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Comparison of Behavioural Belief Structures in the Physical Activity Domain

Ryan E. Rhodes

University of Victoria, Canada

Mark Conner

University of Leeds, U.K.

Key Words: Theory of Planned Behaviour, Exercise, Theory of Reasoned Action

Address Correspondence to:

Ryan E. Rhodes, Ph.D., Behavioural Medicine Laboratory, Faculty of Education, PO Box 3010 STN CSC, University of Victoria, Victoria, B.C., V8W 3N4 CANADA, Tel: (250) 721-8384, Fax: (250) 721-7767, EM: rhodes@uvic.ca

Abstract

In this study, behavioural belief structures were evaluated in the physical activity domain along four dimensions: positive/negative, affective/instrumental, distal/proximal and specific motive. Participants (n = 200) completed 19 behavioural belief items and a measure of intention. These behavioural beliefs were subsequently classified on each dimension by two independent judges. Results using structural equation modelling showed that positive/negative, affective/instrumental, and proximal/distal dimensions each improved fit over a single behavioural belief construct. Division by affective/instrumental and positive/negative yielded the best fit compared to single dimensions but no division resulted in adequate model fit. Indeed, fit continued to improve as each dimension was added, but this specificity came with incumbent multicollinearity when trying to use the constructs for prediction purposes.

Key Words: Theory of Planned Behaviour, Exercise, Theory of Reasoned Action, Attitude

Comparison of Behavioural Belief Structures in the Physical Activity Domain

Despite the considerable benefits of regular physical activity, the majority of the population remain inactive (Warburton, Katzmarzyk, Rhodes, & Shephard, 2007). Thus, the promotion of physical activity has become a public health priority. The use of theory-based approaches to understanding physical activity has been recommended, and one of the most validated models has been Ajzen's (1991) theory of planned behaviour (TPB) (Symons Downs & Hausenblas, 2005). The TPB has been used to identify key beliefs that might be targeted in an intervention to change physical activity. This approach typically results in a list of beliefs that might be targeted in an intervention. However, such beliefs are not independent. The present research aimed to explore the structure of such beliefs.

Briefly, the TPB proposes that intention (i.e., summary motivation to act) and perceived behavioural control (PBC; i.e., perceived capability to enact the behaviour) are the primary influences on behaviour. In turn, attitude (i.e., overall evaluation of the behaviour), subjective norm (i.e., perceived social pressure to enact the behaviour) and PBC exert influence on behaviour through intention. Interventions that apply the TPB, however, are usually based on belief-level constructs (Ajzen, 2002b). Specifically, attitude, subjective norm, and PBC are comprised of specific behavioural (e.g., physical activity is good for my health), normative (e.g., my friends would approve if I was active), and control (e.g., I lack the free time to be active) beliefs respectively. These belief-level constructs have received scant attention in physical activity research in comparison to the more generalized TPB constructs, yet they remain the focal target for TPB interventions. Thus, the structures of beliefs need to be better understood.

The attitude construct is arguably the central and distinguishing construct in the TPB, beginning in its heritage from the Theory of Reasoned Action (Fishbein & Ajzen, 1975). Both theories start from a summative model of attitudes (Fishbein, 1967a, 1967b) which suggests that attitudes are based on salient individual beliefs about the outcomes of a behaviour weighted by the value placed on each outcome. However, this aggregate expectancy-value formulation structure has received limited support in recent research with a number of researchers criticising the necessity of the value component (Courneya & Friedenreich, 1997; Gagne & Godin, 2000; Rhodes, Blanchard, Courneya, & Plotnikoff, in press). Instead, the sum of the expectancy component of the beliefs (an aggregate model) has been found to be generally sufficient to account for the variance in belief-attitude or belief-intention relations. This is likely due to limited range in the value component (e.g., most people value the positive outcomes of health behaviours) and the implicit values residing within an expectancy and intention relationship. Furthermore, in the physical activity domain, the aggregate structure of beliefs tends to account for approximately 80% of the predictive variance (Rhodes, Plotnikoff, & Spence, 2004), although belief-level specificity is certainly present among behavioural beliefs (e.g., Blanchard et al., in press; Courneya & Friedenreich, 1997; Rhodes et al., in press; Rhodes, Blanchard, & Matheson, 2007).

The present research focuses on the best way to treat this aggregate of beliefs. At one extreme, some analyses treat behavioural beliefs as an aggregated total (Ajzen, 2002a). This may be unhelpful as it provides little information on the relative power of different beliefs to determine intentions. At the other extreme some analyses treat behavioural beliefs through a series of univariate analyses (Fishbein, Von Haeften, & Appleyard, 2001). The problem here is that individual beliefs generally show high levels of intercorrelation suggesting some lack of

independence. An alternative way of examining such beliefs has been to examine individual ratings of the importance of beliefs (van der Pligt, de Vries, Manstead, & van Harreveld, 2000). However, the added complexity of analyses has led to few researchers adopting this approach. A further alternative, that is explored here, is to fit beliefs into a limited number of conceptual dimensions (e.g., positive versus negative; instrumental versus affective). An advantage of this approach is that conceptually similar beliefs are grouped together and tested as predictors of intentions. In this way it may be possible to identify key types of beliefs that might be targeted in intervention. This research attempted to evaluate whether such intermediary belief structures better accounted for belief-level constructs.

Theoretical considerations support four possible dimensions along which behavioural beliefs might be grouped. First, beliefs may be distinguished along positive (e.g., physical activity makes me feel good) and negative (e.g., physical activity is painful) valences. This approach is central to assessment of attitudinal ambivalence (e.g., Armitage, 2003; Conner, Povey, Sparks, James, & Shepherd, 2003), and is a focus of belief structure in models like the transtheortetical model (Prochaska & DiClemente, 1982) and health belief model (Rosenstock, 1974). It has also been argued that it is the positive-negative dimension that value judgements tap in traditional applications of the TPB/TRA (Conner & Sparks, 2005). Second, beliefs may be distinguished along an affective (e.g., physical activity is fun) to instrumental (physical activity prevents disease) continuum (Lawton, Conner, & Parker, 2007). This distinction has been made with considerable success in attitude constructs in the exercise domain (e.g., French et al., 2005; Lowe, Eves, & Carroll, 2002; Rhodes, Blanchard, & Matheson, 2006). Third, beliefs may be distinguished by the temporal proximity of the expected outcome. That is, physical activity has proximal (e.g., stress management) and distal (e.g., weight control, disease prevention) temporal

outcomes. Proximity is a key feature in social cognitive theory (Bandura, 2004) and fundamental to temporal self-regulation theory (Hall & Fong, 2007). Fourth and finally, behavioural beliefs may be structured in terms of content or purpose. For example in the physical activity domain behavioural beliefs can be classified in relation to the basic motives they serve. Research in this domain has suggested that the number of basic motives ranged from four (affect/stress management, appearance/weight control, fitness/health management, and socializing) (Cash, Novy, & Grant, 1994) to sixteen (Markland & Ingledew, 1997). Given lack of agreement the current research focused on the most parsimonious solution, namely four basic motives.

The purpose of the current study was to evaluate these four dimensions of behavioural beliefs in terms of quality of measurement and predictive capability of intention in the physical activity domain. We focused on evaluating distinguishing beliefs along each dimension first one at a time and subsequently in combination. Based on previous research, it was hypothesized that beliefs would be distinguishable across each of the four dimensions and that prediction of intention would favour affective, positive, proximal, and affect/stress structures. We also explored the value of considering dimensions simultaneously. Based on research in other behavioural domains (Lawton, Conner, & Parker, 2007), it was further hypothesized that a positive/negative by affective/instrumental split might be particularly predictive and yield better measurement.

Method

Participants and Procedure

Two hundred students participated in this study for extra credit in their introductory psychology and health psychology courses. The participants attended large group sessions during February and March 2003, completing self-report measures of behavioural beliefs and intention.

The mean age of participants was 21.07 (*SD* = 6.42 yrs), 83% were female, and the mean year in university for the sample was 2.89 (*SD* = 1.76). These details have been reported in a previously published manuscript (Rhodes et al., 2007).

Instruments

Physical activity was defined using Health Canada's position stand for recommended weekly physical activity among adults (Health Canada, 2002). Health Canada (2002) defines endurance activities as accumulating at least 30 minutes of physical activity of at least at a moderate intensity on at least four or more days of the week. Complete descriptors for physical activity were included and participants were asked to use this definition when answering all TPB questions.

Belief-based measures were developed using the belief elicitation procedures of Ajzen (2002a) on an independent sample of 30 participants from an introductory psychology course. These procedures are reported in Rhodes et al. (2007). Items were generated in terms of expectancies using the most common elicited phrases and measured using a 7 point scale that ranged from 1 (strongly disagree) to 7 (strongly agree). The statement "doing endurance activities 4-7 times per week over the next 2 weeks would…" preceded the items. For the present study, 19 behavioural beliefs underwent content analysis from two independent judges (first author, doctoral student) in order to score them along dimensions of positive/negative, affective/instrumental, proximal/distal, and motives of affect management/ health management/ social/ and weight management. The judges demonstrated 100% agreement on all categories, but both felt that a fifth motive of "competence" was needed to accurately address two of the items. Results of the scoring procedure and the behavioural beliefs used in this analysis can be found in Tables 1 and 2.

Physical activity intention was assessed by two items following the scaling recommended by Ajzen (2002a). Items were answered using 7 point scales ranging from 1 (strongly disagree) to 7 (strongly agree). The two items were 1) "Over the next 2 weeks, I plan to engage in [physical activity] 4-7 days per week" and 2) "Over the next 2 weeks, I intend to engage in [physical activity] 4-7 days per week." Internal consistency for these items was $\alpha = .96$.

Analysis

Negatively phrased belief items were reverse coded before analyses. The research questions were investigated using structural equation modeling, which allows for an assessment of statistical significance tests for the size of each theoretical relation in the model and overall model fit. Models were estimated with maximum likelihood procedures and assessed using LISREL 8.70 for Windows (Jöreskog & Sörbom, 2004). For specification of the latent concepts, the loading for each concept's first indicator was pre-set to 1.0 in the structural equation model to create a metric scale. Belief structures were freed to correlate. The structural models followed basic TPB theory, where belief constructs were posited to have an effect on intention (Ajzen, 1991, 2002a).

Our analysis of fit was based on several indicators. First, χ^2 was reported so $\Delta\chi^2$ tests from the base model (i.e., single belief construct) and subsequent models could be evaluated in terms of overall fit. Significant differences ($p < .01$) in this test were considered an indicator of better fit. Still, these models do not represent simple nested approaches to fit assessment, so other markers of fit were deemed necessary. RMSEA and CFI assessments are also reported as additional fit indices for comparison (Hu & Bentler, 1999). In terms of measurement model assessment, we computed both composite reliability and average variance extracted (Fornell & Larker, 1981). Finally, evaluations of predictive capability with intention were assessed via R^2,

standardized structural effects (β) and through inter-factor correlations. These assessments allow for total and relative prediction assessments across the various models.

Results

Demographics of age, gender, year in school did not correlate with intention or the behavioural beliefs ($p > .05$) so these were not employed as covariates in the analyses. Results of the analysis of positive ($M = 5.84$; $SD = 1.30$) / negative ($M = 4.69$; $SD = 1.61$), affective ($M = 5.52$; $SD = 1.36$) / instrumental ($M = 5.67$; $SD = 1.40$) and proximal ($M = 5.51$; $SD = 1.40$) / distal ($M = 5.71$; $SD = 1.31$) domains can be found in Table 3. Overall, a behavioural belief aggregate explained 21% of the variance in intention, but the measurement structure showed a poor fit (χ^2 (188) = 1356.99, $p < .01$; $CFI = .80$; $RMSEA = .18$; Average variance extracted from beliefs = .38). Division of the beliefs into positive/negative ($\Delta\chi^2$ (2) = 372.62, $p < .01$; $CFI = .86$; $RMSEA = .15$), affective/instrumental ($\Delta\chi^2$ (2) = 181.22, $p < .01$; $CFI = .82$; $RMSEA = .17$), or proximal/distal ($\Delta\chi^2$ (2) = 72.59, $p < .01$; $CFI = .81$; $\Delta RMSEA = .18$) all improved fit significantly compared to the overall aggregate. Further divisions by these dimensions showed that affective/instrumental by positive/negative yielded the best fit when compared to these single dimensions ($\Delta\chi^2$ (2) = 141.12, $p < .01$; $CFI = .85$; $RMSEA = .14$). This division also yielded the highest explained variance in intention (26%), and acceptable measurement properties of each construct (average variance extracted .47 to .78). Standardized structural coefficients showed that positive (.35; $p < .01$) and negative (.21; $p < .01$) affect belief clusters predicted intention but neither set of instrumental (positive or negative) beliefs did. It should be noted that a model of all dimensions in interaction produced the best model fit, but the belief structures had inter-correlations that reached unity (1.0) and standardized coefficients were

biased by this incumbent multicollinearity. Overall, no structure exhibited good model fit using current standards (Hu & Bentler, 1999).

An evaluation of behavioural beliefs by motives of affect management (M = 5.37; SD = 1.45), health management (M = 6.50; SD = 0.92), appearance management (M = 5.85; SD = 1.44), socializing (M = 4.39; SD = 1.67), and competence (M = 6.32; SD = 1.09) can be found in Table 4. This model fit significantly better than the single behavioural belief aggregate ($\Delta\chi^2$ (14) = 508.19, $p < .01$; CFI = .87; $\Delta RMSEA$ = .15) but showed signs of multicollinearity with biased coefficients in the standardized effects and inter-factor correlations. Similarly, a combination of positive/negative dimensions and these five motives produced the best fitting model (CFI = .93; $RMSEA$ = .10), but showed signs of serious multicollinearity from high inter-factor correlations.

Discussion

Treatment of belief-level constructs in the TPB has been relatively unstandardized. This study focused on behavioural beliefs, arguably the central constructs in attitude-based models like TPB, and evaluated belief structures along positive/negative, affective/instrumental, distal/proximal and specific motive continuums in the physical activity domain. The results supported our hypotheses that each of these domains would exhibit better measurement properties and model fit than a single summated belief construct. Further, in support of prior research and theorizing, affective, positive, proximal, and affect/stress management beliefs were shown to be the best predictors of intention within each dimension.

The best tested model for belief constructs, however, was an interaction between the affective/instrumental and positive/negative continuums. This approach yielded the highest explained variance (ΔR^2 = .05 from base model) in intention and showed no serious multicollinearity among the four belief constructs. The results subsequently showed that positive

and negative affective beliefs were key predictors of intention, while instrumental beliefs were not. This would support the value of grouping beliefs into this two by two structured formed by affective/instrumental and positive negative dimensions. It would also suggest the value of targeting positive and negative affective beliefs in order to increase physical activity intentions and behaviour. Our findings complement prior findings in the physical activity domain using general affective and instrumental attitude constructs (e.g., Lowe et al., 2002; Rhodes et al., 2006). Further, the findings in this physical activity-based sample replicate recent divisions of behavioural beliefs from driving and smoking domains (Lawton et al., 2007). Thus, there may be some generality to belief clusters in social cognition.

From an applied perspective, these results suggest that interventions targeting positive affective beliefs (fun, accomplishment, stress relief) may yield higher intentions to be physically active, and a secondary focus on overcoming negative affective beliefs (muscle soreness, pain) may also have merit. The findings suggest that a focus on instrumental beliefs, positive or negative, would yield little value if these affective beliefs are considered. This result is in general support of prior distinctions between affective and instrumental attitude; however, almost no intervention research has focused specifically on affective beliefs in the physical activity domain. Preliminary research efforts, however, suggest that affective attitude can be modified through changing environmental aesthetics (outdoor superior to indoor) (Plante et al., 2007) or exercise mode (interactive videobikes superior to standard stationary bikes) (Rhodes, Warburton, & Coble, 2008). This seems a very worthy research focus for continued experimental efforts.

The results also demonstrated that the division of beliefs by proximal/distal, or basic motive dimensions may not be necessary after consideration of affective/instrumental and positive/negative dimensions. The lack of effect for proximal distal outcomes is in stark contrast

to the importance placed on proximal outcomes by Hall and Fong (2007) in their temporal self-regulation theory. This may be explained by the strong confound between the affect/instrumental and positive/negative dimensions and the proximal/distal dimension. In the physical activity domain, affective outcomes tend to be proximal while instrumental outcomes tend to be distal in nature. Similarly, positive and negative outcomes can be proximal but our sample reported no negative distal outcomes. These confounds may make it difficult to distinguish the importance of proximal/distal outcomes after consideration of the other two dimensions.

Still, it is important to note that none of the belief structures resulted in formally adequate model fit when considering standard criteria. Indeed, fit continued to improve as each belief model became more specific (i.e., more dimensions added above two). The results showed that behavioural beliefs have very specific measurement structures, but this specificity comes with incumbent multicollinearity when trying to use the constructs for prediction purposes.

Based on these results, we suggest three possible future actions. First, when using behavioural beliefs in prediction models like the TPB, researchers may have to wilfully acknowledge a formative model approach (see Rhodes et al., 2006) whereby detailed and accurate measurement structures are sacrificed in order to create parsimony in the prediction model. In this approach our data-set suggests that instrumental/affective and positive/negative belief clusters will yield the best formative scales. Second, researchers may need to theorize causal depth to behavioural belief structures. This seems necessary to retain good model fit and reduce multicollinearity; however, the approach would benefit greatly through experimental manipulation or time varying mediation analyses of belief structures. Third and finally, behavioural belief models may be improved through reduced multicollinearity by using items

that are exemplars of each proposed dimension and lack measurement overlap. A strength of the current study was the use of elicited beliefs, and thus good representations of how a sample thinks in terms of physical activity. A quick scan of the beliefs elicited, however (see Tables 1 and 2), clearly shows that some of these beliefs could measure multiple domains. Thus, future study may benefit by a priori decisions about the items used to cover each dimension in order to create uncorrelated factors if possible.

Some other suggestions for future research warrant mention. First, this sample was comprised of primarily female undergraduate students. Although behavioural beliefs do not appear to differ by gender or age (Rhodes, Blanchard, & Blacklock, 2008), replication of the results would be helpful by using a more diverse sample. Finally, subjective norm and PBC are also comprised of belief-level constructs and are probably subject to the same issues as behavioural beliefs. It may be that normative beliefs (e.g., proximal/distal referents; family/friends/community, etc.) and control beliefs (e.g., external/internal, skills/resources/ opportunities, etc.) have similar categorical structures that could work for grouping and targeted intervention of beliefs. Thus, a focus on dimensions of these beliefs would also seem fruitful in future research efforts.

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Table 1

Behavioural Beliefs Organized byPositive/Negative, Affective/Instrumental, and Distal/Proximal

	Positive	Negative	Affective	Instrumental	Proximal	Distal
1. Improve my health	✔			✔		✔
2. Improve my physical appearance	✔			✔		✔
3. Be a fun thing to do	✔		✔		✔	
4. Help relieve my stress	✔		✔		✔	
5. Maintain social relationships	✔			✔		✔
6. Cause muscle soreness		✔	✔		✔	
7. Cause me injury		✔		✔	✔	
8. Provide a sense of accomplishment	✔		✔		✔	
9. Keep my body healthy	✔			✔		✔
10. Help me look good	✔			✔		✔
11. Cheer me up	✔		✔		✔	
12. Reduce my tension and worry	✔		✔		✔	
13. Improve my overall happiness	✔		✔			✔
14. Maintain my connections with friends/family	✔			✔		✔
15. Improve my physical endurance	✔			✔		✔
16. Be physically painful		✔	✔		✔	
17. Cause me physical harm		✔		✔	✔	
18. Give me a sense of personal achievement	✔		✔		✔	
19. Be a pleasant experience	✔		✔		✔	

Table 2

Behavioural Beliefs Organized by Motive

	Affect Management	Health Management	Social	Appearance Management	Competence
1. Improve my health		✔			
2. Improve my physical appearance				✔	
3. Be a fun thing to do	✔				
4. Help relieve my stress	✔				
5. Maintain social relationships			✔		
6. Cause muscle soreness	✔				
7. Cause me injury	✔				
8. Provide a sense of accomplishment					✔
9. Keep my body healthy		✔			
10. Help me look good				✔	
11. Cheer me up	✔				
12. Reduce my tension and worry	✔				
13. Improve my overall happiness	✔				
14. Maintain my connections with friends/family			✔		
15. Improve my physical endurance		✔			
16. Be physically painful	✔				
17. Cause me physical harm	✔				
18. Give me a sense of personal achievement					✔
19. Be a pleasant experience	✔				

Table 3

Measurement and Predictive Structure of Behavioural Beliefs by Dimension

	$\chi 2$	df	CFI	RMSEA	α	Avg Variance Extracted	R^2 with Intention	β	R between constructs
1. Total Aggregate	1356.99	188	.80	.18	.85	.38	.21	.45	N/A
2. Positive and Negative	984.37	186	.86	.15			.25		.17
Positive					.89	.47		.42	
Negative					.77	.55		.21	
3. Instrumental and Affective	1175.77	186	.82	.17			.21		.80
Instrumental					.65	.36		-.02	
Affective					.82	.46		.48	
4. Proximal and Distal	1284.40	186	.81	.18			.23		.87
Proximal					.79	.46		.59	
Distal					.80	.46		-.12	
5. Positive and Negative Instrumental and Affective	843.25	181	.85	.14			.26		.03-.79
Positive Instrumental					.75	.47		.07	
Negative Instrumental					.82	.78		.03	
Positive Affective					.88	.58		.35	
Negative Affective					.57	.51		.21	
6. Positive Proximal and Distal and Negative Proximal and Distal	929.65	183	.86	.15			.26		.08-.88
Positive Proximal					.86	.55		.45	
Positive Distal					.80	.46		-.01	
Negative Proximal					.77	.45		.17	
Negative Distal					N/A				

7. Proximal and Distal and Affective Proximal and Instrumental	933.18	180	.85	.15			.23	.03-1.00
Instrumental Proximal					.82	.75	.21	
Instrumental Distal					.75	.46	-.04	
Affective Proximal					.78	.44	-.21	
Affective Distal					N/A	.70	.66	
8. Positive Affective/Instrumental Proximal/Distal and Negative Affective/Instrumental Proximal/Distal	801.49	175	.88	.14			.25	.03-1.02
Positive Affective Proximal					.86	.55	-.14	
Positive Instrumental Proximal					N/A			
Positive Instrumental Distal					.75	.46	-.03	
Positive Affective Distal					N/A	.70	.55	
Negative Instrumental Proximal					.82	.77	.04	
Negative Affective Proximal					.57	.51	.23	
Negative Instrumental Distal					N/A			
Negative Affective Distal					N/A			

Table 4

Measurement and Predictive Structure of Behavioural Beliefs by Motive and Dimension

	$\chi 2$	df	CFI	RMSEA	α	Avg Variance Extracted	R^2 with Intention	β	R between constructs
1. Total Aggregate	1356.99	188	.80	.18	.85	.38	.21	.45	N/A
2. Affect Management, Physical Health, Appearance, Social and Competence	848.80	174	.87	.15			.23		.37-.78
Affect Management					.79	.46		.61	
Physical Health					.56	.46		-.12	
Appearance					.87	.84		.07	
Social					.73	.61		-.21	
Competence					.80	.74		.06	
3. Positive/Negative Affect Management, Positive/Negative Physical Health, Positive/Negative Appearance, Positive/Negative Social and Positive/Negative Competence	457.14	161	.93	.10			.28		-.08-.84
Positive Affect Management					.87	.62		.47	
Negative Affect Management					.57	.48		.27	
Positive Physical Health					.68	.65		-.05	
Negative Physical Health					.82	.76		-.06	
Positive Appearance					.87	.84		.06	
Negative Appearance					N/A				
Positive Social					.73	.61		-.16	
Negative Social					N/A				
Positive Competence					.80	.74		.06	
Negative Competence					N/A				

4. Proximal/Distal Affect Management, Proximal/Distal Physical Health, Proximal/Distal Appearance, Proximal/Distal Social and Proximal/Distal Competence	585.86	164	.90	.12			.25	-.10-1.01
					.74	.52	.34	
Proximal Affect Management					.57	.70	.11	
Distal Affect Management					.82	.50	.14	
Proximal Physical Health					.68	.65	-.09	
Distal Physical Health					N/A			
Proximal Appearance					.87	.84	.09	
Distal Appearance					N/A			
Proximal Social					.73	.61	-.12	
Distal Social					.80	.74	.08	
Proximal Competence					N/A			
Distal Competence								

Note: Motives were subsets of affective (affect management, competence) and instrumental (physical health, appearance, social) beliefs and have, therefore, not been included in further divisions.