-risk populations" (Prochaska & Velicer, 1997b, p. 38).

Can the TTM really do all that? This thesis provided a multifaceted response to this question. The structure of the model was clarified, and the implications of that structure for testing the model were fully explained, both with regard to the nature of the claims made, and with regard to the analytic approaches that would be appropriate for testing them. The TTM literature was critically examined, revealing that the central tenets of the model have been either untested or very poorly supported. These central claims were then empirically tested with a sample of 386 smokers who participated in a longitudinal survey study. The critical effects requiring examination were identified and analyzed with the appropriate statistical methods in order to provide the first explicit, unambiguous tests of the model to date.

Each of these efforts will be reviewed in turn, beginning with the clarification of the model's structure.

The TTM: Structure and Implications

In order to examine the tenability of any model, its structure must be fully understood. A great deal of clarification was needed in the case of the TTM. Although Prochaska and his colleagues have talked about a correspondence between the stages and processes (Prochaska & DiClemente, 1992), and a "series of patterned relationships" between these variables (Fava et al., 1995), they have not been very explicit about what these relationships actually look like. In their own empirical work, they have presented their hypotheses in such vague and unspecific terms that the nature of the effects they were seeking is unclear. For example, in an important cross-sectional study of process use by stage, DiClemente et al. (1992) proposed only that that "significant differences across stages are hypothesized for ... process activity" (p. 296).

The integration of the processes and stages (Prochaska et al., 1992), comprises the only specific statement of the interrelationships of these variables, but its presentation is not terribly clear. One wishes for the structural clarity of the Theory of Planned Behavior (Ajzen, 1985) and other psychosocial models whose diagrammatic depictions clearly indicate not only the presumed causal relationships, but also the nature of those relationships (e.g., direct, indirect, mediating, or moderating). However, Prochaska et al. have indicated that this table illustrates how the processes and stages interrelate, so it can confidently be taken as a structural statement about their model. The text that accompanies the table does make it clear that the

integration depicts both cross-sectional process activity, and Prochaska et al.'s suppositions about how the processes "can be applied or avoided at each stage" (p. 1109). Despite this structural summary, however, Prochaska and his colleagues have never tested the predictions it offers. Their failure to examine the degree to which self-reevaluation helps contemplators vs. smokers in the other stages, for example, introduces a note of confusion and uncertainty regarding their stance on these relationships.

These characteristics of the TTM literature may have made it difficult for other researchers to understand and to use the model. As Velicer and Prochaska have indicated, the majority of the work conducted by other researchers has focused primarily on the stages of change, while the processes of change have been neglected (Velicer & Prochaska, 1997a). In fact, of the seven empirical papers accepted for publication in the special issue of the American Journal of Health Promotion devoted to the TTM, only one paper even mentioned the processes of change (Ruggiero et al., 1997). However, it is the process-to-stage correspondence that comprises the central thrust of the TTM, as it articulates how stage-matched treatments should be developed (Prochaska & DiClemente, 1986; Prochaska et al., 1992). This lack of attention to these key relationships hinders the development of the model. Perhaps researchers have not studied these concepts because they are poorly described and poorly understood.

To rectify this problem, this thesis has provided a thorough and concrete explanation of the concepts contained in the integration, including the degree of specificity of processes to stages being proposed, the implications of that degree of specificity for stage-matching, issues relevant to the direction of the processes' presumed effects, and the between- and within-stage statements implied by the model's structure. Of particular importance, this thesis has underscored the fact that the claim of specificity demands that smokers across the stages *not* score in the same direction on every process. In fact, the concept of stage-specificity has been so poorly articulated that this "general ordering pattern" of findings has even been cited as supportive of the model by the model's own developers (e.g., Fava et al., 1995). This, in particular, emphasizes the need for clarity regarding the structure of the model and the relationships it proposes. Only if these concepts are clearly understood can the tenability of the model be evaluated.

The appropriate methods for evaluating these concepts also required attention in this thesis. Despite offering a series of complex hypotheses about the interrelationships of ten processes with five stages, the TTM's proponents have chosen analytic methods that are completely unable to accommodate this complexity. It was established in this thesis that the claim of specificity of processes to stages on a cross-sectional level demands that a number of process-by-stage interactions be tested; however, such an analysis has never appeared in the TTM literature. This thesis demonstrated the appropriate use of MANOVA techniques for testing multivariate contrasts that can examine sets of processes simultaneously, and that can test both between- and within-stage effects as the model's claims demand.

In addition, despite making longitudinal claims for specificity – that the processes should vary by stage in their power to predict cessation-related outcomes – the TTM's proponents have chosen either to merge the processes with other variables (e.g., Prochaska et al., 1985), or to collapse them into two factors (e.g., Perz et al., 1996) in their own longitudinal work. The claim of specificity of processes to stages on a longitudinal level demands a strategic, hierarchical model-testing approach that can offer stage-based comparisons of the predictive power of particular sets of processes vs. others. Such an analytic strategy has never been employed in the TTM research. This thesis demonstrated the appropriate use of hierarchical multiple regression techniques for estimating the predictive power of the processes of change by stage, and for testing the integration's specific claims about how the processes should vary in their effectiveness by stage.

The TTM Literature: Support for Specificity?

A thorough review of the literature on the TTM was conducted, and the quality of support for the model's cross-sectional and longitudinal claims of stage-specificity was critically evaluated. The sections that follow provide a brief summary of the evidence for both forms of specificity, and of the implications of that evidence for the model. The quality of the cross-sectional evidence is considered first.

Cross-Sectional Evidence

The TTM literature offers no support for the notion that smokers in different stages use different processes of change. In fact, *none* of the available studies has even tested these

process-by-stage relationships. The model specifies an interaction between process and stage; however, in their research on these variables, the TTM's developers have tested only between-stage effects. One-way ANOVAs with post-hoc comparisons cannot detect the presence of interactions in the data.

Moreover, even though Prochaska et al. have not fully tested the claim of specificity, they have presented between-stage findings that strongly refute the model. The observation that the processes simply receive increased use across successive stages (Prochaska et al., 1991; Fava et al., 1995) completely disclaims the notion of qualitative specificity. Specificity demands that each stage (with the exception of precontemplation) exceed the other stages on at least one of the processes. If this condition is not satisfied, then the differences between the stages are purely quantitative, and specificity is not possible. Finally, equally surprising is the failure of the TTM researchers to acknowledge the negative implications of their findings. Instead, in their most recent publication to date, Prochaska and Velicer (1997b) declared that they have discovered "systematic relationships between the stage people were in and the processes they were applying" (p. 43). It is unknown how this conclusion could have been reached on the basis of the existing literature.

Longitudinal Evidence

The TTM literature offers no evidence that smokers in different stages benefit from the processes differently – i.e., that smokers that use the processes matched to their stage will be more likely to improve than smokers who use mismatched processes. In fact, *none* of the longitudinal studies explicitly tests this hypothesis. The few studies that are available (in particular, Prochaska et al., 1985, and Perz et al., 1996) suffer from a number of serious limitations, including using the earlier version of the stage construct instead of the current version (as illustrated in Table 3), the failure to test the processes in isolation from other variables (e.g., decisional balance), and the failure to test the processes in a strategic, a priori manner.

The latter limitation is particularly troublesome. Although the model claims that the processes' effectiveness varies by stage, and although the integration offers specific hypotheses about the structure of these relationships, these concepts have never been explicitly tested on the earlier or the current version of the model. There have been no longitudinal correlational

studies that predict particular stage transitions from particular processes, as the integration (and, more generally, the claim of specificity) demands. In addition, there have been no longitudinal experimental studies that could test the claim that a process might be more helpful to one stage than another. This concept, known as "stage matching," is the cornerstone of the model, yet its tenability remains untested. The one intervention study reviewed in this thesis (Prochaska et al., 1993) not only failed to explain how the processes were matched to stage in their intervention materials, but even failed to vary stage-matching across the conditions. Strangely, the TTM researchers have not acknowledged the lack of work on these important questions, let alone its implications for the model. Instead, Prochaska and Velicer (1997a) declared that their research "clearly demonstrates the advantages of tailored interventions" (p. 11). It is unknown how this conclusion could have been reached on the basis of the existing literature.

It was concluded that the evidence for the model's core concepts is too frail to support the claims being made on its behalf. If the TTM is indeed a "revolution" in health care (Prochaska, 1994a), then it is a revolution built upon research findings that have been murky, contradictory, and, at times, irrelevant to the purposes of the model. Focused tests that examine the central claims of the model, so far completely absent from the TTM literature, are essential for determining where the model stands scientifically.

The Present Study: Testing The Claims

This thesis has provided the most focused tests to date of the claims for stage-specificity in the TTM. While testing the model's claims in their strictest sense (i.e., as they appear in the integration), evidence was also sought for weaker forms of support for the model. In addition, multiple dependent variables were employed in order to give the processes maximum power to demonstrate their predictive functioning, and to support, or fail to support, the strong statements made on their behalf by the developers of the TTM.

The findings from the present study are reviewed below. First, the degree of support obtained for the model's claims of cross-sectional specificity is considered; this is followed by a review of the support for the longitudinal claims. The implications of the findings for the model are discussed, and limitations of the present study are considered.

Cross-Sectional Evidence

"Smokers at different points in the change process have been shown to use processes differently..." (Perz et al., 1996, p. 463).

How differently? Consistent with the findings from the TTM literature, evidence for the "general ordering pattern" was obtained in the present study. A trend of increasing means across the stages was observed for all of the processes but one, social liberation. Generally speaking, precontemplators used the processes less than did contemplators, who used them less than did preparers. In order to support the notion of stage-specificity, however, the findings needed to demonstrate that the differences between stages were qualitative rather than quantitative. Therefore this pattern of findings, observed both in the TTM's cross-sectional literature and in this thesis, completely fails to support the claim of cross-sectional specificity of processes to stages.

A search for a weaker form of specificity was undertaken. Weaker specificity – minor qualitative distinctions in the context of large quantitative distinctions – would not support the concept of specificity, nor facilitate stage-matching. Regardless, it was necessary to fully explore the nature of specificity that might be present in the model, however weak.

The findings from the present study failed to support even weak specificity. The multivariate contrasts used to test the process-use patterns hypothesized in the integration indicated, in all cases, that a significant interaction was present. However, the pattern of means in each interaction did not match the patterns specified by the integration. For example, although contemplators did exceed precontemplators more on their endorsement of the contemplator processes than on the remaining seven processes, the data *also* showed that the contemplator–precontemplator differences on the remaining processes were not small. In fact, a simple cognitive vs. behavioural distinction was equally as characteristic of contemplators as was the hypothesized pattern. For example, although preparers exceeded contemplators most on the preparation process, their activities relative to those of contemplators were best described by a set of *six* processes, not just one.

These cross-sectional findings provide a double blow to the model. In the first place, we must be content with weak rather than strong specificity; the qualitative distinctions that can be made among stages are minor in the context of the quantitative effects, and can really

only describe stage differences *downward* to a stage earlier in the continuum. In addition, however, the evidence for weak specificity was, in itself, weak. The process patterns indicated by the integration could easily be substituted by other patterns, equally descriptive or even *more* descriptive of the stage differences.

Considering again the pattern of means shown in Figure 8 (page 86), it may be that the search for cross-sectional, qualitative differentiation would require a lens with such magnification that the potential gain for stage-matching of interventions would not be worth the effort.

Longitudinal Evidence

"We have to provide interventions that match the stage particular patients are in." (Prochaska & Goldstein, 1991, p. 729).

The claim of longitudinal, predictive stage-specificity was examined from two different angles in this thesis. First, the processes' predictive relationships with stage movement were investigated. Second, continuous measures of the variables that underlie stage were also employed in order to maximize the potential for observing stage-specific functioning among the processes. Intentions to quit and to reduce smoking were examined, as were two behavioural measures, including the change in smoking (cigarettes per day) over the one-month time frame of the study, and an index of the total days of change activity that occurred over that month.

Analyzing stage movement. Were the processes predictive of stage movement in the present study? If so, did their predictive power vary by stage? If so, did their stage-specific effects match those proposed by the integration?

Although the analyses examining stage movement were low in power for the precontemplation and preparation stages, some trends emerged from the data. First, there was a weak association between the processes and stage movement. As shown in Table 15 through Table 17, there was a trend for advancers to exceed the non-advancers in their endorsement of the processes. Second, the processes' relationships with stage movement appeared to differ by stage to a weak degree. The simple effects comparisons suggested that the process of dramatic relief was important to both precontemplators and preparers, and that the process of self-

liberation was important to both contemplators and preparers. These findings refute the notion of stage-specificity, as pairs of stages, *particularly* nonadjacent ones, should not have common intervention needs. However, other processes did have unique roles, such as the correspondence of self-reevaluation only to precontemplation, and the correspondence of social liberation only to contemplation. Third, the stage-movement analyses did not provide support for the specific hypotheses proposed in the integration. The MANOVA analyses demonstrated that, although some stages were able to benefit from the use of matched processes (e.g., precontemplators and dramatic relief), they also derived equal or greater benefit from mismatched processes (e.g., contemplators and self-liberation).

The problem of low power for these analyses does not permit strong interpretation or speculation; however, the trends that emerged suggested a relationship between the processes and stage movement that has only weak degrees of stage-differentiation, and that offers almost no support for the particular process-by-stage relationships proposed by the integration.

Analyzing continuous measures of change. Were the processes associated with the continuous measures of change? If so, did their predictive power vary by stage? If so, did their stage-specific effects match those proposed by the integration?

The processes were used to predict two measures of intention and two measures of behaviour. The degree to which they were successful in predicting these outcomes can be seen in Table 33, which provides a summary of the processes important to each dependent variable for each stage. Over the 11 regression equations computed, the processes accounted for a statistically significant proportion of variance in outcome in only six of those regressions. The measures of intention were fairly well predicted by the processes, particularly intentions to reduce smoking. Intentions to reduce were predicted particularly well for precontemplators, and to a significant but lesser degree for contemplators. While only 5% of the variance in intentions to reduce was predicted for preparers, this was the only continuous dependent variable to be predicted by the processes for this stage. Intentions to quit smoking were predicted to a lesser but still significant degree for the precontemplation and contemplation stages.

Table 33

Summary of Processes Important to the Prediction of Intentions and Behaviour

Stage	Important Predictors (% of Variance Explained)			
	Intentions to Quit	Intentions to Reduce	Smoking Reduction	Days of Change
Precontemplation	SR (7%)	SR, CC, RM (25%)	--	N/A
Contemplation	ER, DR[a], SR (11%)	ER, RM[a] (12%)	--	SR[b], RM[a,b] (3%)
Preparation	--	SL[b] (5%)	--	--

Note. Processes that are underlined are those that are matched to that stage according to the integration. A dashed line indicates that none of the processes was able to predict change for that stage. "N/A" indicates that the analysis was not performed.

[a] Negative direction of effect [b] Marginally significant effect

The prediction of behaviour, on the other hand, was very poor across all of the stages in the present study. This failure of the processes to be associated with behaviour for precontemplators and contemplators is actually consistent with the model. The TTM states that smoking cessation is a premature goal for individuals in the early stages. The findings from the present study support and extend this concept, suggesting that even smaller changes in smoking behaviour are not a useful target for intervention among precontemplators and contemplators.

However, the complete lack of predictability of the processes for the behavioural outcomes among preparers is startling. Low statistical power may be partially to blame, as the preparation-stage analyses contained the fewest participants of all the stage-based regressions. However even at the zero-order level there were very few significant relationships observed between the processes and the behavioural outcomes for this stage, as shown earlier in Table

31 and Table 32. Those significant correlations that were observed pertained entirely to mismatched processes.

In addition, although the matched process of self-liberation was important to the prediction of intentions for preparers, the integration actually states that this process should predict *behaviour*, as behaviour change is the task facing smokers in preparation. Furthermore, the integration calls upon self-liberation to predict a *large* behaviour change for preparers, as smoking cessation is the task that marks the transition from this stage. In the present study, self-liberation was unable to account for even smaller increments in behaviour for smokers in this stage, and it was completely unrelated to smoking reduction even at the zero-order level. These findings suggest that the model has not identified the elements necessary for the preparation-to-action shift. It is perhaps one of the most critical of the transitions, as it is the point at which smokers finally quit smoking.

The second question addressed was the degree to which the processes' predictive power varied by stage, irrespective of the hypotheses proposed by the integration. The stage-by-stage analyses, summarized earlier in Tables 22 through 32, provide a moderate degree of support for this concept. As shown in Table 33, there were both commonalities and differences in the processes important to each stage. Consistent with the notion of specificity, no single process was helpful to smokers in all three stages. However, there were common processes shared by precontemplation and contemplation, as both stages were aided by self-reevaluation and by reinforcement management, although the latter differed in the direction of its effects. This finding of shared processes is inconsistent with the claim of strong specificity, which states that a fully unique set of processes will be helpful to each stage. However, the common processes were shared between adjacent rather than non-adjacent stages, consistent with the logic of the model which implies that the greatest distinctions should be observed between nonadjacent pairs of stages. Finally, consistent with the notion of specificity, two processes had a positive association with only one stage, with counterconditioning predicting intentions to reduce only for precontemplators and self-liberation predicting the same only for preparers. These findings, therefore, suggest a moderate degree of stage-specificity in the processes' predictive effects across these four measures of change.

Interestingly, only for the contemplation stage did some processes emerge as *negative* predictors of change. It is possible that the processes are stronger in their positive effects than in their negative effects; if this were the case, then the relatively greater power available for the contemplation stage analyses has permitted these effects to emerge. Some of them, clearly, are puzzling: why should dramatic relief (the emergence of worries and concerns about one's smoking) be a negative predictor of intentions for contemplators? Should feelings of fear and concern not encourage them to consider changing? In addition, why should reinforcement management (the receipt of rewards for not smoking) be negatively associated with intentions to reduce? Prochaska et al. might argue that these processes had a negative influence because they were not "matched" to the stage of contemplation – in other words, contemplators, by using these processes, would be doing the "wrong thing at the wrong time" (Prochaska et al., 1992). However, this explanation would be circular; it would be an insufficient explanation to state that mismatched processes hindered contemplators because they were mismatched. Clearly, the negative effects of the processes on the stages require further consideration.

The final question pertained to the degree of support for the nature of the stage-specificity proposed by the integration. To review, the integration indicates not just that stage-specificity exists, but that this specificity should take a particular form. First, consciousness raising, dramatic relief, and environmental reevaluation are matched to precontemplation; these three processes should be more powerful positive predictors of change for that stage than the mismatched processes, and they should predict change only for that stage. The integration indicates that self-reevaluation is matched to contemplation; it should be a more powerful positive predictor than the mismatched processes, and should predict change only for that stage. Finally, the integration indicates that self-liberation is matched to preparation; it should be a more powerful positive predictor than the mismatched processes, and it should predict change only for that stage.

The findings from the present study provide equivocal support for the integration's specific hypotheses about how the processes should be matched to stage. The processes that are underlined in Table 33 are those that the integration regards as matched. In strong opposition to the integration, precontemplators were aided by three mismatched processes and none of the matched processes. In particular, the finding that two behavioural processes were

important to precontemplators' intentions to reduce strongly contradicts the model's claim that behavioural processes are only helpful to smokers in the later stages. Moderate support for the integration was obtained for the contemplation stage, as both matched and mismatched processes emerged as important predictors. Only for the preparation stage was the integration hypothesis fully supported: the matched process, self-liberation, was the only process to predict change for this stage, and it was not predictive of change for either of the other two stages.

One additional issue bears a brief consideration. Both stage movement and continuous measures of behaviour change were used to assess the processes' predictive effects over time. This was not staged as a "contest" – the continuous measures were implemented in order to provide further power for the analysis of the processes, and to bypass some of the measurement problems associated with the use of stage movement. However, it is fruitful to consider the degree of correspondence of the process-to-stage relationships across these two very different types of outcome.

Remarkably, there appeared to be very little correspondence. With the exception of the link between self-reevaluation and precontemplation and between self-liberation and preparation, very different sets of processes emerged as important to each stage across these types of outcome[46]. However, it is very interesting that the degree to which the stage-matched processes were successful or unsuccessful was relatively consistent; both types of analysis provided very weak support for the processes that the integration proposes should be the most helpful to each stage.

Summary. The processes of change had fair to good predictive relationships with the outcome variables examined here. The evidence for stage-specificity (process use varying by stage) was moderate, particularly for the processes' relationships with the continuous measures, but the support for the stage-specificity hypotheses proposed by the integration was either very weak, as in the case of stage movement, or inconclusive, as in the case of the continuous variables. In fact, for the continuous variables, the degree of support for the integration *varied* by stage, with precontemplators being aided completely by mismatched

processes, contemplators being aided by both matched and mismatched processes, and preparers being aided only by their matched process.

Conclusions and Implications

The findings from the present study suggest a number of implications for the model. First, the robustness of the cross-sectional "general ordering pattern" demands that integration be altered to reflect this reliable and persistent pattern of process endorsement by stage. At present, the integration implies not only that smokers in different stages use different processes, but also that they use *completely different* sets of processes. The integration shows no overlap or redundancy in the stages' endorsement of the processes whatsoever. This is a claim that the model has simply been unable to live up to.

Second, the implications of these cross-sectional findings for the longitudinal issue of stage-matching of treatments should be considered. Recall that the processes used within a given stage define the focus for intervention for the smokers in the stage immediately prior to it in the continuum. In other words, what smokers do *within* a stage identifies what "the next step" should be for smokers trying to move *into* that stage from the one preceding it. Akin to the career advice often given to junior executives to "dress like the next level" in order to be promoted, smokers are urged to adopt the strategies of those in the next stage. However, this logic of deriving the longitudinal, *prescribed* patterns of process activity from the cross-sectional, *spontaneous* patterns of process activity may have boxed the model into a corner: following this logic, if there is no cross-sectional specificity, there can be no stage-matching.

Rather than declaring the demise of stage-matching, however, we should question Prochaska et al.'s logic. The manner in which smokers use the processes cross-sectionally likely has no bearing whatsoever on how the processes *should* be applied strategically. The reasoning itself is circular: it states that contemplators should use preparer processes because those are the processes that preparers are using, and contemplators wish to become preparers.

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[46] While there was lower power for the stage movement analyses, even the trends that emerged showed little correspondence with the outcomes from the continuous-measure analyses.

The notion that contemplators should act like preparers involves the assumption that preparers somehow know what is best to do. The fact that a smoker is in preparation signifies only that he or she intends to change soon; it does not imply that the smoker knows how to be a "good" preparer, whatever that might involve. Perhaps preparers use all of the processes because they don't know which ones are most important for them. In fact, Prochaska and his colleagues have stated that, left to their own devices, smokers typically fail to use the processes strategically and may remain stagnant within a stage for up to a year (Prochaska et al., 1992). A contemplator who mimics the activities of this type of preparer would learn only how to become a preparer that never advances!

This suggests that the characteristics of each stage to which the processes should be matched might as yet be unidentified. Rather than having contemplators act like preparers, it would seem more fruitful to try to understand how contemplators' thoughts, feelings, and attitudes toward smoking permit some processes to have more relevance and more impact than others, assuming that the processes do function differentially. Prochaska and his colleagues have indicated that "stage" implies a level of readiness to change. At present, this readiness is measured only by dichotomous indicators of intention and behaviour, as shown by the stage algorithm in Appendix A. Perhaps developing a more fully articulated concept of readiness would highlight the aspects of stage to which treatments should be matched.

Third, the longitudinal findings suggest that more conservative claims should be made regarding the processes' predictive effects in general, and regarding stage-matching in particular. While some of the outcome measures were very well predicted by the processes of change (e.g., precontemplators' intentions to reduce their smoking), only six of eleven stage-by-outcome regression analyses showed the processes to be capable of explaining significant proportions of variance. In addition, across the eleven regression analyses, only two of the five cognitive processes and only one of the five behavioural processes emerged as important positive predictors of change. While it is acknowledged that the four missing behavioural processes should not be relevant to smokers in these early stages, the lack of support for the three missing cognitive processes casts doubt on the notion that there is a role for each process to play. In all, to support the claim that the processes are "potent predictors of change"

(Prochaska et al., 1992, p. 1107), stronger effects than those observed here would be required[47].

In addition, while there was some evidence of uniqueness in the processes' relationships to stage, the considerable commonalities weaken the claim that matching to stage must occur. The findings from the stage-movement analyses in particular suggested that smokers in adjacent and even in nonadjacent stages might be aided by common processes. If stage-matching is to be the "motto of the model" (Prochaska & DiClemente, 1992, p. 190), then the proponents of the TTM must provide stronger evidence than that provided here.

Finally, and most importantly, the pattern of results aggregated across the five outcome measures and the three stages simply do not support the "prescription" of processes to stages that is depicted by the integration. In very few cases were smokers aided most by the processes matched to their stage. In addition, with one exception, smokers in every stage across every type of outcome measure were aided by processes presumed to be irrelevant or detrimental for their stage. In only *one* analysis out of eleven – that of intentions to reduce among preparers – did the matched process alone serve as an important predictor. The analyses in the present study therefore seriously threaten the claim that interventions based upon the stage-matching template provided by the integration will provide "unprecedented impacts" (Prochaska & Velicer, 1997b).

It must be remembered, however, that this series of analyses comprises the first real test of the processes' effects on outcome. The conclusions drawn from these longitudinal analyses require replication before substantive statements can be made about the degree of support for the processes' predictive functioning by stage.

Limitations

The present study is not without its limitations. First, some of the analyses were subject to problems of low power, particularly those analyzing the relationships between the processes of change and stage movement over time. While the results were interpreted with

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[47] Concerns about low statistical power do not temper this conclusion to a strong degree, as the estimation of R^2 in the regression analyses is unbiased – it does not depend upon sample size in the way that the tests of significance do.

the requisite caution, the search for trends in the data was an integral part of the main goals of the thesis. Not only was support sought for the specific claims made for the model, but also *any* degree of evidence, however small, was recognized. In view of the strength of the claims made for the TTM, the issue of effect size or "clinical" significance is pertinent. Clear trends, despite smaller sample sizes, should have emerged. In addition, the strength of the relationships that can be observed between the processes of change and the various measures of outcome will be attenuated by virtue of the stratification of the sample by stage. The analyses for each stage were essentially conducted on a "restricted range" of the dependent variables. This deficiency will plague any study of stage-based effects. Despite these points, it is recognized, however, that the findings that emerged from the lower-power analyses – indeed, from *all* of the analyses conducted in the present research – require replication with different samples and with greater power. Because this thesis offers the only focused tests of the model to date, further work is needed, regardless of power concerns, to further the clarification of these issues.

A second limitation to the findings of this study is the fact that they can generalize only to the first three of the five stages of change. The TTM literature offers more research on these three stages – the ones in which individuals are still smoking – than it does on the full set of five, perhaps because researchers are more interested in how the model can account for smoking cessation than how it can account for relapse and relapse prevention. Nonetheless, a complete understanding of how the processes relate to the stages, and of the tenability of the stage-matching concept, requires that all five stages be studied.

Third, all data in the present study were collected by self-report methods. Researchers who study smoking behaviour have thoroughly examined the implications of relying upon self-reports of smoking behaviour, and the need for biochemical validation measures (e.g., Velicer, Prochaska, Rossi & Snow, 1992). However, the problems associated with the self-report method (in particular, under-reporting of smoking) would not seriously influence the conclusions of the present study because the process-by-stage relationships, and not the accurate estimation of smoking rates, were the focus of interest.

Finally, the present study stops short of providing the strongest research evidence for the TTM – that which could be obtained from an experimental intervention study. The claims

for the TTM have been tested at the level of predictability, but the degree to which the processes of change can *cause* changes in smokers' intentions, behaviour, and stage need to be examined in an experimental design.

Where To From Here?

The Transtheoretical Model is a highly appealing, potentially important model that has excited health care providers and researchers alike for the past 10 to 15 years. It has undoubtedly influenced the work of physicians and other health care practitioners for the better. Those who have learned about the concept of stage or readiness report feeling better able to understand their smoking patients than they were beforehand (Samuelson, 1997). An appreciation of stage inspires consideration of the "how" of intervention, not just the "what." The very idea of "precontemplation" reminds them to tread gently, and perhaps to respect the choices of smokers who are not yet ready to change, rather than to bombard them with leaflets, patches, and well-meaning lectures. It gives them a language for thinking about the patients who most frustrate them – smokers who receive the benefit of their articulate, enthusiastic, supportive interventions, but who fail to change. It reminds them to stay the course and to strive to make their interventions fit the needs of the patient, rather than to make the patient fit the demands of the intervention.

However, the most meaningful contribution that the TTM can make lies in the articulation of treatment-matching principles. It is this aspect of the model that holds the most promise for changing the way in which public health programs are delivered, and the degree to which they can impact upon this important health threat. Prochaska and his colleagues have identified a considerable shortcoming of the majority of smoking-cessation strategies; they are, indeed, meant mainly for those who are ready to use them. The need to understand how to work with precontemplators and contemplators is paramount. However, unlike the useful heuristic that the concept of "stage" offers to practitioners, the principles that determine the development of stage-matched interventions *must* be based upon a solid scientific foundation. This foundation is, at present, fragile.

Where should the work proceed? Further longitudinal correlational work in which smokers from all five stages are represented would be important for clarifying the processes' stage-based predictive functioning. Multiple continuous measures of outcome should be

investigated, with the goal of identifying how different types of behaviour change are associated with the processes, and how that might vary by stage. Follow-up intervals of differing lengths should be explored, and the problems inherent in the measurement of stage movement should be examined. Further thought to *how* the processes should be matched to stage is required, and the possible process-by-stage relationships should be explored from all angles, not just those proposed by the integration.

The greatest need, however, is for experimental intervention studies that can identify how the processes function causally by stage. Stage-matched interventions need to be developed that clearly articulate how the processes are "delivered" in intervention terms, and that specify the principles upon which the processes are matched to stage. Finally, the use of appropriate no-treatment and mismatched-treatment control conditions would be essential for fully testing the effects of stage-matching.

The contemplator quoted at the beginning of this discussion begged for help to be sent "ASAP!" It is believed that the TTM, with further work to establish its place as a validated and empirically-based psychosocial model, could be an important provider of help to this and other smokers who are eager to "beat this thing" but do not know how.

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Appendix A

Stage Assessment Items and Algorithm for Assignment to Stages

Items

1.	Do you currently smoke cigarettes?	1. Yes	2. No	
2.	Have you smoked any cigarettes during the past six months?	1. Yes	2. No	
3.	Are you seriously considering quitting within the next six months?	1. Yes	2. No	3. I don't smoke
4.	Are you planning to quit in the next 30 days?	1. Yes	2. No	3. I don't smoke
5.	In the last year, how many times have you quit for at least 24 hours?	0. None	1. one or more times	

Scoring Algorithm

Stage	Q1	Q2	Q3	Q4	Q5
Precontemplation	1	–	2	2	–
Contemplation	1	–	1	2	–
Contemplation	1	–	1	1	0
Preparation	1	–	1	1	1
Action	2	1	3	3	–
Maintenance	2	2	3	3	–

Note. Algorithm indicates patterns of response to the five questions that must be present for classification into each stage. The stages are mutually exclusive with the exception that there are two routes to classification into Contemplation. A dash (–) indicates that the question is irrelevant to that stage.

Appendix B

Baseline Questionnaire

Section	Page
Instructions	162
Consent Form	163
Demographics	164
Stages of Change Items	165
Fagerström Revised Tolerance Scale[48]	166
Quitting History	168
Feelings about Smoking	169
Social Smoking Context	170
Intentions	171
Attitudes	172
Subjective Norms	175
Perceived Behavioural Control	177
Decisional Balance Scale (Short Form)	178
Processes of Change Scale (Short Form)	180
Self-Efficacy Temptation Scale (Short Form)	182
Self-Efficacy Confidence Scale (Short Form)	184

[48] Item number two on the Fagerström Scale is an addition by the author and is not part of this 10-item scale.

The Psychology of Smoking Study

Principal Investigator: Dr. Donald Meichenbaum, Professor

Student Investigator: Ms. Janice Hansen, Graduate Student

Administered at:

The Department of Psychology
University of Waterloo
Waterloo, Ontario
Canada N2L 3G1

(519) 885-1211 ext. 2551

Instructions

Please read carefully before proceeding to the rest of the survey.

Thank you for participating in the Psychology of Smoking Study!

This booklet should take roughly 30 minutes to complete. While you fill it out, please keep in mind that there are no "right or wrong answers" to any of the questions. We are interested in your personal opinions, not your knowledge of facts.

As well, we would appreciate that you:

- go through the pages in order
- complete the booklet by yourself — we are interested in *your* opinions, not those of others you know

As you go through the survey, it might seem like you are sometimes asked for the same information in different places. Even though a question might seem like you've already answered it before, please answer it again to the best of your ability without going back to check your previous answer.

~ Please read and sign the form on the next page before you complete the survey ~

IMPORTANT

Please read and complete this Consent Form before continuing.

Principal Investigator: Dr. Donald Meichenbaum, Professor

Student Investigator: Ms. Janice Hansen, Graduate Student

Administered at:

The Department of Psychology
University of Waterloo
Waterloo, Ontario, Canada N2L 3G1
(519) 885-1211 ext. 2551

I, _____, hereby state that I volunteer to participate in a study that investigates some of the psychological factors involved in smoking. I understand that my involvement in this study will include:

1. completing and returning a written survey

2. completing and returning two brief follow-up surveys one and two months following the original survey

Although I am consenting to these procedures, I am in no way required to participate in all phases of the study. I may withdraw my participation at any time without consequence. I am also aware that the intended purpose of this study is **not** to change my behaviour, nor to offer assistance in quitting smoking.

My responses to the written survey and the followups will be kept completely confidential. My address and telephone number are provided below in order that I may be contacted for the follow-up surveys. This page will be detached from my survey to protect my privacy.

This project has been reviewed and received ethics clearance through the University's Office of Human Research and Animal Care. If you have any questions or concerns about this project, please contact that office at (519) 885-1211, ext. 6005.

Name: (please print) _____

Address: _____

_____

Home Telephone: ( ) _____

Date: _____ **Signature:** _____

This first set of questions asks you for some information about yourself. In order to help us to keep it confidential, please do not put your name anywhere on this page.

Today's date: _____

Your age: _____

Sex:
- ❑ Male
- ❑ Female

Marital Status:
- ❑ Single
- ❑ Married
- ❑ Cohabiting
- ❑ Separated
- ❑ Divorced
- ❑ Widowed

Highest level of education: (Check one)
- ❑ some high school
- ❑ high school graduate
- ❑ some community college
- ❑ community college graduate
- ❑ some university
- ❑ university graduate
- ❑ some post-graduate training
- ❑ post-graduate degree

Do you <u>currently</u> use any of the following products?

(Check all that apply)
- ❑ nicotine gum (e.g., Nicorette)
- ❑ a nicotine patch (e.g., Nicoderm)
- ❑ LifeSign Computer
- ❑ another smoking-cessation product (please specify) _____
  _____

Are you currently participating in a stop-smoking program?
- ❑ Yes
- ❑ No

These questions ask you about your current smoking and your thoughts about quitting.

1. Are you currently smoking?

❑ Yes → How many cigarettes do you smoke per day? ☐ cigarettes

❑ No → How long have you been off cigarettes? ☐ days

2. Are you seriously considering quitting within the next 6 months?

❑ Yes
❑ No
❑ I am not currently smoking

3. Are you planning to quit within the next 30 days?

❑ Yes
❑ No
❑ I am not currently smoking

4. Have you quit smoking for a period of at least 24 hours sometime in the past year?

❑ Yes
❑ No

The following questions also ask you about your current smoking as it typically occurs on the average day.

1. How many cigarettes a day do you smoke? (circle one)

10 or less	31-35
11-15	36-40
16-20	41-45
21-25	46-50
26-30	51 or more

2. For how long have you been smoking this number of cigarettes per day? Please fill in any ONE of these:

_____ days
_____ weeks
_____ months
_____ years

3. How deeply do you inhale? (circle one)

1	2	3	4	5
I do not inhale		Moderately		Very Deeply

4. How often do you smoke more in the morning than during the rest of the day? (circle one)

1	2	3	4	5
Never		About Half the Time		Always

5. How often do you smoke your first cigarette of the day within 30 minutes of waking? (circle one)

1	2	3	4	5
Never		About Half the Time		Always

6. How difficult would it be for you to give up your usual first cigarette of the day? (circle one)

1	2	3	4	5
Not Difficult		Somewhat Difficult		Extremely Difficult

7. How difficult do you find it to refrain from smoking in places where it is forbidden (e.g., in church, on an airplane, at the library, cinema, etc.)? (circle one)

1	2	3	4	5
Not Difficult		Somewhat Difficult		Extremely Difficult

8. How often do you smoke when you are sick with a cold, the flu, or are so ill that you are in bed most of the day? (circle one)

1	2	3	4	5
Never		About Half the Time		Always

9. On average, about how much of each cigarette do you smoke? (circle one)

1/3 or less	1/2	2/3	3/4	All

10. On average, how often do you inhale? (circle one)

1	2	3	4	5
Never		About Half the Time		Always

11. On average, how often do you hold cigarette smoke in your lungs for a moment or two before exhaling?

1	2	3	4	5
Never		About Half the Time		Always

The following questions ask you about your own attempts to **quit smoking**. If you have never tried to quit smoking, please answer question #1 and then move on to the next page.

1. Have you ever attempted to quit smoking completely (not just reducing your smoking, but cutting it out altogether) ?

   ❑ Yes
   ❑ No ➔ Please move on to the next page.

2. How many times in the past year have you intentionally quit smoking, and succeeded for at least 24 hours? Please fill in the number:

   ❑ times

3. What is the longest period of time in your life that you were able to stay off cigarettes after quitting on your own? (Not counting any times you were forced to quit due to illness, etc.)

   ❑ days

4. Have you ever tried to quit smoking with the help of a formal stop-smoking program?

   ❑ No

   ❑ Yes ➔ How many times? Please fill in the number: ❑ times

   What was the longest period of time that you remained off cigarettes following a formal stop-smoking program? Please fill in the number of days:

   ❑ days

These questions ask you about some of your feelings about smoking.

1. What are some of the things that you <u>like</u> most about smoking?

_____
_____
_____

2. What are some of the things that you <u>dislike</u> most about smoking?

_____
_____
_____

3. Do you ever feel "hassled" by others about your smoking?

❑ No
❑ Yes ➔ In what ways?
Please describe: _____
_____
_____
_____
_____
_____
_____
_____

These questions ask you about the amount of smoking that occurs in your environment.

1. How many of your friends smoke?

None at all 1 2 3 4 5 6 7 All of them

2. How many of your coworkers smoke?

None at all 1 2 3 4 5 6 7 All of them

3. How much time do you spend with others who smoke?

None at all 1 2 3 4 5 6 7 A great deal

4. How many smokers currently live in your household (including yourself)?

Please fill in the number: ❑

5. Are you exposed to other people's tobacco smoke at work? ❑ Yes ❑ No

6. If you have a spouse or partner, does this person smoke?

❑ No
❑ Yes → Does this person live in the same household as you? ❑ Yes ❑ No

Please estimate how much this person smokes:

❑ cigarettes per day

7. Please think about your social activities in the average week. At what percentage of these activities is there usually someone (or a group of people) smoking? Please circle one number.

0 % 10 20 30 40 50 60 70 80 90 100 %

People often make plans or have intentions to change their behavior, such as when they make New Year's Resolutions. However, following through on those plans and actually making the change can be difficult. These questions ask you about your intentions and plans regarding smoking, **and** about whether you think you will end up **acting** on those plans. For each one, please circle the number that best describes your response.

1. I **intend to quit** smoking in the next month.

No, definitely do not intend	1	2	3	4	5	6	7	Yes, definitely do intend

2. I **expect that I will quit** smoking in the next month.

Not at all likely	1	2	3	4	5	6	7	Absolutely certain

3. I **intend to continue** smoking in the next month.

No, definitely do not intend	1	2	3	4	5	6	7	Yes, definitely do intend

4. I **expect that I will continue** to smoke in the next month.

Not at all likely	1	2	3	4	5	6	7	Absolutely certain

5. I **intend to reduce** the amount that I smoke in the next month.

No, definitely do not intend	1	2	3	4	5	6	7	Yes, definitely do intend

6. I **expect that I will reduce** the amount that I smoke in the next month.

Not at all likely	1	2	3	4	5	6	7	Absolutely certain

Here are three statements about smoking, followed by pairs of descriptive words. Please think about which of the two words in each pair best describes the way you feel about that statement. For each pair, please put a checkmark (✓) on the line that shows how well you think that word best describes your feelings about the statement.

For example:

Someone who thinks that quitting smoking would be **somewhat beneficial** would respond this way:

	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	
Harmful	____	____	____	____	✓	____	____	Beneficial

My stopping smoking in the next month would be:

	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	
Good	____	____	____	____	____	____	____	Bad
Rewarding	____	____	____	____	____	____	____	Punishing
Wise	____	____	____	____	____	____	____	Foolish
Worthless	____	____	____	____	____	____	____	Worthwhile
Negative	____	____	____	____	____	____	____	Positive
Nice	____	____	____	____	____	____	____	Awful
Unpleasant	____	____	____	____	____	____	____	Pleasant

My <u>continuing to smoke</u> in the <u>next month</u> would be:

Good	____ Extremely	____ Very	____ Somewhat	____ NEITHER	____ Somewhat	____ Very	____ Extremely	Bad
Rewarding	____ Extremely	____ Very	____ Somewhat	____ NEITHER	____ Somewhat	____ Very	____ Extremely	Punishing
Wise	____ Extremely	____ Very	____ Somewhat	____ NEITHER	____ Somewhat	____ Very	____ Extremely	Foolish
Worthless	____ Extremely	____ Very	____ Somewhat	____ NEITHER	____ Somewhat	____ Very	____ Extremely	Worthwhile
Negative	____ Extremely	____ Very	____ Somewhat	____ NEITHER	____ Somewhat	____ Very	____ Extremely	Positive
Nice	____ Extremely	____ Very	____ Somewhat	____ NEITHER	____ Somewhat	____ Very	____ Extremely	Awful
Unpleasant	____ Extremely	____ Very	____ Somewhat	____ NEITHER	____ Somewhat	____ Very	____ Extremely	Pleasant

<u>Reducing</u> my smoking in the <u>next month</u> would be:

Good	____	____	____	____	____	____	____	Bad
	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	
Rewarding	____	____	____	____	____	____	____	Punishing
	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	
Wise	____	____	____	____	____	____	____	Foolish
	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	
Worthless	____	____	____	____	____	____	____	Worthwhile
	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	
Negative	____	____	____	____	____	____	____	Positive
	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	
Nice	____	____	____	____	____	____	____	Awful
	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	
Unpleasant	____	____	____	____	____	____	____	Pleasant
	Extremely	Very	Somewhat	NEITHER	Somewhat	Very	Extremely	

People who are important to you often have opinions about the things you do, including smoking. These questions ask you to think about how other people who are important to you might view your smoking. For each question, please circle the number that you think best represents their opinions.

1. Most people who are important to me think:

I **should** quit smoking in the next month	1	2	3	4	5	6	7	I **should not** quit smoking in the next month

2. Most people who are important to me would:

Disapprove strongly of my quitting smoking in the next month	1	2	3	4	5	6	7	**Approve strongly** of my quitting smoking in the next month

3. Most people who are important to me think:

I **should continue** to smoke in the next month	1	2	3	4	5	6	7	I **should not continue** to smoke in the next month

4. Most people who are important to me would:

Disapprove strongly of my continuing to smoke in the next month	1	2	3	4	5	6	7	**Approve strongly** of my continuing to smoke in the next month

5. Most people who are important to me think:

I **should reduce** my smoking in the next month	1	2	3	4	5	6	7	I **should not reduce** my smoking in the next month

6. Most people who are important to me would:

Disapprove strongly of my reducing my smoking in the next month	1	2	3	4	5	6	7	**Approve strongly** of my reducing my smoking in the next month

Still thinking about those people who are most important to you, please consider how important you think their opinions are regarding the things that you do. Please circle one number for each response.

1. With regard to smoking, how important are their opinions about what you do?

Not at all important	1	2	3	4	5	6	7	Extremely important

2. In general, how important are their opinions about what you do?

Not at all important	1	2	3	4	5	6	7	Extremely important

Whether or not you are considering **changing** your smoking habits, you have probably thought about how easy or difficult it would be to make a change. For each of these questions, **please circle the number** that best indicates your opinion about changing your smoking habits.

1. For me to **quit** smoking in the next month would be:

Very easy	1	2	3	4	5	6	7	Very difficult

2. If I wanted to, I could easily **quit** smoking in the next month.

Strongly agree	1	2	3	4	5	6	7	Strongly Disagree

3. I have:

Complete control over quitting smoking in the next month	1	2	3	4	5	6	7	Absolutely no control over quitting smoking in the next month

4. For me to **continue** to smoke in the next month would be:

Very easy	1	2	3	4	5	6	7	Very difficult

5. If I wanted to, I could easily **continue** to smoke in the next month.

Strongly agree	1	2	3	4	5	6	7	Strongly Disagree

6. I have:

Complete control over continuing to smoke in the next month	1	2	3	4	5	6	7	Absolutely no control over continuing to smoke in the next month

7. For me to **reduce** my smoking in the next month would be:

Very easy	1	2	3	4	5	6	7	Very difficult

8. If I wanted to, I could easily **reduce** my smoking in the next month.

Strongly agree	1	2	3	4	5	6	7	Strongly Disagree

9. I have:

Complete control over reducing my smoking in the next month	1	2	3	4	5	6	7	Absolutely no control over reducing my smoking in the next month

The following statements represent different opinions about the positive and negative aspects of smoking. Please rate how important each statement is to you by circling the appropriate number.

	Not important to me	Slightly important to me	Moderately important to me	Very important to me	Extremely important to me
1. Smoking cigarettes is pleasurable.	1	2	3	4	5
2. My smoking affects the health of others.	1	2	3	4	5
3. I like the image of a cigarette smoker.	1	2	3	4	5
4. Others close to me would suffer if I became ill from smoking.	1	2	3	4	5
5. I am relaxed and therefore more pleasant when smoking.	1	2	3	4	5
6. Because I continue to smoke, some people I know think I lack the character to quit.	1	2	3	4	5
7. If I try to stop smoking I'll be irritable and a pain to be around.	1	2	3	4	5
8. Smoking cigarettes is hazardous to my health.	1	2	3	4	5
9. My family and friends like me better when I am happily smoking than when I am miserably trying to quit.	1	2	3	4	5
10. I'm embarrassed to have to smoke.	1	2	3	4	5
11. I like myself better when I smoke.	1	2	3	4	5
12. My cigarette smoking bothers other people.	1	2	3	4	5
13. Smoking helps me concentrate and do better work.	1	2	3	4	5

	Not important to me	Slightly important to me	Moderately important to me	Very important to me	Extremely important to me
14. People think I'm foolish for ignoring the warnings about cigarette smoking.	1	2	3	4	5
15. Smoking cigarettes relieves tension.	1	2	3	4	5
16. People close to me disapprove of my smoking.	1	2	3	4	5
17. By continuing to smoke I feel I am making my own decisions.	1	2	3	4	5
18. I'm foolish to ignore the warnings about cigarettes.	1	2	3	4	5
19. After not smoking for a while, a cigarette makes me feel great.	1	2	3	4	5
20. I would be more energetic right now if I didn't smoke.	1	2	3	4	5

These statements describe things that smokers sometimes do. For each question, please circle the one number that indicates how often you typically do each of these things.

		Never		Occasionally		Repeatedly
1.	When I am tempted to smoke, I think about something else.	1	2	3	4	5
2.	I tell myself I can quit smoking if I want to.	1	2	3	4	5
3.	I notice that nonsmokers are asserting their rights.	1	2	3	4	5
4.	I recall information people have given me on the benefits of quitting smoking.	1	2	3	4	5
5.	I can expect to be rewarded by others if I don't smoke.	1	2	3	4	5
6.	I stop to think that smoking is polluting the environment.	1	2	3	4	5
7.	Warnings about the health hazards of smoking move me emotionally.	1	2	3	4	5
8.	I get upset when I think about my smoking.	1	2	3	4	5
9.	I remove things from my home or place of work that remind me of smoking.	1	2	3	4	5
10.	I have someone who listens when I need to talk about my smoking.	1	2	3	4	5
11.	I think about information from articles and ads on how to stop smoking.	1	2	3	4	5
12.	I consider the view that smoking can be harmful to the environment.	1	2	3	4	5

	Never		Occasionally		Repeatedly
13. I tell myself that if I try hard enough I can keep from smoking.	1	2	3	4	5
14. I find society changing in ways that make it easier for nonsmokers.	1	2	3	4	5
15. My need for cigarettes makes me feel disappointed in myself.	1	2	3	4	5
16. I have someone I can count on when I'm having problems with smoking.	1	2	3	4	5
17. I do something else instead of smoking when I need to relax.	1	2	3	4	5
18. I react emotionally to warnings about smoking cigarettes.	1	2	3	4	5
19. I keep things around my home or place of work that remind me not to smoke.	1	2	3	4	5
20. I am rewarded by others if I don't smoke.	1	2	3	4	5

The following is a list of situations that lead some people to smoke. Please indicate how **tempted** you would feel to smoke in each of these situations by circling the appropriate number.

	Not at all tempted	Slightly tempted	Moderately tempted	Very tempted	Extremely tempted
1. At a bar or cocktail lounge having a drink.	1	2	3	4	5
2. When I am desiring a cigarette.	1	2	3	4	5
3. When things are just not going the way I want and I am frustrated.	1	2	3	4	5
4. With my spouse or close friend who is smoking.	1	2	3	4	5
5. When there are arguments and conflicts with my family.	1	2	3	4	5
6. When I am happy and celebrating.	1	2	3	4	5
7. When I am very angry about something or someone.	1	2	3	4	5
8. When I would experience an emotional crisis, such as an accident or death in the family.	1	2	3	4	5
9. When I see someone smoking and enjoying it.	1	2	3	4	5
10. Over coffee while talking and relaxing.	1	2	3	4	5
11. When I realize that quitting smoking is an extremely difficult task for me.	1	2	3	4	5
12. When I am craving a cigarette.	1	2	3	4	5
13. When I first get up in the morning.	1	2	3	4	5

14. When I feel I need a lift.	1	2	3	4	5
15. When I begin to let down on my concern about my health and am less physically active.	1	2	3	4	5
16. With friends at a party.	1	2	3	4	5
17. When I wake up in the morning and face a tough day.	1	2	3	4	5
18. When I am extremely depressed.	1	2	3	4	5
19. When I am extremely anxious and stressed.	1	2	3	4	5
20. When I realize I haven't smoked for awhile.	1	2	3	4	5

Here is the same list of situations from the previous two pages.
This time, please indicate how **confident** you are that you would not smoke in each of these situations by circling the appropriate number.

		Not at all confident	Slightly confident	Moderately confident	Very confident	Extremely confident
1.	At a bar or cocktail lounge having a drink.	1	2	3	4	5
2.	When I am desiring a cigarette.	1	2	3	4	5
3.	When things are just not going the way I want and I am frustrated.	1	2	3	4	5
4.	With my spouse or close friend who is smoking.	1	2	3	4	5
5.	When there are arguments and conflicts with my family.	1	2	3	4	5
6.	When I am happy and celebrating.	1	2	3	4	5
7.	When I am very angry about something or someone.	1	2	3	4	5
8.	When I would experience an emotional crisis, such as an accident or death in the family.	1	2	3	4	5
9.	When I see someone smoking and enjoying it.	1	2	3	4	5
10.	Over coffee while talking and relaxing.	1	2	3	4	5
11.	When I realize that quitting smoking is an extremely difficult task for me.	1	2	3	4	5
12.	When I am craving a cigarette.	1	2	3	4	5
13.	When I first get up in the morning.	1	2	3	4	5
14.	When I feel I need a lift.	1	2	3	4	5
15.	When I begin to let down on my concern about my health and am less physically active.	1	2	3	4	5

16. With friends at a party.	1	2	3	4	5
17. When I wake up in the morning and face a tough day.	1	2	3	4	5
18. When I am extremely depressed.	1	2	3	4	5
19. When I am extremely anxious and stressed.	1	2	3	4	5
20. When I realize I haven't smoked for awhile.	1	2	3	4	5

Thank you very much for your participation!
We are very grateful for your help.

Please make sure that you have filled out and signed the consent form on page 3, then seal your survey in the enclosed stamped envelope, and drop in the mail.

The enclosed pink page provides information about
the follow-ups that will occur over the next two months.

Smokers, We Need Your Help!

Researchers at the Psychology Department at the University of Waterloo are conducting a study that investigates what it's like to be a smoker in today's society.

If you are a cigarette smoker, you are cordially invited to participate.

This project has been reviewed and received ethics clearance through the Office of Human Research and Animal Care at the University of Waterloo.

This project has been reviewed and received ethics clearance through the Office of Human Research and Animal Care at the University of Waterloo.

The Psychology of Smoking Study

Department of Psychology
The University of Waterloo
Waterloo, Ontario
N2L 3G1

Are you a smoker?

If you are, we would love to have you participate in a study we are doing that looks at the experiences of smokers today.

This study is <u>not</u> intended to help smokers quit, nor to convince them that they need to.

Whether you want to quit smoking or not, as long as you are currently a smoker, we would like to hear your thoughts and opinions on a number of issues that are important to smokers today.

What is the study about?

As researchers, we are interested in learning more about smokers' opinions on such issues as:

- How smokers manage in an increasingly non-smoking society
- The kinds of pressure smokers face from others to quit smoking
- The pleasures and the problems of smoking
- What makes it so hard to quit smoking

What does participation involve?

If you decide to take part in this study, you will be asked to do two things:

1. Fill out a survey on smoking that will be mailed to you. It will take about 30 minutes to complete. A stamped, addressed envelope will be provided for you to return it to the University of Waterloo at no cost to you.
2. Participate in two brief (5 to 10 minute) telephone interviews about smoking in the two months following the survey.

All responses are kept ***completely confidential.***

Although we cannot offer payment to participants, there will be 4 draws for $50 each held at the end of the study.

How do I participate?

In order to participate in the study, please call anytime:

(519)747-2291

There is no long-distance charge if you are dialing from the local Kitchener-Waterloo area.

<u>If you prefer</u>, you may mail in the coupon below, and information will be sent to you.

Please send me information about the Psychology of Smoking Study:

Name: _____

Address: _____

_____

_____

Telephone: _____

<u>Mail to</u>:

The Psychology of Smoking Study
Department of Psychology
University of Waterloo
Waterloo, Ontario N2L 3G1

Appendix D

Recruitment Notice Posted on the World-Wide-Web[49]

The Psychology of Smoking Study

Department of Psychology, University of Waterloo

We would like to hear from people who smoke!

Please join in this study, and tell us:

- How you feel about smoking
- What makes it difficult (or easy) to quit smoking
- Whether your family or friends influence your decision to smoke
- What you think about the pleasures and problems of smoking

Is this another quit-smoking thing?

No. This study is not intended to convince anyone to quit or cut back on smoking, and it does not offer any kind of a treatment program for doing so. (If you're interested in some sites that help with such things, check out the great links at the bottom!)

So what is it?

Instead, we would like to hear from smokers who are already thinking about quitting or cutting back, even if they aren't thinking about it very seriously. We would like to learn more about what helps, and what gets in the way of their efforts to change.

What would I have to do?

If you decide to take part in this study, you will be asked to do two things:

1. Fill out a survey on smoking that will be mailed to you. Filling it out takes about 30 minutes. Whether you live in Canada or the U.S., we will provide postage to return the survey to us.
2. Participate in two 5-minute interviews over the two months following the survey. These interviews can take place over the phone, by e-mail, or by regular mail.

---

[49] Only the formatted text from this HTML notice is included; the coloured background and different colours of text that were used were not reproduced here. Links to other sites or to e-mail addresses are indicated here by underlined text but appear as coloured text on the web page. In addition, page breaks do not appear in the World-Wide Web version of this document.

Okay, I might be interested...

Great! You'll need to send us an e-mail to let us know. When we respond, we'll answer any questions you might have, and make arrangements to send you the study package.

Please click here to send us your message: jshansen@watarts.uwaterloo.ca

Special Note to Recent Quitters: We regret that we can't use your help in this study, as it's geared only for current smokers. But thank you very much for all your kind notes of interest and offers of help. Best wishes for continued success to all of you.

The Fine Print:
This study is part of doctoral research being conducted at the University of Waterloo's Department of Psychology. It has been reviewed and approved by the Office of Human Research and Animal Care at the university. This office ensures that research carried out by university members does not pose harm or risk to those participating. This office may be reached at (519)885-1211 ext. 6005 with questions or concerns.

Contact Persons:

Ms. Janice S. Hansen, Graduate Student,
Dept. of Psychology, University of Waterloo
Waterloo, ON N2L 3G1 Canada
jshansen@watarts.uwaterloo.ca
(613)562-5800, ext. 8277

Dr. Donald Meichenbaum, Professor,
Dept. of Psychology, University of Waterloo
Waterloo, ON N2L 3G1 Canada
dmeich@watarts.uwaterloo.ca
(519)885-1211, ext. 2551

Smoking Resources on the Web

Check out these great sites!

Blair's Quit Smoking Resource Page

The No-Smoke Cafe

Home Page for Alt.Support.Stop-Smoking

The Tobacco BBS

Appendix E

Introductory Letter[50]

Dear

Thank you for your interest in participating in the Psychology of Smoking Study! I am a graduate student researcher from the Psychology Department at the University of Waterloo in Waterloo, Ontario, Canada who is interested in learning more about the issues faced by people who smoke.

This study is not intended to change your behavior.

This study is not designed to convince you that you should quit smoking, nor to offer help to those who would like some assistance in doing so. Its purpose *is* to learn about how smokers feel about their smoking and how they may have tried to change it. We need your help in learning more about some of the feelings, attitudes, beliefs, intentions, and social influences that smokers experience. Health programs that are designed to help people quit smoking need to start from a clear understanding of how smokers feel and think about some of these issues. It is this understanding that we are seeking in this project.

What am I being asked to do?

If you are interested in taking part in the study, I would be asking you to:

1. Fill out a survey on smoking issues.

   The survey is enclosed in this package, and takes roughly 30 minutes to do. Complete instructions are included, along with a stamped, addressed envelope for mailing it back to us.

2. Participate in two brief follow-up interviews with the researcher roughly one and two months after your survey is returned to us.

   These interviews take place in the form of a "questionnaire" sent to you via e-mail. They are very brief, requiring roughly 5 minutes each. *Please see the pink page in this package for more information about these two interviews.*

---

[50] For Internet participants, the phrase "telephone interviews" is replaced by "e-mail interviews."

What will be done with my survey answers?

The information that you provide will be combined with that provided by the other participants; in other words, we're interested in the *group's* responses rather than those of any individual person. We understand that the survey contains personal information, and we have procedures in place to safeguard your privacy. For example, once your survey is received, you will be identified by a code number rather than by your name or other personal identification. The names of the people who participate in this study will never be used for any reason. All responses are completely confidential.

What if I have questions?

If you would like more information about this project, I would be pleased to hear from you. You may contact me by mail at the address above, by e-mail at "jhansen@watarts.uwaterloo.ca" or by leaving a message at (519)885-1211, ext. 2813. Your call will be returned promptly.

As well, because this project has been reviewed and received ethics clearance through the University of Waterloo's Office of Human Research and Animal Care, you may contact that office at (519) 885-1211, ext. 6005 if you have any questions or concerns about this project.

Thank you very much for your interest. I look forward to receiving your survey!

Sincerely,

Janice S. Hansen
Graduate Student

Appendix F

Follow-up Interview Information Sheet[51]

The Follow-up Interviews

Why two interviews?

As time passes, people sometimes change their minds or their opinions about things. We are interested in learning about how some of your opinions and attitudes about smoking might (or might not) change over time. The first interview will happen one month after you have done the survey, with the second interview happening one month after the first one.

What will be asked?

A *small* set of questions from the written survey will be asked — most of them will have to do with your smoking over the past month. The same questions will be included in both interviews.

How will they be arranged?

Roughly one month after your survey has been returned, a research associate will contact you by e-mail to inquire whether you would prefer to do these followups by e-mail or by regular post.

- the e-mail version would take the form of a questionnaire that you can edit on-screen with your responses, then e-mail back to the researcher.
- the regular mail version would take the form of a small (3-page) printed questionnaire that you can fill out and return in the stamped, addressed envelope that will be provided.

The second follow-up will be identical to the first, and will take place roughly one month after the first one.

How long will they take?

In either format, the follow-up interviews should take no more than 5 to 10 minutes.

---

[51] The version of this information sheet (referred to in the questionnaire as the "pink page") that was sent to Internet participants omits any reference to telephone follow-ups, and refers to e-mail format follow-ups only.

Appendix G

Follow-up Interview Script (Telephone Version)

Subject Name: _____

Phone #: _____

Date of call: _____

Hi, I'm a research assistant calling about the Psychology of Smoking Study. You might recall completing a questionnaire for this study a little over a month ago. I'm calling regarding the first follow-up interview.

Is this interview still something that you would be willing to do?
(If no, say thanks and hang up.)

This should take between 5 and 10 minutes. Would this be a good time for us to do it, or would there be a better time for me to call back?

Alternate Time: _____

Okay ...

As I ask each question, I'm going to let you know exactly what type of answer is needed — so some them will need "yes or no" answers, some will ask you to provide a number, and so forth. Please let me know if there are any questions that you don't quite understand.

To start with, I'd like you to think back over the past 7 days, until last _____. Thinking just of the weekdays and forgetting Saturday and Sunday for the moment, what would you say is the average number of cigarettes that you smoked on each of those weekdays?

_____

Thinking now just of last Saturday and Sunday, what would you say is the average number of cigarettes that you smoked on each of those two days?

_____

This next one is a "yes or no" question ...

Thinking back over the past 30 days, were there any days where you intentionally did not smoke at all? That is, not smoking because you decided not to, not because of other things beyond your control. Were there any days like that in the last month?

No ☐ → *go to next page*

Yes ☐ → Still thinking of these last 30 days, what would you say is the longest number of days **in a row** that you intentionally did not smoke? Your answer could be anywhere between 1 and 30.

_____

How many of these days were there in total — disregarding whether they're all in a row or not, how many days in total, over the month, did you intentionally not smoke at all?

_____

Would you say that you intentionally did not smoke on those days because you were trying to quit, or was there a different reason that you didn't smoke?

trying to quit ☐
a different reason ☐ → What was that reason?

_____
_____
_____
_____

Would you say that it was easy or difficult NOT to smoke on those days? Please give me a number between 1 and 7 where 1 is "very easy" and 7 is "very difficult"

1 2 3 4 5 6 7

What would you say helped you not to smoke on those days?

_____
_____
_____
_____

This next one is another "yes or no" question ...

Thinking back over the past 30 days, were there any days where you intentionally cut back on your smoking? That is, intentionally reducing the amount that you smoke because you decided to, not just because of circumstances. Were there any days like that in the last month?

No ☐ → *go to next page*

Yes ☐ → Still thinking of these last 30 days, what would you say is the longest number of days **in a row** that you intentionally cut back? Your answer could be anywhere between 1 and 30.

_____

How many of these days were there in total — disregarding whether they're all in a row or not, how many days in total, over the month, did you intentionally cut back on the number of cigarettes?

_____

Would you say that you intentionally cut back on those days because you were trying to quit, or was there some other reason?

trying to quit ☐
some other reason ☐ → What was that reason? _____
_____
_____
_____
_____

Would you say that it was easy or difficult to cut back on those days? Please give me a number between 1 and 7 where 1 is "very easy" and 7 is "very difficult"

1 2 3 4 5 6 7

What would you say helped you to cut back?

_____
_____
_____
_____

I have some questions now about a few other aspects of your smoking that might have changed over the last 30 days. For each one, I'd like you to tell me if each aspect has increased, decreased, or stayed the same over the last 30 days.

1. The number of different places where you have a cigarette. Over the past 30 days, has this:

- increased ☐
- decreased ☐
- stayed the same ☐

2. The amount of enjoyment that you get from smoking. Has this:

- increased ☐
- decreased ☐
- stayed the same ☐

3. The amount of each cigarette that you smoke. Has this:

- increased ☐
- decreased ☐
- stayed the same ☐

4. The number of times that you would inhale when you smoke. Has this:

- increased ☐
- decreased ☐
- stayed the same ☐

Next, I have **9** "yes or no" questions about things you might or might not have done this past month.

Please answer "yes" if the item is something you have done, and "no" if it's something you have not done in the past 30 days.

The thing that I'd like you to keep in mind when you answer, is that I'm asking specifically about the past 30 days and not just about your behavior in general.

In the past 30 days, have you:

1. Felt bothered or angry about a look or comment from a non-smoker.	Yes	No
2. Avoided places and situations where you know you'll want a cigarette.	Yes	No
3. Felt bothered or angry about non-smoking regulations in public places.	Yes	No
4. Removed things from home or work that remind you of smoking.	Yes	No
5. Heard someone that you know ask you why you smoke.	Yes	No
6. Intentionally spent more time in places where smoking is not permitted.	Yes	No
7. Felt guilty or defensive about smoking.	Yes	No
8. Planned in advance how you might resist an urge to smoke.	Yes	No
9. Thought about your freedom to choose whether you smoke or not.	Yes	No

These last questions ask you about what you might be intending or planning for the next little while. I'll ask if you intend or plan to do this particular thing, and I'd like you to answer on a 1 to 7 scale:

1 means "no, I definitely do not plan to do this"
7 means "yes, I most definitely do plan to do this."

The first one is **"continuing to smoke"** over the next 30 days from today. On the 1 to 7 scale, what are your intentions regarding continuing smoking over the next month?

1 2 3 4 5 6 7

The next one is **"reducing your smoking"** over the next 30 days. On the 1 to 7 scale, what are your intentions regarding reducing over the next month?

1 2 3 4 5 6 7

The next one is **"quitting smoking"** over the next 30 days. On the 1 to 7 scale, what are your intentions regarding quitting over the next month?

1 2 3 4 5 6 7

The last one is **"quitting smoking"** again, only this time I'm asking you about **the next 6 months**. What are your intentions regarding quitting over the next 6 months?

1 2 3 4 5 6 7

end

Okay, thank you very much!

There is one more interview exactly like this one, planned for one month from now. Would you still be willing to participate in that?

Thanks for your help.

Appendix H

Follow-up Interview (E-mail Version)

Dear _____,

It has been a month since you completed the survey for this study. I appreciate your taking the time to do it and send it back.

I wanted to get back to you with the first follow-up "e-mail interview." It is attached below. It shouldn't take you much more than 10 to 15 minutes.

If you wouldn't mind, please complete it by "editing" it as you would any other mail message, and then sending it back to me. It should be clear what type of answer is needed - some questions ask you just to mark off your answer with an "x" while others ask you to type in a number or a brief answer. Please feel free to send me a quick e-mail if there are any questions that you don't quite understand.

Once again, *many* thanks for your help with this project.

Regards,

Janice Hansen
Department of Psychology
University of Waterloo
Waterloo, Ontario

- -

Follow-Up Interview #1

- -

Please type here the date that you are completing this:

To start with, I'd like you to think back over the past 7 days from today.

Question #1:
~~~~~~~~~~~
Thinking just of the weekdays, and disregarding the weekend for the moment, what would you say is the average number of cigarettes that you smoked on each of those weekdays?

average number:

Question #2:
~~~~~~~~~~~
Thinking now just of last Saturday and Sunday, what would you say is the average number of cigarettes you smoked on each of those two days?

average number:

Next, please try to think back over the past 30 days ...

Question #3:
~~~~~~~~~~~
~~~~~~~~~~~

Thinking back over the past 30 days, were there any days where you *intentionally* did not smoke at all? That is, not smoking because you *decided* not to, not because of other things beyond your control? Please type an "x" in front of your answer:
^^^^^^^^

Yes --> please continue to Question #4
No --> please skip to Question #10

Question #4:
~~~~~~~~~~~
Still thinking of these last 30 days, what would you say is the longest number of days *in a row* that you intentionally did not smoke? Please type in a number anywhere between 1 and 30.

longest number of days in a row:

Question #5:
~~~~~~~~~~~
How many of these days were there in total? Disregarding whether or not they were all in a row, how many days in total over the month did you intentionally not smoke at all? Please type in the number.

total number of days:

Question #6:
~~~~~~~~~~~
Would you say that you intentionally did not smoke on those days because you were trying to quit, or was there a different reason? Please put an "x" in front of your answer:
^^^^^^^^

trying to quit --> please skip ahead to Question #8
a different reason --> please continue on to Question #7

Question #7:
~~~~~~~~~~~
Please briefly describe that reason:

Question #8:
~~~~~~~~~~~
Would you say that it was *easy* or *difficult* NOT to smoke on those days this past month? Please type in a number between 1 and 7, where "1" means "very easy" and "7" means "very difficult."

number:

Question #9:
~~~~~~~~~~~
What would you say *helped* you not to smoke on those days?

Question #10:
~~~~~~~~~~~~
Thinking back over the past 30 days, were there any days where you *intentionally* cut back on your smoking? That is, *intentionally* reducing the among that you smoke because you decided to, not just because of other circumstances. Were there any days like that this past month?

Please type an "x" in front of your answer:
^^^^^^^^

Yes --> please continue on to Question #11
No --> please skip ahead to Question #16

Question #11:
~~~~~~~~~~~~
Still thinking of these last 30 days, what would you say was the longest number of days *in a row* that you intentionally cut back on your smoking? Please type in a number anywhere between 1 and 30.

number:

Question #12:
~~~~~~~~~~~~
How many of these days were there *in total*? Disregarding whether or not they were all in a row, how many days in total, over the month, did you intentionally cut back on the number of cigarettes you smoke? Please type in the number.

total number of days:

Question #13:
~~~~~~~~~~~~
What would you say is the main reason behind your decision to cut back this past month? Please describe it briefly.

Question #14:
~~~~~~~~~~~~
Would you say that it was *easy* or *difficult* to cut back on smoking this past month? Please type in a number between 1 and 7, where "1" means "very easy" and "7" means "very difficult."

number:

Question #15:
~~~~~~~~~~~~
What would you say *helped* you to cut back?

Question #16:
~~~~~~~~~~~~
These next 4 items ask about a few other aspects of your smoking that might have changed over the past month. For each one, please indicate whether that aspect of your smoking increased, decreased, or stayed the same over the last 30 days.

For each one, please type an "x" in front of your answer.
^^^^^^^^

(a) The number of different places where you have a cigarette. Over the past month, has this:

increased
decreased
stayed the same

(b) The amount of enjoyment that you get from smoking. Over the past month, has this:

increased
decreased
stayed the same

(c) The amount of each cigarette that you smoke. Over the past month, has this:

increased
decreased
stayed the same

(d) The number of times that you inhale when you smoke. Over the past month, has this:

increased
decreased
stayed the same
~~~~~~~~~~~~

Question #17:
~~~~~~~~~~~~

These next 9 questions ask about things that you might or might not have done this past month. Please answer "yes" if the item describes something that you *have* done, and "no" if it describes something that you *haven't* done in the last 30 days. Please think just about the last 30 days, and not about your behaviour in general.

To indicate your answer, please type "yes" or "no" after each item.

(a) Felt bothered or angry about a look
or a comment from a non-smoker:

(b) Avoided places and situations where
you know you'll want a cigarette:

(c) Felt bothered or angry about non-smoking
regulations in public places:

(d) Removed things from home or work
that remind you of smoking:

(e) Heard someone that you know ask you *why*
you smoke:

(f) Intentionally spent more time in places
where smoking is not permitted:

(g) Felt either guilty or defensive about
smoking:

(h) Planned in advance how you might resist
an urge to smoke:

(i) Thought about your freedom to choose
whether you smoke or not:

These last questions ask you about your plans or intentions for the next little while. To indicate your intentions, please type in a number between 1 and 7, where:
^^^^^^^^^^^^^^^^

1 = No, most definitely do NOT plan to do this
7 = Yes, most definitely DO plan to do this

Question #18:
~~~~~~~~~~~~

(a) Continuing to smoke over the next 30 days from today.

On the 1 to 7 scale, my intentions regarding continuing smoking over the next month are:

(b) Reducing my smoking over the next 30 days from today.

On the 1 to 7 scale, my intentions regarding reducing my smoking over the next month are:

(c) Quitting smoking over the next 30 days from today.

On the 1 to 7 scale, my intentions regarding quitting smoking over the next month are:

(d) Quitting smoking over the next *6 MONTHS* from today.

On the 1 to 7 scale, my intentions regarding quitting smoking over the next 6 months are:

- -

That's it!

Thank you very much for completing this follow-up interview. To complete the study there is one more follow-up just like it planned for next month. I will send it to you at that time unless I hear otherwise from you ... please be aware that you are under no obligation to continue with the study if you don't wish to.

My sincere thanks again. I'll look forward to receiving this interview back from you, and to chatting with you again in another month.

Sincerely,

Janice Hansen
Psychology Department
University of Waterloo
jshansen@watarts.uwaterloo.ca

- -

Appendix I

Debriefing Letter

The Psychology of Smoking Study
Feedback Information

Dear Participant:

Many thanks once again for participating in our study on smoking. Your help has been very important -- your written survey, and your answers to the questions asked in the follow-up interviews, both help to answer a number of questions that guided this research project. This letter is intended to give you more information on this project and to try to answer some questions that may have occurred to you as you were participating.

WHY DO RESEARCH ON SMOKING?

Psychologists are interested in smokers' attitudes, behaviors, and beliefs about smoking and quitting because any effort to help smokers quit needs to be based upon research. There are many opinions on why people do or do not quit, and what the most effective quitting methods might be. However, personal opinions and hunches can be inaccurate – and a smoker who wants to quit as painlessly as possible will not appreciate advice and assistance based only on opinions and hunches that may or may not be helpful. Careful research is the best means we have for teasing apart opinion from fact.

HASN'T SMOKING CESSATION BEEN STUDIED ENOUGH ALREADY?

Although psychologists and others have been studying smoking cessation for some time now, the situation has changed for the smoker in recent years. As you have no doubt noticed, there seems to be a lot more pressure on smokers to quit than ever before. The message comes from doctors, the workplace, advertisements, friends, and loved ones. More and more, smokers see that restaurants and businesses do not allow smoking. They see the "sin taxes" increased on cigarettes each year, especially in Canada. The social environment is therefore quite different for smokers now than it was even 10 years ago. Because of these factors, studies on smoking and smoking cessation continue to be important as the social climate and popular opinions continue to change.

WHY DIDN'T YOU STUDY SOME OF THE OTHER ASPECTS, LIKE ADDICTION?

Any single study needs to focus on a narrow set of questions that it will address. No single project can answer broad questions like "Why do people quit smoking?" or "What is the most successful way to quit smoking?" Instead, each study addresses a specific set of questions

about a small number of variables in order to determine the relationships among those variables.

WHAT IF I DIDN'T QUIT SMOKING?

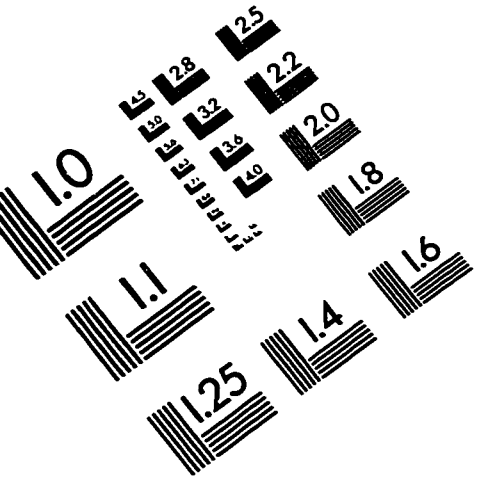
This study defines "change" rather loosely. The goal was *not* to find smokers who were all going to quit smoking; many participants had no intentions at all of quitting, and they were just as important to the investigation of these theories as those who did quit or reduce their smoking. If a theory is going to be able to predict "change," it also needs to predict when change will *not* happen. If we do not understand some of the factors that are involved in being a satisfied smoker who has no desire to change, then we will not fully understand how to help the smoker who *does* want to change.

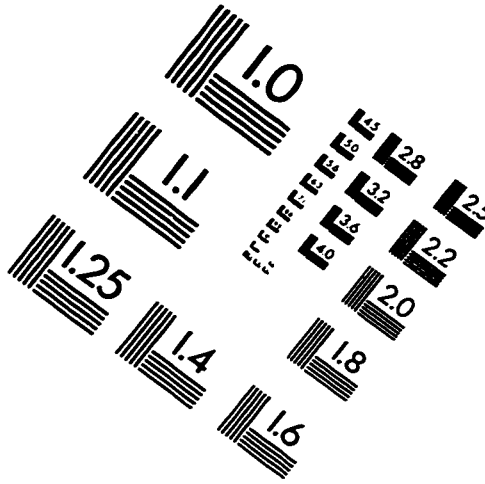
Thanks again for your help on this project. If you would like to receive any further information about the study or any aspect of your participation in it, I encourage you to call with your questions and I'll be happy to reply.

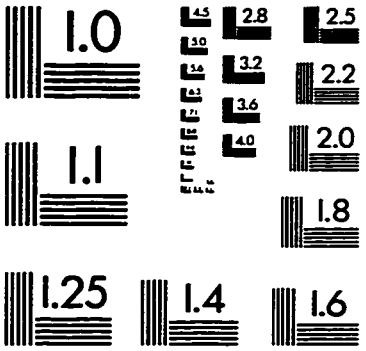
Sincerely,

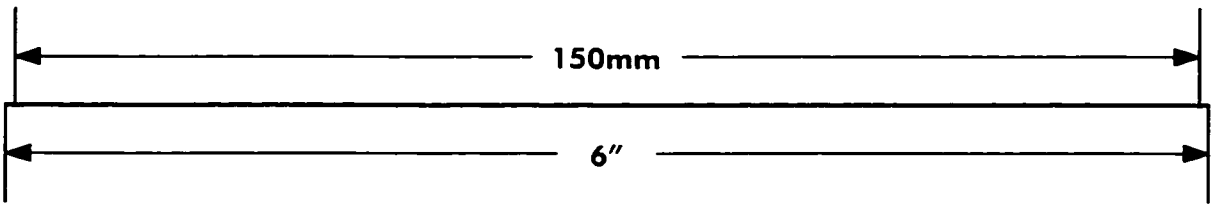
Janice S. Hansen

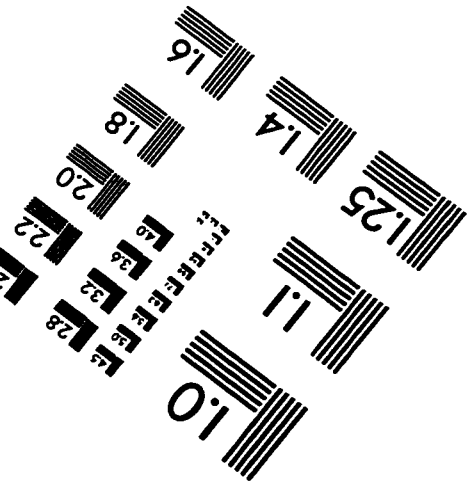
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TEST TARGET (QA-3)

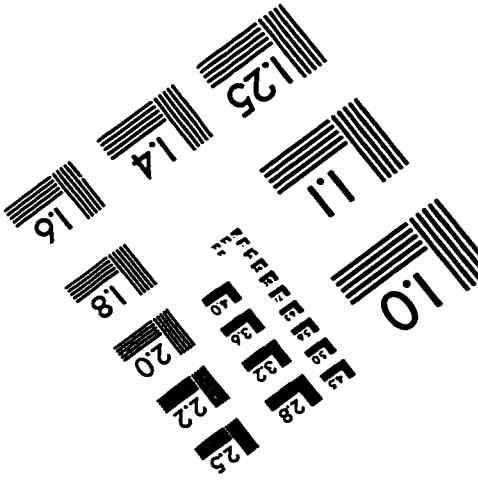












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