
Article:
Rhodes, RE, Beauchamp, MR, Conner, M et al. (3 more authors) (2015) Prediction of Depot-Based Specialty Recycling Behavior Using an Extended Theory of Planned Behavior. Environment and Behavior, 47 (9). pp. 1001-1023. ISSN 0013-9165

https://doi.org/10.1177/0013916514534066

Running Head: Predicting Depot Recycling

Prediction of Depot-Based Specialty Recycling Behavior using an Extended Theory of Planned Behavior Model

Ryan E. Rhodes, PhD[1]*, Mark R. Beauchamp, PhD[2], Mark Conner, PhD [3], Gert-Jan deBruijn, PhD[4], Navin Kaushal, MSc [1]and Amy Latimer-Cheung, PhD [5]

[1]University of Victoria, Victoria, British Columbia
[2]University of British Columbia, Vancouver, British Columbia
[3] University of Leeds, Leeds, UK
[4]University of Amsterdam, the Netherlands
[5]Queen's University, Kingston, Ontario

[*]Corresponding author

[1]Behavioural Medicine Laboratory, Faculty of Education, University of Victoria, PO Box 3015 STN CSC, Victoria BC, V8W 3P1, CANADA, E-mail address: rhodes@uvic.ca, Tel: (250) 721-8384, Fax: (250) 721-6601

[2]Psychology of Exercise, Health, and Physical Activity Laboratory, School of Kinesiology, 210-6081 University Blvd, University of British Columbia, Vancouver BC, V6T 1Z1, CANADA, E-mail address: mark.beauchamp@ubc.ca, Tel: (604) 822 4864, Fax: (604) 822-6842

[3]Institute of Psychological Sciences, Faculty of Medicine and Health, University of Leeds, Woodhouse Ln, Leeds, West Yorkshire, LS2 9JT, UNITED KINGDOM, E-mail address: m.t.conner@leeds.ac.uk, Tel: +44(0)113 343 5720. Fax: +44 (0)113 3435749

[4]Department of Communication Science, Faculty of Social and Behavioural Sciences, University of Amsterdam, Spui 21, Amsterdam North Holland, 1012 CX, NETHERLANDS, E-mail address: g.j.debruijn@uva.nl, Tel: +31205252636, Fax: +31205253681

[5]School of Kinesiology and Health Sciences, Queen's University, 28 Division St., Kingston ON, K7L 3N6, CANADA, E-mail address: amy.latimer@queensu.ca, Tel: (613)533-6000 x 78773, Fax: (613)533-2009

Acknowledgements

RER is supported by a Canadian Cancer Society Senior Scientist Award and the Right to Give Foundation. This study was supported through funds from the Social Sciences and Humanities Research Council of Canada. The authors report no conflict of interest.

Abstract

Curbside recycling has been a very successful neighborhood-level intervention designed to maximize waste containment, but many communities have specific limitations on what products can be recycled within their community bins and must rely on depots for recycling these specialty items. The purpose of this study was to examine an extended theory of planned behavior (TPB) that included both affective and instrumental attitudes and a planning construct to predict depot specialty recycling in a community sample across one month. Participants were 176 residents of detached homes who completed baseline measures of TPB and self-reported behavior one month later. Structural equation modeling identified a modest fit of the TPB, and 48% variance of depot recycling behavior was explained with the constructs of intention, planning and perceived behavioral control, yet these constructs did not perform as well in predicting change in behavior across four weeks. While proximity to the recycling depot did not relate to behavior, it significantly moderated the planning-recycling behavior relationship, whereby those who lived closer to the depot had larger planning-behavior relations than those who lived further away. Developing plans to recycle may help in addition to motivation, but these are still contingent on there being an easy commuting distance to a depot.

Key Words: Affect, Instrumental beliefs, planning, depot proximity

Environmental waste containment becomes more problematic with each passing year due to the rising global population and an increasing consumption of manufactured goods (Oskamp, 2000; Vlek & Steg, 2007). For example, Canadian households produce 13.4 million tonnes of waste (418 kg per person) and 75% of this is sent to landfill (Statistics Canada, 2004, 2013). Similar per capita statistics are present in most other developed nations.

Clearly recycling is an essential element of any long-term solution to waste control, and how to motivate full participation in recycling programs becomes of critical concern to policy makers. For example, curbside recycling made easy and convenient has been shown to have an enormous effect on recycling efforts in a community (Osbaldiston & Schott, 2012). Large scale policies that involve corporate leadership and make recycling easy and rewarding have shown considerable success in the last few decades (Statistics Canada, 2004). While very promising, products such as organic waste, styrofoam, and soft plastics are not eligible in many curbside community recycling programs at present. This places the burden of specialized recycling at the level of the individual who must collect, bag, transport, and often pay for recycling.

Unfortunately, in comparison to curbside (i.e., recycling with containers at one's residence) and public (i.e., casually recycling while at a public place) recycling, very little is known about the motives that underlie depot recycling behavior. Indeed, our literature search found no studies designed to examine depot recycling in terms of its background correlates or via interventions to improve upon the behavior. It would seem important to have a firm understanding of the correlates of depot-based recycling in order to embark upon subsequent intervention efforts and this forms the basis for our paper.

Despite a paucity of research on specialty depot recycling, a large literature on public and curbside recycling as well as other similar prosocial behaviors has amassed across the last 20

years in which to draw from and build hypotheses. For example, a recent meta-analysis of the correlates of general pro-environmental behavior (Bamberg & Möser, 2007) identified that these behaviors are explained primarily thorough intentions that mediate attitudes and behavioral control over the behavior. Perhaps not surprisingly, given these results and findings, Ajzen's (1991) theory of planned behavior (TPB) contains the largest body of literature among models applied to understand recycling and other environmental behaviors. The theory has also been compared with other models and appears to hold more favorably than some of these other approaches (e.g., Aguilar-Luzón, García-Martínez, Calvo-Salguero, & Salinas, 2012; Do Valle, Rebelo, Reis, & Menezez, 2005; Ramayah, Lee, & Lim, 2012). The TPB places intention (motivation to enact a behavior) as the proximal antecedent of behavior and intention is subsequently influenced by attitude (overall evaluation of the behavior), subjective norm (perceived pressure from what others think) and perceived behavioral control (PBC; perceived ability to perform the behavior) (Ajzen, 2006). Perceived behavioural control is also considered a direct antecedent to behaviour, to the extent that it represents actual control. Our review of TPB studies when applied specifically to recycling found 24 independent papers (Aguilar-Luzón et al., 2012; Barr, 2007; Barr, Gilg, & Ford, 2001; Castro, Garrido, Reis, & Menezes, 2009; K. Chan, 1998; L. Chan & Bishop, 2013; Chen & Tung, 2010; Cheung, Chan, & Wong, 1999; Chu & Chiu, 2003; Chu, Huang, & Chiu, 2004; Chu, Yeh, & Yang, 2006; Do Valle et al., 2005; Fielding, McDonald, & Louis, 2008; Kaiser, Hübner, & Bogner, 2005; Knussen & Yule, 2008; Largo-Wight, Bian, & Lange, 2012; Mahmud & Osman, 2010; Mannetti, Pierro, & Livi, 2004; Nigbur, Lyons, & Uzzell, 2010; Ramayah et al., 2012; Rise, Thompson, & Verplanken, 2003; Taylor & Todd, 1995; White & Hyde, 2012; Whitmarsh & O'Neill, 2010). Like the Bamberg and Moser (2007) meta-analysis of all pro-environmental behaviors, recycling was predicted by

intention, while attitude and perceived behavioral control were subsequently the most consistent predictors of intention although their relative contribution to the model varied considerably across studies. Subjective norm was of lesser importance in almost all of the studies.

Besides the predictive capability of the abovementioned TPB constructs, a strength of the model is also Ajzen's (1991) inclusiveness of other constructs if one can argue 1) that a construct possesses a measurement domain different from that of the TPB proper and 2) subsequently demonstrate that the construct explains meaningful variance beyond the base model. Thus, researchers have also extended the TPB in the recycling domain to include constructs such as proximity of the recycling bin (Chen & Tung, 2010; Do Valle et al., 2005; Ramayah et al., 2012; Taylor & Todd, 1995), confidence to sort recycling items (Chu & Chiu, 2003), knowledge of recycling (Barr, 2007), habituated response (Knussen & Yule, 2008), recycling identity (Fielding et al., 2008; Mannetti et al., 2004; Nigbur et al., 2010; White & Hyde, 2012; Whitmarsh & O'Neill, 2010), personality traits (White & Hyde, 2012), and personal prosocial norms (L. Chan & Bishop, 2013; Nigbur et al., 2010).

Interestingly, what has seen less research attention is the expansion of constructs that reside within the overarching constructs of the TPB proper. For example, Ajzen (2006) acknowledges that the attitude construct is comprised of two components that represent instrumental (benefit, utility) and affective (pleasure, enjoyment) evaluations of a behavior. This decomposition of attitude into two constructs has seen considerable attention in other domains, such as health and safety behavior where affective attitudes tend to predict intention better than instrumental attitudes (Lawton, Conner, & McEachan, 2009; Lawton, Conner, & Parker, 2007; Rhodes, Fiala, & Conner, 2009). To our knowledge, the use of these two constructs of attitude in the TPB has not been applied to recycling behavior at present, yet the instrumental attitude

construct bears some resemblance to moral norms (feelings that the behavior is important for one to perform) which is used quite often in models of prosocial behavior (L. Chan & Bishop, 2013). This would present an interesting test of the extended TPB, because prosocial behavior, often infrequent (e.g., curbside recycling is typically every two weeks) and relatively non-physically taxing, may be more motivated by instrumental than affective outcomes compared to health behaviors. Still, the process of sorting and disposing of recyclables is not particularly pleasant and depot based recycling is more taxing in terms of hassle than basic curbside or public recycling so affective attitudes may play a key role in the motivation for its performance.

On the other side of intention is an emergent literature demonstrating the importance of planning in order to facilitate behavior change (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006). From a theoretical standpoint, the premise follows that regulatory planning behaviors are required to tie motivation to subsequent behavior (Gollwitzer & Sheeran, 2006; Schwarzer, 1992). In response to this literature, Ajzen (2005) has subsequently acknowledged that planning may be an important bridge construct between intention and behavior to consider within the TPB. The extension of the TPB to consider this addition has seen enormous attention in a domain like exercise behavior (see Carraro & Gaudreau, 2013) where the behavior is complex in logistics, but far less within the prosocial domain. Our review of the TPB in relation to recycling behavior found only one study where researchers had investigated a planning construct within the TPB proper (Rise et al., 2003). The results did not support the additional utility of planning within the TPB which may explain the relatively low uptake of this possible extension in the recycling domain. It may be that curbside recycling behaviors are easy enough that they require little self-regulation and public recycling is reflexive and spontaneous in its nature. Still, depot based recycling may be far more relevant to planning as people need to organize the behavior

within the hours of depot operation, arrange a way to travel to the depot, and plan where to go. It seems worthwhile to examine whether an intermediary planning construct has utility when predicting specialty depot recycling.

Therefore, the purpose of this study was to examine an extended TPB that includes both affective and instrumental attitudes and a planning construct to predict depot specialty recycling in a community sample across a one month timeframe. Based on the general recycling and prosocial behavior literature, it was hypothesized that instrumental attitudes and perceived behavioral control, and to a lesser extent, subjective norm, would predict intention. It was also hypothesized as per TPB that intention and PBC would predict behavior. Based on our rationale for the additional constructs within TPB, however, we also hypothesized that affective attitude would contribute to the prediction of intention because depot based recycling will contain affective properties (pleasant-unpleasant). We also hypothesized that planning would be an independent predictor of behavior and at least partially account for the covariance between intention and behavior based on the rationale that depot recycling has challenging logistics that preclude mere motivational impulse.

As we employed a longitudinal design, we also had the opportunity to examine change in depot recycling behavior across the month. The examination of change in behavior adds additional testing power to prediction models because behavior change is the desired outcome in interventions (Weinstein, 2007). This has seen limited examination in the recycling domain from our literature review. We hypothesized the same basic effects of the TPB in the prospective prediction model that did not account for behavior change, but with effects of smaller magnitude because not all people would be expected to necessarily change over the course of the study and the variability would be subsequently restricted. Finally, as recycling depots will conceivably

vary in proximity among respondents (unlike curbside recycling), we examined whether the relationship between proximity to the nearest recycling depot and behavior could be accounted for by the TPB. We hypothesized that TPB would account for covariance of any relationship based on similar evidence in public recycling (Chen & Tung, 2010; Do Valle et al., 2005; Ramayah et al., 2012; Taylor & Todd, 1995). We also examined whether proximity to a depot moderated the intention and planning relationship with behavior. While there is no prior research in prosocial behavior for this examination, it stands to reason that people who live further away from recycling depots may be less likely to follow through with their recycling plans because of the complexity of transport, scheduling and other factors. This finding has been shown several times with the TPB in physical activity where people further away from recreation centres are less likely to follow through with their plans (e.g., Prins et al., 2010; Rhodes, Brown, & McIntyre, 2006; Rhodes, Courneya, Blanchard, & Plotnikoff, 2007).

Method

Study Design and Participants

Initial respondents were 220 community-dwelling residents (one respondent per household) between the ages of 18-65 years who self-identified room to improve depot recycling activities. Respondents were provided with a baseline questionnaire package and 44 participants declined to participate further due to lack of interest. The initial purpose of this study was to examine whether four different brief messages could impact a change in depot recycling over a month. Thus, the remaining 176 participants were randomly assigned to 1) a standard instructions condition (n = 34), 2) a group that received instructions and messages targeting the affective benefits of depot recycling (n = 49), 3) a group that received instructions and messages targeting the utility of depot recycling (n = 48), and 4) a group that received instructions and

directions on how to set plans to perform depot recycling (n = 45). The trial yielded no significant between group effects (all $p > .50$) so the sample was combined to merely predict depot recycling. The reason for the null intervention effect was not clear, but may have been from the short duration of the study, low potency of the intervention materials, or a lack of range for change in these constructs of focus. The study was approved by the first author's institutional ethics review board and all participants provided initial and ongoing informed consent (at follow-up) during participation.

Procedure

Potential participants were invited to take part in the study by means of door to door recruitment in the Capitol Region District of British Columbia. Recruitment in this fashion was ongoing from March, 2012 until November, 2012. Interested participants were instructed on the study purpose, elements, and inclusion criteria. Participants were then handed an instruction sheet that provided a questionnaire URL link to the online baseline questionnaire and provided informed consent, their name and their email address (100% of participants had email and internet access). One week after recruitment, participants who had not yet completed the baseline measures were sent an email reminder and the link to the questionnaire. At four weeks, the follow-up questionnaire link was emailed to participants that included a self-reported measure of depot recycling of specialty materials over the past month. An email reminder prompt was provided to those who had not completed the follow-up questionnaire one week later (Dillman, 1983). The participants received a thank you letter after completion of the follow-up questionnaire.

Measurement

The questionnaire asked for a contact resident to complete all measures on behalf of the members of the residence across the study. This was deemed necessary to aid in consistency across measurement although it may bias (downward) the estimates of total recycling. Basic demographic measures resembled those asked in Canadian census questions and included age, sex, ethnicity, education, family income, marital status and employment status. Additional health status indicators were also included because local depots could include walking, lifting, or cycling. Finally, we gathered information of approximate distance from the local depot.

Theory of Planned Behavior Measures

The questionnaire package consisted of information about the definition of depot recycling compared to curbside recycling in order to orient participants to the questions being asked in the questionnaire, followed by the types of products that can be recycled at these depots. This included soft plastics (grocery bags, cereal bags, shrink/over wrap), styrofoam (cups, containers, insulators), electronics, and hard plastics. The recycling centre locations and times available were subsequently provided. These included local community depots as well as a central municipal depot.

Attitude towards depot recycling was measured using two items that tap the instrumental (i.e., useful-useless, wise-unwise) component, and two items that tap the affective (enjoyable-unenjoyable, pleasant-unpleasant) component. The response format was a series of 7-point scales (1,7 = extremely, 2,6 = moderately, 3,5 = slightly) and the phrase that preceded these scales was "For me, depot recycling over the next month would be…". Cronbach's alpha coefficients of internal consistency were 0.77 (r = .64) for instrumental attitude and 0.94 (r = .88) for affective attitude.

Subjective norm was measured by two items assessing the injunctive component of subjective norm. The items were: (1) "Most people who are important to me want me to engage in depot recycling over the next month," and (2) "Most people whose opinions I value would approve of me engaging in depot recycling over the next month," Cronbach's alpha coefficient of internal consistency was 0.76 (r = .59) for the items.

Perceived behavioral control was measured by two items that have been previously recommended to measure control without the confound of motivation (Ajzen, 2002; Rhodes & Courneya, 2003). The items were: (1) "In the next month, I have complete personal control over depot recycling if I really wanted to do so," and (2) Engaging in depot recycling is mostly up to me in the next month if I wanted to do so." The items were scored on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The items had an internal consistency of $\alpha = .67$ (r = .47).

Intention and planning were measured with attention to reducing potential measurement confounds. Based on the recommendations of Rhodes et al. (2006), intention was measured without the use of "intend" and "plan" items and instead by items that reflect motivation and remain conceptually distinct from planning. The two items were: (1) "I am motivated to engage in depot recycling over the next month," from 1 (extremely unmotivated) to 7 (extremely motivated), and (2) "I am determined to engage in depot recycling over the next month," from 1 (extremely undetermined) to 7 (extremely determined). Internal consistency was $\alpha = 0.84$ (r = 72). Planning was measured using items created by Rise et al. (2003). These items were: (1) "I have made plans concerning "when" I am going to depot recycle over the next month," (2) "I have made plans concerning "where" I am going to engage in depot recycling over the next month," (3) "I have made plans concerning "what" kind of recycling (e.g., styrofoam, soft

plastics, hard plastics, etc.) I am going to engage in over the next month" and (4) "I have made plans concerning "how" I am going to get to a depot to recycle specialty materials over the next month." These items were scored from 1 (strongly disagree) to 7 (strongly agree) and internal consistency was acceptable ($\alpha = 0.95$).

Depot Recycling Behavior. For the measurement of depot recycling, we again reminded participants that we were asking for recycling of styrofoam, polycarbonate, acrylic, plexiglass, polypropylene, ABS plastic, soft/film & hard/rigid plastics, foil-lined bags, non-refundable drink cartons and tetra paks, as well as all electronics, ballasts and automotive batteries and not curbside recyclables. There is no validated self-report measure for depot-based recycling so we adapted from the measures of Nigbur et al. (2010) and Barr (2007). The item asked participants "How often during the last four weeks have you delivered your materials to a specialty recycling depot?" from 0 (never) to 7 (every week).

Preliminary analyses

Eighteen participants did not complete the follow-up recycling measure so point-biserial correlations, t-tests, and chi-square tests of proportions were conducted to test for selective drop-out (coded 0/1/2/3) and equality of study groups at baseline. To determine the pattern of missingness surrounding recycling, a dummy variable was created (0 = data absent; 1 = data present). There were no differences in drop-out by group assignment ($p > .05$). When this variable was compared on the baseline recycling, demographic and TPB variables via zero-order correlations and χ^2 analyses, however, the results showed that missingness was significantly ($p < .05$) related to lower baseline recycling and being male compared to those who completed the study. Therefore, these data were not missing at random and multiple imputation is not recommended (Allison, 2002). The conservative within-participant intention to treat (ITT)

imputation was conducted using a baseline carried forward procedure to substitute missing values at follow-up. Complete case analyses were also conducted but they yielded similar results to the intention to treat analyses. Thus, we have chosen to report the most conservative missing data strategy within this paper.

Analysis Plan

Bivariate correlations and descriptives of depot proximity, TPB constructs and follow-up recycling behavior were evaluated. Because of our secondary research question of examining change in recycling, we also evaluated the unstandardized residual of recycling, which was created by regressing depot recycling at follow-up upon depot recycling at baseline.

Analyses of the TPB used structural equation modeling (Jöreskog & Sörbom, 2004) with maximum likelihood estimation and a covariance matrix. Specifically, proximity to a recycling depot was modeled as an antecedent of the TPB, which was subsequently used to predict depot recycling. The planning variable was modeled as the proximal predictor of recycling with intention and PBC as its respective antecedents (Carraro & Gaudreau, 2013). The first indicator of each latent variable was fixed to 1.0 in order to create a metric scale. Single indicators (i.e., proximity to depot, recycling) were fixed to 0 error, which is commensurate with ordinary least squares regression analyses. The structural disturbance terms (residual variance) among TPB variables of affective attitude, instrumental attitude, subjective norm, and PBC were also freed to correlate amongst each other as per the tenets of the TPB (Ajzen, 1991).

To evaluate whether proximity to a recycling depot moderated intention, planning and recycling relations, we mean-centered all variables (Aiken & West, 1991) and followed the procedure suggested by Cohen and Cohen (1983) using ordinary least squares multiple

regression. All hypothesized variables were analyzed simultaneously. Specifically, intention, planning, PBC, and depot proximity were entered into the regression equation first, and interaction terms were then entered into the regression equation in a second block. Finally, interpretation of significant interaction effects used Aiken & West's (1991) suggested procedure of slope analysis. Type one error was set at $p < .05$.

Results

There were no significant differences among the groups on demographic, health, or environmental variables by the original randomized group design ($p > .05$) so baseline data is presented for the complete set of respondents in Table 1. Contact residents were on average in their late 40s/early 50s, typically female, mainly white, commonlaw/married, and employed. Just over half of the sample reported having a college degree and were above the median household income for the Greater Victoria region (Statistics Canada Website, 2010). The participants reported generally good health and had a mean BMI just below the just below the 25-30 range range (i.e., overweight) (World Health Organization, 2013). In terms of environmental characteristics, participants lived in detached housing, used a car for transportation, and over half lived within 3 km of a recycling depot. Finally, 100 percent of participants used curbside recycling and most participants had engaged in some, but a low volume ($M = 0.61$ bouts) of depot recycling in the past four weeks.

Bivariate correlations and descriptives for depot proximity, TPB variables, depot recycling four weeks later and change in recycling from baseline can be found in Table 2. All TPB constructs significantly correlated with depot recycling. By contrast, only perceived behavioral control, planning, and intention significantly correlated with change in recycling across the four

weeks. Finally, proximity to a depot did not significantly correlate with any of the TPB or recycling behavior variables.

The structural equation model for these constructs resulted in a modest fit of the data [χ^2 (87) = 290.67; $p < .01$; CFI = .93; RMSEA = .09] using conventional cut-off criteria and considering the complexity and size of the model (Hu & Bentler, 1999). Observation of the standardized residuals showed that misfit was from several correlated error terms, factor cross-loadings and correlated structural disturbance terms that no single change or a priori theory-based series of changes could rectify. There were no potentially freed paths in the structural model that improved fit significantly ($p < .05$). Substituting change in recycling from baseline as the dependent variable in place of recycling at four weeks, resulted in a similar model fit [χ^2 (87) = 289.01; $p < .01$; CFI = .93; RMSEA = .09]. The final structural model is presented in Figure 1 (covariance results among TPB constructs have been omitted for illustrative parsimony) and the measurement model with descriptives is presented in Table 3.

Overall, the measurement model suggested good measurement of the TPB constructs and planning with significant and large factor loadings. In the structural model, affective attitude (standardized effect = .30), instrumental attitude (standardized effect = .59), subjective norm (standardized effect = .14) and PBC (standardized effect = .22) subsequently explained 69% of the variance in intention. Proximity to the depot did not have any significant effects in the model.

For the prediction of behavior, 48% of the variance in depot recycling was explained. Specifically, intention (standardized effect = .31), perceived behavioral control (standardized effect = .28), and planning (standardized effect = .32) all had significant independent effects on behavior. Affective attitude (standardized effect = .16), instrumental attitude (standardized effect

= .32), but not subjective norm and PBC, subsequently had significant indirect effects on recycling through intention/planning.

The structural model to predict change in recycling from baseline can also be found in Figure 1 with coefficients in parentheses. Planning, PBC, and intention explained 10% of the variance in change in recycling, however, only PBC (standardized effect = .20) was statistically significant in the model.

The structural model also showed that planning was explained by intention (standardized effect = .58), and affective attitude (standardized effect = .19), instrumental attitude (standardized effect = .38), and PBC (standardized effect = .20) had indirect effects on planning through intention. Intention also had a significant indirect effect on recycling (standardized effect = .26) through planning.

Results of the sub-analysis of proximity to the recycling depot as a moderator of intention and planning on recycling showed a significant effect for planning but not intention. Specifically, a significant interaction effect of planning and depot proximity ($\beta = -.57$, $t = 2.64$; $p < .01$) was identified after controlling for the main effect of proximity, intention, planning, PBC, and a nonsignificant ($p > .05$) interaction of intention and depot proximity [total model F_{change} (2,123) = 3.57, $p < .05$; $R^2_{change} = .05$]. Slope analyses, presented in Figure 2, showed that planning (β = .42) had a larger effect on intention for those living within 3km of a depot when compared to 6-9 km ($\beta = .31$) and 9+ km ($\beta = .11$). No significant ($p > .05$) moderation was identified for the change in recycling behavior variable.

Discussion

The purpose of this study was to examine an extended TPB that includes both affective and instrumental attitudes and a planning construct to predict depot specialty recycling in a

community sample across one month. The TPB is an established prediction model for curbside recycling (Bamberg & Möser, 2007), but to our knowledge this was the first application of TPB to depot recycling of specialty materials. We hypothesized that intention and perceived behavioral control would predict behavior as per the tenets of TPB and past curbside recycling prediction models. Still, we also hypothesized that planning would be an independent predictor of behavior and at least partially account for the covariance between intention and behavior based on the rationale that depot recycling has challenging logistics that preclude mere motivational impulse. Results supported our hypotheses. Intention, planning and perceived behavioral control all had independent effects on recycling behavior and intention had a sizeable and significant indirect effect via planning upon recycling.

It is interesting to note that the effect of planning on recycling is discrepant with the only other study to apply a planning construct within TPB structure (Rise et al., 2003).The difference may be due to different samples (college students vs. community), different countries (Norway vs. Canada), or the differences in curbside versus depot-based recycling. We theorize that the additional logistics of acting within depot hours of operation, driving to the depot, acquiring funds for payment of recyclables, and the bagging of all of these different specialty materials represents a challenge where enactment improves with planning and a high perception of control. This is similar to the rationale put forth for other logistically challenging behaviors such as exercise or studying (Gollwitzer & Sheeran, 2006). From an intervention perspective, however, our model offers relatively little novel insight into how to change plans as intention was the only antecedent. Thus, one reverts back to the TPB proper as an explanation as to how to change planning via increasing intention. This limitation is similar to other planning models combined with the TPB (Carraro & Gaudreau, 2013). Research showing that planning skills can be

manipulated directly in experimental designs is helpful to demonstrate that planning can be improved independent of intentions (Allan, Sniehotta, & Johnston, 2013; Gollwitzer & Sheeran, 2006). Future models of planning may be improved by demonstrating this link within the causal model (Conner, Sandberg, & Norman, 2010). Nevertheless, our finding needs to be considered within the context that the original intervention aim of this study to change planning did not have an effect on recycling behavior.

Our prospective between-participant design provided insight into who recycled compared to who did not, but the longitudinal design also enabled us to examine within-participant change in depot recycling behavior across the month. This analysis of change adds additional testing power to prediction models because behavior change is the desired outcome in interventions. We hypothesized the same basic effects of the TPB as the between-participant prediction model, but with effects of smaller magnitude because not all people would be expected to necessarily change over the course of the study and the variability would be subsequently restricted. Baseline recycling and one-month recycling correlated r =.45, suggesting overlap but also considerable residual variance for the TPB to explain. The results showed that the TPB was able to explain 10% of this residual variance but and perceived behavioral control was the only significant predictor. Thus, the TPB proved to be a strong model for predicting between participant recycling but not as strong for predicting within participant recycling changes across the month. It is important to note that planning, and intention both had significant bivariate correlations with change in behavior, thus supportive of the TPB constructs; the effect was merely diminished in the multivariate equation. The result needs replication, but it highlights the difference between explanative models compared to models of behavior change (Head & Noar, 2014).

In terms of predicting intention, it was hypothesized that instrumental attitude, perceived behavioral control, and to a lesser extent subjective norm, would contribute based on past research. We also hypothesized that affective attitude would contribute to the prediction of intention because depot based recycling will contain affective properties due to the hassle and complexity of the act. These hypotheses were supported by the results. The largest effect on intention was via instrumental attitude – a person's perception of utility and benefit from performing the act. The construct has not been specifically evaluated in the recycling domain, but it has considerable similarity with moral norms given the environmental impact of recycling (i.e., benefit of reducing waste, utility of retaining natural resources, etc.) (L. Chan & Bishop, 2013). Future examination of the discriminant validity of instrumental attitude and moral norms would be prudent.

Still, affective attitude contributed a medium-sized effect similar to PBC when explaining intention. This supports past research and the importance of control over motivation to recycle, but the prominent role of affective attitude suggests that pleasure-displeasure is also an important antecedent. Prior reviews have critiqued the general lack of inclusion of hedonic motives in prosocial behavior models (Osbaldiston & Schott, 2012), and this criticism can be directed at attitude-behavior models in general (Van der Pligt, Zeelenberg, van Dijk, de Vries, & Richard, 1998; Zanna & Rempel, 1988). Nevertheless, hedonic theory (Higgins, 1997; Kahneman, 1999) and other models such as Deci and Ryan's (1985) self-determination theory place affective considerations as prime antecedents for sustained behavioral action. To our knowledge this is the first of such tests with TPB in recycling and one of the only tests when considering attitude models and recycling more generally (Smith, Haugtvedt, & Petty, 1994).

Subjective norm was also a significant contributor to intention in the model but the effect was small and did not translate to a significant indirect effect upon recycling via intention. Subjective norm, as measured via TPB, often performs poorly across behaviors (Armitage & Conner, 2001) and our assessment of 24 prior studies in the recycling domain showed a similar trend of null or small effects. Social pressure to recycle, conceived and measured as a self-reported subjective norm in TPB, does not appear to be as important a construct as attitude and perceived behavioral control.

Finally, our extension of the TPB also included a socioecological (Stokols, 1996) component by taking into account the proximity of the recycling depot and its potential impact on recycling behavior via the TPB as well as its potential moderating role of intention and planning. We hypothesized that perceived behavioral control would account for covariance of a relationship between depot distance and recycling. Counter to our hypothesis, proximity to the depot was not related to any variable of interest. The small correlation of convenience or proximity and TPB has been identified in prior curbside recycling literature (Chen & Tung, 2010; Do Valle et al., 2005; Ramayah et al., 2012; Taylor & Todd, 1995). Interestingly, however, proximity did act as a moderator of the relationship between planning and recycling, with the major effect occurring for those individuals living within nine km (identified via simple slopes analyses) of the depot following through with their recycling plans more than individuals further away. This was a relatively large effect size interaction (Cohen & Cohen, 1983), suggesting the difference is substantive. Prior examination of proximity as a moderator of recycling behavior had not been conducted (Chen & Tung, 2010), but similar findings are present in physical activity where people further away from recreation centres are less likely to follow through with their plans (e.g., Prins et al., 2010; Rhodes, Brown, et al., 2006; Rhodes et

al., 2007). The result is interesting because it underscores how living near a depot may not affect behavior directly, but it may facilitate or impede that behavior when plans are made to enact it.

Despite the unique focus on depot-based recycling and the longitudinal design, our findings need to be considered within the context of limitations. First, we employed a self-report measure of depot recycling that may provide bias and be subject to social desirability. Self-report measures of recycling have shown validity when compared to direct observation (Lingard, Gilbert, & Graham, 2001; Nigbur et al., 2010) and depot-based recycling is such a discrete act that it is unlikely to be prone to severe memory bias. Still, follow-up validation of our findings with observed behavior would be prudent. Second, our sample of participants is limited to self-selected respondents who were interested in the study topic and may be additionally biased because these participants self-identified as having room to improve in relation to depot recycling. While this is laudable for the initial aims of intervention in this sample, it does restrict the range in the dependent variable of depot recycling. Still, we were able to predict 48% of the variance in recycling behavior and the sample matched the education, health, income, and marital status of residents in the Capitol Region District of British Columbia (Statistics Canada, 2007) but we clearly had a bias in favor of respondents who were female, Caucasian, and practiced recycling generally (Statistics Canada, 2004). Third, while our findings were interesting, the model fit was modest. This means that the findings need to be interpreted with some caution and alternative modelling of these data may better reflect the covariances among the variables. Finally, our time frame of four weeks is short to understand depot recycling and any change in recycling across that time; a behavior that relies on sustained action. A longer follow-up would be informative to track, particularly in the understanding of behavior change.

Conclusions

In summary, our extended TPB predicted sizeable variance of depot recycling behavior with the constructs of intention, planning and perceived behavioral control, yet these constructs did not perform as well in predicting change in behavior across four weeks. Intention was explained by instrumental and affective attitudes and perceived behavioral control but not injunctive and descriptive norms. While proximity to the recycling depot did not relate to behavior, it moderated the planning and recycling behavior relationship, whereby those who lived closer to the depot had larger planning-behavior relations than those who lived further away. The findings suggest that intervening to target both affective and instrumental reasons for depot recycling may act to predict subsequent motivation and improving perceived control may be important to subsequent behavior. Developing plans to recycle may help in addition to motivation, but these are still contingent on easy commuting distance to a depot.

References

Aguilar-Luzón, M. D. C., García-Martínez, J. M. A., Calvo-Salguero, A., & Salinas, J. M. (2012). Comparative study between the theory of planned behavior and the value-belief-norm model regarding the environment, on spanish housewives' recycling behavior. Journal of Applied Social Psychology, 42(11), 2797-2833.

Aiken, L. S., & West, S. G. (1991). Multiple regression: Testing and interpreting interactions. Newbury Park, CA: Sage.

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50, 179-211.

Ajzen, I. (2002). Constructing a TPB questionnaire: Conceptual and methodological considerations. Retrieved April 7, 2007, from http://www-unix.oit.umass.edu/~aizen/

Ajzen, I. (2006). Constructing a theory of planned behavior questionnaire. http://people.umass.edu/aizen/pdf/tpb.measurement.pdf

Ajzen, I., & Fishbein, M. (2005). Theory-based behavior change interventions: Comments on Hobbis and Sutton. Journal of Health Psychology, 10, 27-31.

Allan, J. L., Sniehotta, F. F., & Johnston, M. (2013). The Best Laid Plans: Planning Skill Determines the Effectiveness of Action Plans and Implementation Intentions. Annals of Behavioral Medicine. doi: 10.1007/s12160-013-9483-9

Allison, P. D. (2002). Missing Data. Thousand Oaks: Sage Publications.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behavior: A meta-analytic review. British Journal of Social Psychology, 40, 471-499.

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. Journal of Environmental Psychology, 27, 14-25.

Barr, S. (2007). Factors influencing environmental attitudes and behaviors: A U.K.case study of household waste management. Environment and Behavior, 39(4), 435-473.

Barr, S., Gilg, A. W., & Ford, N. J. (2001). A conceptual framework for understanding and analysing attitudes towards household-waste management. Environment and Planning, 33(11), 2025-2048.

Carraro, N., & Gaudreau, P. (2013). Spontaneous and experimentally induced action planning and coping planning for physical activity: A meta-analysis. Psychology of Sport and Exercise, 14, 228-248.

Castro, P., Garrido, M., Reis, E., & Menezes, J. (2009). Ambivalence and conservation behaviour: An exploratory study on the recycling of metal cans. Journal of Environmental Psychology, 29(1), 24-33.

Chan, K. (1998). Mass communication and pro environmental behaviour: Waste recycling in Hong Kong. Journal of Environmental Management, 52(4), 317-325.

Chan, L., & Bishop, B. (2013). A moral basis for recycling: Extending the theory of planned behaviour. Journal of Environmental Psychology, 36, 96-102.

Chen, M. F., & Tung, P. J. (2010). The moderating effect of perceived lack of facilities on consumers' recycling intentions. Environment and Behavior, 42(6), 824-844.

Cheung, S. F., Chan, D. K. S., & Wong, Z. S. Y. (1999). Reexamining the theory of planned behavior in understanding wastepaper recycling. Environment and Behavior, 31(5), 587-612.

Chu, P. Y., & Chiu, J. F. (2003). Factors influencing household waste recycling behavior: Test of an integrated model. Journal of Applied Social Psychology, 33(3), 604-626.

Chu, P. Y., Huang, C. C., & Chiu, J. F. (2004). Reexamining the decomposition and crossover effects in expanded theory of planned behavior models - A study of household waste recycling behavior. Journal of Solid Waste Technology and Management, 30(1), 37-51.

Chu, P. Y., Yeh, S. C., & Yang, S. M. (2006). The impact of local mandatory recycling policy on citizen recycling behavior - A test of an integrated model. Journal of Solid Waste Technology and Management, 32(4), 206-219.

Cohen, J., & Cohen, P. (1983). Applied multiple regression / correlation analysis for the behavioral sciences. Hillsdale, NJ: Erlbaum.

Conner, M., Sandberg, T., & Norman, P. (2010). Using action planning to promote exercise behavior. Annals of Behavioral Medicine, 40, 65-76.

Deci, E. L., & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. New York: Plenum Press.

Dillman, D. A. (1983). Mail and other self-administered questionnaires. In P. H. Rossi, J. D. Wright & A. B. Anderson (Eds.), Handbook of survey research (pp. 359-378). Toronto, ON: Academic Press.

Do Valle, P. O., Rebelo, E., Reis, E., & Menezez, J. (2005). Combining behavioral theories to predict recycling involvement. Environment and Behavior, 37(3), 364-396.

Fielding, K. S., McDonald, R., & Louis, W. R. (2008). Theory of planned behaviour, identity and intentions to engage in environmental activism. Journal of Environmental Psychology, 28(4), 318-326. doi: http://dx.doi.org/10.1016/j.jenvp.2008.03.003

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. American Psychologist, 54, 493-503.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. Advances in Experimental Social Psychology, 38, 69-119.

Head, K. J., & Noar, S. M. (2014). Facilitating progress in health behaviour theory development and modification: the reasoned action approach as a case study. Health Psychology Review, 8, 34-52.

Higgins, E. T. (1997). Beyond pleasure and pain. The American Psychologist, 52(12), 1280-1300.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1-55.

Jöreskog, K., & Sörbom, D. (2004). LISREL 8.71 for Windows. Lincolnwood, IL: Scientific Software International.

Kahneman, D. (1999). Objective happiness. In D. Kahneman, E. Diener & N. Schwarz (Eds.), Well-Being: Foundations of Hedonic Psychology. New York: Russell-Sage.

Kaiser, F. G., Hübner, G., & Bogner, F. X. (2005). Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior. Journal of Applied Social Psychology, 35(10), 2150-2170.

Knussen, C., & Yule, F. (2008). "I'm not in the habit of recycling": The role of habitual behavior in the disposal of household waste. Environment and Behavior, 40(5), 683-702.

Largo-Wight, E., Bian, H., & Lange, L. (2012). An empirical test of an expanded version of the theory of planned behavior in predicting recycling behavior on campus. American Journal of Health Education, 43(2), 66-73.

Lawton, R., Conner, M., & McEachan, R. (2009). Desire or reason: predicting health behaviors from affective and cognitive attitudes. Health Psychology, 28, 56-65.

Lawton, R., Conner, M., & Parker, D. (2007). Beyond cognition: Predicting health risk behaviors from instrumental and affective beliefs. Health Psychology, 26, 259-267.

Lingard, H., Gilbert, G., & Graham, P. (2001). Improving solid waste reduction and recycling performance using goal setting and feedback. Construction Management and Economics, 19, 809-817.

Mahmud, S. N. D., & Osman, K. (2010). The determinants of recycling intention behavior among the Malaysian school students: An application of theory of planned behaviour.

Paper presented at the World Conference on Learning, Teaching and Administration Papers.

Mannetti, L., Pierro, A., & Livi, S. (2004). Recycling: Planned and self-expressive behaviour. Journal of Environmental Psychology, 24(2), 227-236.

Nigbur, D., Lyons, E., & Uzzell, D. (2010). Attitudes, norms, identity and environmental behaviour: Using an expanded theory of planned behaviour to predict participation in a kerbside recycling programme. British Journal of Social Psychology, 49, 259-284.

Osbaldiston, R., & Schott, J. P. (2012). Environmental sustainability and behavioral science: Meta-analysis of pro-environmental behavior experiments. Environment and Behavior, 44(2), 257-299.

Oskamp, S. (2000). A sustainable future for humanity? How can psychology help? American Psychologist, 55, 496-508.

Prins, R. G., van Empelen, P., te Velde, S. J., Timperio, A., van Lenthe, F. J., Tak, N. I., . . . Oenema1, A. (2010). Availability of sports facilities as moderator of the intention–sports participation relationship among adolescents. Health Education Research, 25, 489-497.

Ramayah, T., Lee, J. W. C., & Lim, S. (2012). Sustaining the environment through recycling: An empirical study. Journal of Environmental Management, 102, 141-147.

Rhodes, R. E., Blanchard, C. M., Matheson, D. H., & Coble, J. (2006). Disentangling motivation, intention, and planning in the physical activity domain. Psychology of Sport and Exercise, 7, 15-27.

Rhodes, R. E., Brown, S. G., & McIntyre, C. A. (2006). Integrating the perceived neighbourhood environment and the theory of planned behaviour when predicting walking in Canadian adult sample. American Journal of Health Promotion, 21, 110-118.

Rhodes, R. E., & Courneya, K. S. (2003). Self-efficacy, controllability, and intention in the theory of planned behavior: Measurement redundancy or causal independence? Psychology and Health, 18, 79-91.

Rhodes, R. E., Courneya, K. S., Blanchard, C. M., & Plotnikoff, R. C. (2007). Prediction of leisure-time walking: An integration of social cognitive, perceived environmental, and personality factors. International Journal of Behavioral Nutrition and Physical Activity, 4, 51.

Rhodes, R. E., Fiala, B., & Conner, M. (2009). Affective expectations of physical activity among adults: A review and meta-analysis. Annals of Behavioral Medicine, 37, s171.

Rise, J., Thompson, M., & Verplanken, B. (2003). Measuring implementation intentions in the context of the theory of planned behavior. Scandinavian Journal of Psychology, 44, 87-95.

Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviours: Theoretical approaches and a new model. In R. Schwarzer (Ed.), Self-Efficacy: Thought Control of Action (pp. 217-242). Washington, DC: Hemisphere.

Smith, S. M., Haugtvedt, C. P., & Petty, R. E. (1994). Attitudes and recycling: Does the measurement of affect increase prediction? Psychology and Marketing, 11, 359-374.

Statistics Canada. (2004). Recycling in Canada. from http://www.statcan.gc.ca/pub/16-002-x/2007001/article/10174-eng.htm#footnote2

Statistics Canada. (2007). 2006 Census. Retrieved September 24, 2007, from http://www.statcan.ca/start.html

Statistics Canada. (2013). Municipal solid waste statistics and trends. http://www.ec.gc.ca/gdd-mw/default.asp?lang=En&n=1EEE3EF6-1

Statistics Canada Website. (2010). CANSIM table 104-7030. http://www40.statcan.gc.ca/l01/cst01/HLTH68-eng.htm

Stokols, D. (1996). Translating social ecological theory into guidelines for community health promotion. American Journal of Health Promotion, 10, 282-298.

Taylor, S., & Todd, P. (1995). An integrated model of waste management behavior: a test of household recycling and composting intentions. Environment & Behavior, 27(5), 603-630.

Van der Pligt, J., Zeelenberg, M., van Dijk, W. W., de Vries, N. K., & Richard, R. (1998). Affect, attitudes and decisions: Let's be more specific. European Journal of Social Psychology, 8, 33-66.

Vlek, C., & Steg, L. (2007). Human behavior and environmental sustainability: Problems, driving forces, and research topics. Journal of Social Issues, 63, 1-19.

Weinstein, N. D. (2007). Misleading tests of health behavior theories. Annals of Behavioral Medicine, 33, 1-10.

White, K. M., & Hyde, M. K. (2012). The role of self-perceptions in the prediction of household recycling behavior in Australia. Environment and Behavior, 44(6), 785-799.

Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. Journal of Environmental Psychology, 30(3), 305-314. doi: http://dx.doi.org/10.1016/j.jenvp.2010.01.003

World Health Organization. (2013). Gobal database on bodymass index. http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

Zanna, M. P., & Rempel, J. K. (1988). Attitudes: A new look at an old concept. In D. Bar-Tal & A. W. Kruglanski (Eds.), The social psychology of knowledge Cambridge: Cambridge University Press.

Figure Captions:

Figure 1. Extended Theory of Planned Behavior Predicting Depot Recycling across Four weeks.

Note: coefficients in parentheses are predictors of change in recycling across the four weeks (unstandardized residual). ⟶ $p < .05$ ⇢ $p > .05$

Figure 2. Simple Slopes Analysis of Distance to Recycling Depot as a Moderator of the Planning and Recycling Behavior Relationship