

Paved with Good Environmental Intentions:
Reconsidering the Theory of Planned Behaviour

by

Reuven Sussman
B.Sc., University of Toronto, 2003
M.Sc., University of Victoria, 2009

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Abstract

The theory of planned behaviour proposes that behaviour is predicted by behavioural intention which is, in turn, predicted by attitudes toward the behaviour, subjective norms regarding the behaviour and perceived control over the behaviour. Implied within this theory is that each of the three base components (attitudes, subjective norms and perceived behavioural control) influences intentions. However, despite being one of the most widely used theories in social psychology, few studies have investigated this basic premise. In addition, research on *cognitive dissonance*, *public commitment*, *confirmation bias*, *implemental mindset*, and *the false consensus effect* suggest that there may be a reverse-causal influence of intentions back on the base components of the theory. This potential reverse-causal sequence was tested in three studies. The first was correlational, the second was a lab-based experiment, and the third was a quasi-experimental field study. Study 1 employed a cross-lagged correlation design and showed that a reciprocal relation between intentions and base components was plausible. For the behaviour of supporting an environmental organization, Study 1 showed that attitudes were likely to influence intention-setting and that intention-setting subsequently influenced subjective norms. Study 2 employed a modified version of a free choice paradigm in which participants chose to set an intention to support one of two environmental organizations (using different support behaviours). Consequently participants rated the base components for the chosen organization higher and the rejected organization lower. However, this effect was primarily observed if participants were not initially committed to supporting an organization before the study began. Study 3 was a field study in which chemistry lab users who were exposed to an intervention that targeted behavioural intentions subsequently perceived more positive subjective norms (one aspect of subjective norms was changed). Together, the three studies demonstrate that a reverse-causal relation between intentions and base components is plausible and, thus, the theory of planned behaviour should be modified to include a reciprocal relation between these constructs. Intentions are most likely to influence base components that are least relevant to actual behaviour. When attitudes, subjective norms or perceived behavioural control are associated with actual behaviour, the one that is most strongly associated is least likely to change in response to setting an intention to engage in that behaviour. Other, less relevant, base components are more likely to change.

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CHAPTER 1

Background

Introduction

Understanding behaviour has been a recurring theme in environmental psychology research since its inception. Many investigators have attempted to answer the question, “why do people engage, or fail to engage, in pro-environmental behaviour?” Given the state of emergency facing many natural ecosystems, this is a high-stakes question indeed. What will it take to encourage people to take action?

The theory that has, perhaps, gained the widest acceptance since the 1970s, the theory of planned behaviour, proposes that pro-environmental intentions lead to pro-environmental actions, and that intentions are a product of three other mental constructs. True, many studies demonstrate that intentions and actions are strongly related, but what causes an individual to set an intention, and can intentions *cause* other mental constructs such as attitudes to change? Relatively little research has examined this question. Understanding the true cause-effect relation between elements of the theory of planned behaviour (intentions, attitudes, subjective norms and perceived behavioural control) is vital to understanding how to change behaviour and, ultimately, improve the state of the global environment through action. If intentions are predicted, but not caused, by these other constructs then changing these other constructs may not result in a change of intentions to engage in pro-environmental behaviour. If these other mental constructs can be affected by changes in intention (in a reciprocal feedback loop), then perhaps

interventions that directly influence intentions could be useful for changing more than just behaviour.

In the work that follows, I attempt to demonstrate a reciprocal relation between the cognitive elements *attitude*, *subjective norms*, and *perceived behavioural control*, and the decision-based *intention* to act pro-environmentally. This is done using lab studies and field experiments with *actual* behaviour as a dependent variable whenever possible (as opposed to self-reported behaviour).

Theory of Planned Behaviour (TPB)

The theory of planned behaviour (TPB) is a highly influential model for explaining behaviour. When it was described by Ajzen in 1988, and presented in detail in a landmark review paper in 1991, it was based on several years of research, and extended previous theories that had been developed during the preceding two decades. Since its introduction, the theory has been studied and applied in many domains. A quick PsycInfo search reveals 1,636 peer-reviewed articles related to the term “theory of planned behavior,” of which 468 contain the term in the title. The theory has been used to explain health-related behaviour, teaching behaviour, driving behaviour, investing behaviour, voting behaviour and, notably, pro-environmental behaviour (among many other types of behaviour). Indeed, identifying a type of behaviour that has *not* been studied under the framework of the TPB is difficult.

One reason that the TPB is popular is that it is able to predict a wide variety of behaviours with a simple set of predictors. As shown in Figure 1, the theory postulates that an individual’s *attitudes toward a behaviour* (**Att**), *subjective norms* surrounding the

behaviour (**SN**), and *perceived behavioural control* (**PBC**), predict his or her *intention* (**Int**) to engage in the behaviour. That intention, in turn, predicts actual behaviour. If PBC is accurate (i.e., reflects actual control), then PBC may “skip” the intention step and directly influence actual behaviour as well. Although several additional components have been proposed, evidence for the importance of the original three “*base components*” (Att, SN, and PBC), is substantial (for a review, see Ajzen, 2011).

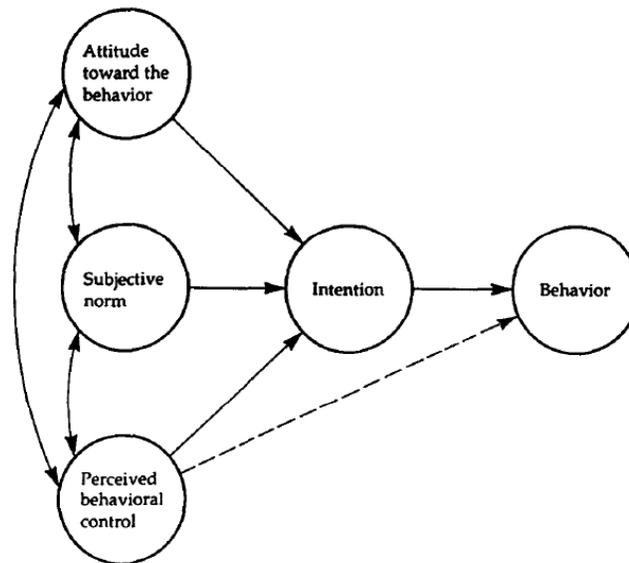


Figure 1. Theory of planned behaviour (TPB). Diagram reprinted from Ajzen (1991)

The Theory of Reasoned Action (TRA)

The TPB is an extension of the theory of reasoned action (TRA), which was the product of years of research by Martin Fishbein and Icek Ajzen. Most of the conceptual framework of the TPB model is the same as the original TRA model. The research that went into developing the TRA is described, in detail, in Fishbein and Ajzen’s book,

Belief, Attitude, Intention and Behavior (1975).¹ The original TRA model, depicted in Figure 2, is the same as the later TPB model, but does not include PBC (putting a particular emphasis on *beliefs* and including a potential feedback loop from behaviour to Att and SN via beliefs).

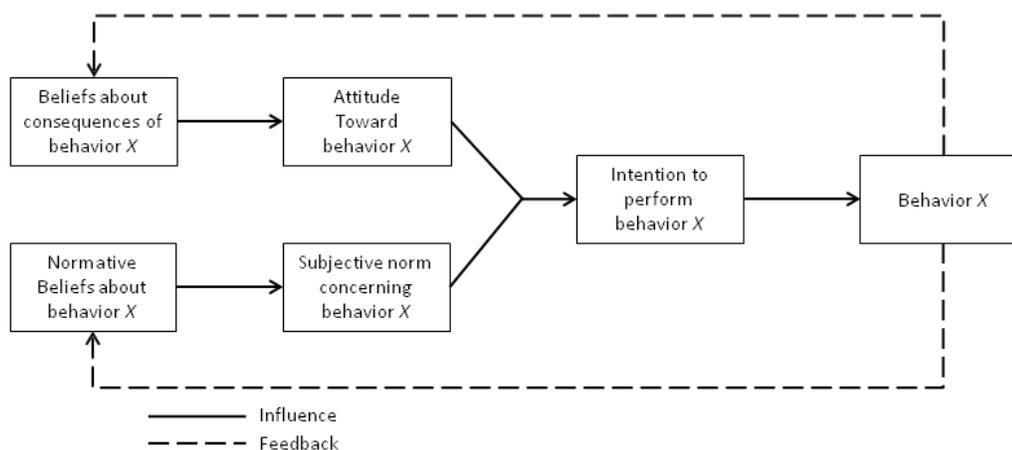


Figure 2. Theory of reasoned action (TRA). Diagram reprinted from Fishbein and Ajzen (1979)

In the TRA model, as well as the later TPB model, beliefs form the basis of attitudes toward the behaviour and subjective norms regarding the behaviour. An individual may hold any number of beliefs about the behaviour, but only those beliefs that are salient when considering the behaviour may affect attitudes or subjective norms. Fishbein and Ajzen, make the point that, according to their models, beliefs are not synonymous with Att. Instead, multiple beliefs combine together to form an Att, and multiple beliefs combine together to form SN. In terms of attitudes, each belief that

¹ The term “theory of reasoned action” was not used until four years later, when the model was presented at the Conference on Motivation in Nebraska (Fishbein, 1979).

comprises an attitude is a piece of information about the behaviour including the subjective probability of occurrence and the consequences associated with it. Thus, “an attitude represents a person’s general feeling of favorableness or unfavorableness toward some stimulus object” (Fishbein & Ajzen, 1975, p. 216) and these attitudes are generally assessed by asking people about their beliefs (attitudes, *per se*, are latent constructs that cannot be assessed directly).

Fishbein and Ajzen believe that Att can be quantified using, what they call the expectancy-value model. In other words, “each belief links the [attitude] object to some attribute...” and “...the person’s attitude toward the object is a function of his evaluations of these attributes” (Fishbein & Ajzen, 1975, p. 222). Therefore, calculating an attitude toward a behaviour becomes an exercise in summing together each belief about the behaviour, multiplied by its associated evaluation.

For example, attitudes toward the behaviour of composting may include the belief that “composting is likely to reduce landfill waste” and the associated evaluation that “reducing landfill waste is good.” It may also include the belief that “composting probably doesn’t do much to reduce greenhouse gas emissions,” with the associated evaluation that “reducing greenhouse gas emissions is good.” If one’s attitude toward composting only consisted of those two beliefs and evaluations, then the net “favourableness” of the attitude toward the behaviour of composting might be neutral. Thus, an overall attitude toward a behaviour will only change if sufficient numbers of

beliefs or evaluations change.² In later years, Ajzen expanded the notion of attitudes to include two types: instrumental and affective (Ajzen & Driver, 1991).

The net effect of subjective norms may also be calculated similarly. SN is postulated to be the sum of beliefs about a referent (someone who is important to the person) multiplied by one's "motivation to comply" with the referent. Thus, one might hold the belief that "my mother would approve of me composting" and the associated motivation "I will do what my mother approves of" (motivation to comply) as well as the belief, "my boss would not approve of me composting" and the motivation, "I am not influenced by the opinion of my boss." In this case, net SN with regards to composting would be slightly positive. Fishbein and Ajzen propose that SN may be determined in either of two ways: (1) a referent directly communicates to the individual what he or she thinks the individual should do, or (2) the individual observes the referent to learn what he or she does. They also acknowledge that SN may influence Att, but maintain that Att and SN are, nevertheless, two distinct concepts. More recently, SN was also expanded to include two types of norms: injunctive (e.g., "my mother would approve of...") and descriptive (e.g., "my mother does behaviour X", Fishbein & Ajzen, 2010).

According to the TRA, Att and SN are the only two factors that contribute to the likelihood of setting an intention to do the behaviour in question.³ In fact, they assert that other variables that can only influence Int indirectly (through either Att, SN or both). The theory was based on Dulany's theory of propositional control (Dulany, 1961; Dulany, 1968). However, Att and SN may not necessarily have equal influence on Int. For

² Note that Fishbein and Ajzen approach the concept of attitudes slightly differently than other researchers. In the TPB and TRA, attitudes are not general traits but specific to a particular behaviour. They point out that general attitudes do not predict behaviour well.

³ Later, Ajzen (1991) proposed that PBC was also a key predictor of Int.

example, in one study (Ajzen & Fishbein, 1972) participants received a description of a building project in which they could choose to invest \$1,000. In a pre-test, their Att and SN regarding the project were assessed. Before the experimental manipulation, participants estimated that the project had a 70% chance of success, and believed that “important others” also shared that belief. In a regression, they found that Att predicted Int, but SN did not.

During the experimental manipulation, some participants were told that the project only had a 30% chance of success (Att change) and other participants were told that friends or family now believed it only had a 30% chance of success (SN change). A manipulation check after the intervention showed that, indeed, participants in the “Att change” group only changed their attitudes, and participants in the “SN change” group only changed their subjective norms pertaining to the investment. Not surprisingly, those in the Att change group were more likely to change their intentions after the manipulation than those in the SN change group. SN, evidently, was not particularly important in deciding whether to invest in the project. This experimental study is one of the few that demonstrates that Att may *cause* a change in intentions. A similar randomized experiment was conducted to demonstrate that SN could be manipulated in order to change Int (Mezei, 1971).

Fishbein and Ajzen maintain that specificity is a key factor for the predictiveness of the TRA. Attitudes and subjective norms may only predict intentions if they are measured at the same level of specificity. If attitudes and subjective norms are assessed by asking people about their general beliefs then they will be unlikely to predict a specific intention. For example, asking people if they believe they should take action to

mitigate climate change and whether they believe “important others” would approve of them doing so, will not predict people’s intentions to “ride their bike to work every morning” (because many other factors also go into deciding to do that specific behaviour). In order to predict morning bicycle commuting, one should ask about attitudes or social norms specifically regarding morning bicycle commuting. Fishbein and Ajzen (1975) review several studies demonstrating that when Att or SN specificity do not match the specificity of the intention then the TRA makes differing predictions (or fails to predict) intentions (e.g., Bishop & Witt, 1970). Specificity of the *behaviour*, *target* object (at which behaviour is directed), *situation* surrounding the behaviour and *time* of the behaviour should all be aligned among Att, SN and Int measures.

Nevertheless, Fishbein and Ajzen also suggest using an aggregate measure of intention. Attempting to use TRA to predict a specific behaviour rather than groups of behaviours (or “a type” of behaviour) is unlikely to be successful. An aggregate measure of “intentions to engage in religious activities,” for instance, was better predicted than any single intention item (Fishbein & Ajzen, 1974). When participants were asked to complete a questionnaire measuring their Att and SN regarding religious activities along with 100 religious intentions (e.g., attending church, singing in church choir, donating money to church), TRA predicted the aggregate intention measure with a correlation of $r = .6$ to $r = .75$, and any individual intention item with a correlation of only $r = .16$ to $r = .2$. One critique of the TPB is that researchers too-often use questionnaires to measure behaviour that contain items that (for the sake of specificity and compatibility) are extremely similar to one another. This may artificially inflate associations between

constructs and, therefore, aggregate and varied measures are recommended (Kaiser, Schultz, & Scheuthle, 2007).

The TRA and TPB version of attitudes. Fishbein and Ajzen differ from most other researchers in social psychology in how they define the concept of attitudes. Aside from an emphasis on “attitudes toward a behaviour within a specific situation and time” rather than a trait-based view, Fishbein and Ajzen also take the position that SN and Int are distinct concepts from Att. They acknowledge that most social psychologists would not agree; saying instead, that Int is the “conative” component of Att, and SN is (probably) part of the “cognitive” component of Att.⁴ They justify their position by noting that “the conative component of attitude has been submitted to little empirical investigation, and the relation between attitude and intention has been largely neglected” (Fishbein & Ajzen, 1975, p. 289). In their short review of a few selected studies they found that Att did not always correlate strongly or significantly with Int and, therefore, it may be a distinct concept. For example, in a series of studies in which white people would ostensibly be asked to pose with black people, their degrees of prejudice did not correlate well (or at all) with their intentions to allow the photographs to be released (DeFleur & Westie, 1958; Green, 1972; Linn, 1965).⁵

The question of whether Int is a part of Att or a separate construct is one of theoretical interest. Although Int may not always correlate with Att, that may not be enough, in my opinion, to declare that Int is certainly not a part of Att. Consider a car, for example. When defining a car, one might say that it has (among other things) four

⁴ Fishbein and Ajzen (1975) do not explicitly state that SN is traditionally part of the cognitive component of Att. This is inferred from their definition of SN.

⁵ Intentions were measured using a “graded” scale from allowing the photograph to be used “in lab experiments where it would only be seen by other sociologists” to “in a nationwide publicity campaign advocating racial integration.”

wheels, a steering wheel and a few seats. The position of the wheels and the steering wheel may correlate, but the position of the wheels is unlikely to correlate with any aspect of the seats (the colour, the fabric, the firmness, etc.). The colour of the rims may sometimes correlate with the colour of the seats, but sometimes it may not. Nevertheless, both the wheels and the seats are part of the definition of a car. Thus, components within a concept may not always correlate with each other despite being part of the same concept.

Nonetheless, the concept of Att is not as clearly defined as the concept of a car. Attitudes cannot be seen or touched, and are entirely social constructions. Therefore, reconstructing them using an alternative theory is reasonable. Furthermore, the lack of correlation between Int and Att does lend some support to the idea that they may be separate concepts. But the choice to accept or reject Fishbein and Ajzen's theoretical formulation of Att and Int rests with each individual researcher. They believe that Int is the only direct predictor of behaviour and that any factor that influences behaviour must do so indirectly through Int.

Perceived Behavioural Control (PBC) and the Theory of Planned Behaviour

Ajzen's TPB (1991) is similar to the TRA in that he believes that attitudes and subjective norms are the sum of individuals' many beliefs (multiplied by evaluations of those beliefs or motivations to comply with normative referents). He also remains tied to the idea that intentions can predict actual behaviour and, most notably, that these elements follow from one-another in the same sequence. The only addition that Ajzen makes to the TRA is the incorporation of the concept of perceived behavioral control. He

argues that individuals may be favourable toward a behaviour and may believe that others engage in the behaviour, but will still only actually engage in it themselves if they believe they have the ability to do it (or find it easy enough to do). For instance, an environmentally concerned person may feel favourably toward riding a bike to work, and may believe that important others would approve of doing so, but may not actually do the behaviour because the distance between home and work is too great. Numerous studies demonstrate the improved predictiveness of the TPB over the TRA when behavioural control could be an issue (e.g., Ajzen & Madden, 1986; Swaim, Perrine, & Aloise-Young, 2007).

According to Ajzen, Int leads to actual behaviour *only if* the individual setting the Int has *actual control* over the behaviour. Thus, behaviour is theoretically a product of both Int and actual control. However, according to Ajzen, *perceived* control is more “psychologically interesting” than actual control. Part of what makes it interesting is the idea that perceived control can directly affect *intentions* or *actions*.

Given that actual control over a behaviour is important for engaging in the behaviour, PBC can directly influence behaviour to the degree that it reflects *actual* control. That is, if PBC is accurate (i.e., equal to actual control) then it will directly influence behaviour. If it is inaccurate, then it may influence intentions without influencing behaviour (or it may influence behaviour indirectly, via intentions). In some cases, when a behaviour or situation is perceived to afford *complete control*, PBC may not play a role at all, and the TRA alone will be sufficient to predict intentions and behaviour. This is how the theory is described by Ajzen (1991), however the notion that

PBC has the potential to *directly* influence behaviour has been called into question more recently (Kaiser & Gutscher, 2003).

Unlike locus of control (Rotter, 1966) or achievement motivation (Atkinson, 1964), Ajzen's definition of PBC is situation-specific rather than dispositional or durable. Ajzen likens his definition of PBC to Bandura's concept of perceived self-efficacy which "is concerned with judgments of how well one can execute courses of action required to deal with prospective situations" (Bandura, 1982, p. 122). Hence, TPB, like TRA, is concerned with specificity. Att, SN, and Int should all be related directly to a specific behaviour within a particular time in a certain situation with regards to a specific object. Recently, the concept of PBC has also been separated into two components: self-efficacy (ease or difficulty of behaviour) and controllability (e.g., Elliott & Ainsworth, 2012).

New Research on the Theory of Planned Behaviour

Since its discovery in the late 1980s, hundreds of studies have investigated or applied the TPB. Many of these are health-related, some are pro-environmental-behaviour-related, and others are unique applications of the theory. With well over 1,000 studies related to the TPB, reviewing them all would be beyond the scope of this chapter. However, I will review a few examples of TPB studies in order to show how the theory is typically studied and expanded.

Health behaviour. In health-related studies, most research is conducted by practitioner-researchers, health psychologists or epidemiologists who are interested in understanding the factors that predict healthy and unhealthy behaviours. Typically, research in this area involves measuring Att, SN, PBC and Int regarding a particular

behaviour (all at once) and then using regressions or structural equation models to fit the theory to the data that was collected. For example, some studies of physical activity using this method find that Att, SN and PBC predict intention to engage in active behaviour (Gretebeck et al., 2007; Guinn, Vincent, Jorgensen, Dugas, & Semper, 2007). In many cases, studies also measure self-reported behaviour several weeks, months or years later and show that intention can also predict behaviour (e.g., Collins & Carey, 2007; McClenahan, Shevlin, Adamson, Bennett, & O'Neill, 2007; Schifter & Ajzen, 1985; Schifter & Ajzen, 1985; Swaim et al., 2007; Ven, Engels, Otten, & Van, 2007). And in a few rare cases, studies of health related-behaviours such as dieting include follow-up measures of (proxies for) *actual* behaviour (e.g., actual weight loss, Schifter & Ajzen, 1985). Studies are often conducted this way because this is how Fishbein and Ajzen (2010) suggest doing them.

Generally, the TPB model predicts health-related behaviours quite well. Meta-analyses of various health-related intentions, for example, find that intentions and behaviour are associated with correlations from .44 to .62 (e.g., Armitage & Conner, 2001; Notani, 1998; Randall & Wolff, 1994; Sheppard, Hartwick, & Warshaw, 1988). And studies of complete TPB models find similar results. For example, in two meta-analyses of research on condom use, the mean multiple correlations were found to be .71 (Albarracín, Johnson, Fishbein, & Muellerleile, 2001) and .65 (Sheeran & Taylor, 1999), and in two meta-analyses of research on physical activity, the mean multiple correlations were .55 (Downs & Hausenblas, 2005) and .67 (Hagger, Chatzisarantis, & Biddle, 2002). In a meta-analysis of medical TPB studies that included only prospective data (i.e., self-reported behaviour was measured some time after the initial TPB questionnaire),

correlations were respectable but somewhat lower: Att, SN and PBC were correlated with Int from 0.40 to 0.57, Int correlated with behaviour .43 and PBC was correlated with behaviour .31 (McEachan, Conner, Taylor, & Lawton, 2011).

However, a few TPB studies in the health domain also find that predictiveness of the TPB improves when additional variables are included. One popular addition is the concept of “identity.” An individual who has a self or social identity that supports healthy behaviour (e.g., “I am an active person”) is more likely to behave in a healthy manner. Identity may be a good additional predictor of exercise, dieting and binge drinking (Hagger, Anderson, Kyriakaki, & Darkings, 2007), as well as fast food consumption (K. I. Dunn, Mohr, Wilson, & Wittert, 2011).

Other behaviour. Studies in a variety of unique domains have also applied the TPB and found it to be a good way to explain behaviour. The TPB model can explain older adults intentions to stop driving (Lindstrom-Forneri, Tuokko, & Rhodes, 2007) and people’s intentions to do “wine tourism” vacations (Sparks, 2007). It can also be used to explain why some students succeed in getting an “A” in a university course (Ajzen & Madden, 1986). But others also suggest including additional variables to improve the model. For example, when explaining individuals’ intentions to commit digital piracy (in China), combining the TPB with a theory of ethics improves the predictiveness of the model (Yoon, 2011), and in a study of internet marketing, including past behaviour improves the model (Celuch, Goodwin, & Taylor, 2007).

Pro-environmental behaviour. Of particular interest for this project is research on the TPB as a predictor of pro-environmental behaviour. Many studies have found support for the TPB as a model for this type of behaviour, however all of them measured

Att, SN, PBC and Int simultaneously (in the same questionnaire) and some also measured self-reported behaviour at this time as well. For example, in a large cross-sectional study, Kaiser and Gutscher (2003) found that TPB base components predicted 81% of intentions to engage in “ecological behaviour” which, in turn, accounted for 51% of self-reported behaviour. In this particular example, behaviour was also re-examined 50 weeks later with similar results. The TPB, in its traditional form, has also been used to predict specific behaviours such as recycling and composting (S. Taylor & Todd, 1995), intentions to recycle, carpool and conserve energy (Laudenslager, Holt, & Lofgren, 2004), or intentions to use bear-resistant containers in a national park (Martin & McCurdy, 2009). One study of US cattle ranchers found that the TPB base components predicted “sustainability” intentions (Willcox, Giuliano, & Monroe, 2012), and another found the TPB to be a better predictor of “mode of transit” than simple demographic variables (Hunecke, Haustein, Böhler, & Grischkat, 2010). Indeed, when 11 studies of pro-environmental behaviour were examined in a Bayesian meta-analysis, intentions (as predicted by the TPB) were related to behaviour, $r_{xy} = .54$ (Schwenk & Möser, 2009).

A few studies of pro-environmental behaviour have also used the TPB as a framework for creating questionnaires. Although Ajzen suggests using these questionnaires to test the TPB model, some investigators find the process of creating the questionnaire useful in itself. For example, in one study Att, SN and PBC-related factors were identified that could be related to recreationists behaviour to control invasive species (Prinbeck, Lach, & Chan, 2011). These “barriers” included the attitudinal beliefs that behaviors, such as using pesticides, may be worse for the environment than invasive species, and that the fight against invasive species is a losing battle. They also include the

SN beliefs that invasive species management is a low priority for many institutions and that the general public does not know and does not care about invasive species. And they also included the PBC beliefs that one does not know enough about invasive species preventive behaviors to be effective and that the recommended preventive behaviors are too difficult to perform. In this way, TPB-related beliefs were used to understand barriers to pro-environmental behaviour without actually testing how these beliefs related to intentions and future behaviour.

In the environmental domain, however, most TPB studies go beyond applying the TPB to changing it or merging it with other theories in order to improve its predictiveness. As with health-related studies, a common addition to the TPB made in pro-environmental behaviour studies is the variable “self-identity” or “group/social identity.” When an individual thinks of him or herself as being “the type of person who cares about the environment,” has a “green identity” or is a member of a social group that has this sort of identity, then this, along with Att, SN and PBC, helps predict Int and behaviour. This has been demonstrated in research on recycling (Mannetti, Pierro, & Livi, 2004; K. M. White & Hyde, 2012), environmental activism (Fielding, McDonald, & Louis, 2008) and carbon offsetting (Whitmarsh & O'Neill, 2010). In one study, “identity” was found to predict intentions to “engage in the natural environment,” but this effect was overwhelmed by the addition of the variable “affective connection to the natural environment” (Hinds & Sparks, 2008). Similarly, other researchers have found that feelings of embarrassment or guilt may influence intentions to engage in pro-environmental behaviours (Kaiser, Schultz, Berenguer, Corral-Verdugo, & Tankha, 2008). Authors of these studies suggest that affect may be an additional variable to

consider in the TPB, but the argument could also be made that affect is already part of attitudes.

Another variable that is frequently added to the TPB in studies of pro-environmental behaviour is “past behaviour.” Researchers often find that adding past behaviour into the TPB improves its ability to predict intentions and behaviour. This has been demonstrated in studies of transportation decisions and glass recycling (Bamberg & Lüdemann, 1996), paper recycling (Boldero, 1995; Cheung, Chan, & Wong, 1999) and pollution reduction preferences by environmental managers (Cordano & Frieze, 2000).

Morals are a common addition to pro-environmental TPB studies and have been added in several ways. Perhaps this is because these types of behaviours surround issues that are more closely tied to morals than other issues. In one study, researchers added two, potentially conflicting, moral beliefs to the TPB model to determine if either one would improve predictiveness of the model (Lam, 1999). They found that intentions to install home retrofits to conserve water were (in addition to Att, SN and PBC) negatively predicted by the moral belief that using water is a perceived moral right. The conflicting “moral obligation to conserve water” did not play a role in predicting retrofit intentions. In a study of recycling, however, people’s sense of “moral obligation” to recycle did add to the predictiveness of the TPB base components for predicting intentions (Chu & Chiu, 2003). One study of environmental decision-makers in the metal-finishing industry found that, although moral obligation was important, moral intensity (the degree to which people might be hurt or helped by a decision) moderated the effects of Att, SN and PBC on intentions to act pro-environmentally (Flannery & May, 2000).

Several studies of so-called “moral norms,” also known as “personal norms” (an individual’s beliefs about moral correctness or incorrectness of a behaviour), have also been found to increase the predictiveness of TPB models explaining recycling intentions (M. Chen & Tung, 2010), commuting choices (Klößner & Blöbaum, 2010; Wall, Devine-Wright, & Mill, 2007), and a variety of specific transportation, purchase and conservation behaviours (Harland, Staats, & Wilke, 1999). Personal norms are a key element of Swartz’s norm-activation model (1973), and in one comparison of this model with the TPB, both were found to be effective predictors of intention (Bamberg, 1999). When considered alone (in that study), personal norm predicted 19% of car driving behaviour. But when Att, SN and PBC were added to the model, personal norm was no longer a significant predictor of behaviour or intention. Nevertheless, a meta-analysis of 46 pro-environmental behaviour studies determined that personal moral norm may be an important independent predictor of pro-environmental intentions (Bamberg & Möser, 2007).

Similarly, a group of Portuguese researchers attempted to combine the TPB with Swartz’ model of personal norms and found that the TPB did a good job of predicting self-reported recycling (Valle, Rebelo, Reis, & Menezes, 2005). Economists looking at “willingness to pay” for environmental goods have also found that combining classic economic theories with the TPB and the norm activation model result in better prediction (Liebe, Preisendörfer, & Meyerhoff, 2011).

Similar to morals, several environmental studies have proposed adding “values” to the TPB. In one large cross-national study, the TPB was combined with Stern’s value-belief-norm theory (1994) to create a new model that predicted self-reported activist

behaviours such as signing a petition or donating money to an environmental organization (Oreg & Katz-Gerro, 2006). Another re-conception of the TPB involves adjusting the concept of “attitudes,” measuring behaviour using a “Rasch scale” and including measures of “environmental knowledge” and “environmental values” to predict general ecological behaviour (Kaiser, Wölfling, & Fuhrer, 1999).

Finally, a few other assorted variables have been added in environmental TPB studies. Local norms (social norms within one’s neighbourhood or city), perhaps empirically different from SN, may help predict household recycling intentions (Carrus, Passafaro, & Bonnes, 2008). Habit, which may be conceptually different from “past behaviour,” may also help predict intention to recycle (Knussen & Yule, 2008). Perceived inconvenience of behaving pro-environmentally could also be an important additional predictor of intentions or self-reported behaviour in some cases (Boldero, 1995; M. Chen & Tung, 2010) but not in others (Hunecke, Haustein, Grischkat, & Böhler, 2007).

General environmental knowledge may contribute to more pro-environmental intentions and behaviour (Cheung et al., 1999; Kaiser et al., 1999), and in one study, personality factors were measured (specifically “conscientiousness”); they did not predict recycling behaviour or intentions (K. M. White & Hyde, 2012). However, other background or demographic factors may be useful additions to the TPB in some cases (Abrahamse & Steg, 2009; Hunecke et al., 2007). Notably, to the best of my knowledge, no TPB studies of pro-environmental behaviour have included measures of *directly observed* behaviour (rather than simply intentions or self-reported behaviour), and none have attempted to test an intervention based on the results of TPB questionnaires.

Expanding the TPB may not be called for. Fishbein and Ajzen (1975) took a rather hard line on the original TRA model and suggested that only Att and SN could affect intentions and only intentions could affect behaviour. In their initial proposal, all other variables that may influence those constructs, including the variables discussed above, must necessarily work through the variables described by the TRA. However, more recently, Ajzen (2011) has taken a softer tone regarding the TPB. As he admits, the TPB was created by adding PBC to the theory of reasoned action and other important variables could conceivably still be identified. However, he also states that “for the sake of parsimony, additional predictors should be proposed and added with caution, and only after careful deliberation and empirical exploration” (p. 1119). Consequently, most of the additions described above could, according to Ajzen (2011), be integrated into the TPB without the addition of new variables.

Ajzen (2011) argues that, in order to consider adding another explanatory variable to the TPB, it should meet four criteria: (1) it should be behaviour-specific, (2) it should conceivably be a “causal factor” of the behaviour (i.e., make conceptual sense as a causal factor), (3) it should be “conceptually independent” of the current factors, and (4) it should “consistently” work as a predictor. Considering these criteria, the factor “local norms” may not be a good additional predictor of intentions because the construct is too conceptually similar to subjective norms (even if it has independent predictive power). Although Ajzen (2011) does not comment specifically on local norms, he does address several other commonly proposed additions.

Adding an “affective” variable to the TPB is, according to Ajzen (2011), somewhat redundant. Affect already plays a role in the TPB in several ways. Emotions

affect the salience of beliefs that influence Att, SN and PBC, they influence the formation of beliefs, and they influence the evaluation of those beliefs. In fact, attitudes, according to Ajzen should already be measured in terms of their “instrumental” and “affective” components (Ajzen & Driver, 1991). Affect may not be “conceptually independent” of current factors and, therefore, is probably not required as an additional variable in most cases.

Past behaviour is one of the most commonly suggested additions to the TPB. Fishbein and Ajzen have long recognized the ability of past behaviour to predict future behaviour better than any other factor and, in most cases, better than the complete TPB. However, past behaviour in itself, suggests Ajzen (2011), is not an explanatory variable; it does not meet the criteria of being a possible “causal factor” for future behaviour. Instead, it is a proxy for a variety of factors that have not been identified. Indeed, the predictions made by examining past behaviour should be the best predictions that can likely be attained with any model (Fishbein & Ajzen, 1975). The TPB is successful to the degree it is *as good as past behaviour for predicting future behaviour*.

But past behaviour, *per se*, is not a motivator of future behaviour. Theoretically, the influence of past behaviour on future behaviour should be through some intervening factors such as Att, SN or PBC. If adding past behaviour into the TPB model improves the prediction of intentions or behaviour (beyond the base components of the model), then either the base components of the model are not accurately specified or some additional motivating variables may still be unidentified.

Self-identity and habit are two variables that are somewhat frequently added to the TPB in environmental studies. Ajzen (2011) discusses these relatively little, except to

say that they are not substitutes for past behaviour and do not fully explain why past behaviour may have an influence on intentions. Therefore, they *could* conceivably be useful additions to the TPB for specific behaviours in particular contexts but may not be *the only missing ingredient* in the TPB.

Ajzen (2011) also acknowledges that including demographic or background information into the TPB could improve its explanatory power. However, these also do not meet the criteria of being “causal factors” for behaviour. Ajzen views these factors as variables that explain where beliefs about Att, SN and PBC originate. Hence, they should influence intentions and behaviour indirectly through the base components unless those components were not fully specified or additional explanatory factors remain undiscovered.

One area of interest for this particular project that was not directly addressed by Ajzen (2011) or Fishbein and Ajzen (1975) is the assumed causal direction of elements within the TPB (in particular that the base components influence intentions and not *vice versa*). This issue will be addressed next.

CHAPTER 2

Reverse Causality Between Intentions and Base Components

Direction of Causality within the Theory of Planned Behaviour

Since Fishbein and Ajzen proposed the TRA, the issue of causality within the model has been largely ignored. A handful of studies were presented by Fishbein and Ajzen (1975) that suggested that changes in Att or SN caused a change in Int, but no study tested a potential reverse-causal link. In the decades since the TRA and then the TPB were proposed, the issue of causality was assumed to be “solved” and most researchers went about conducting research using correlational designs and assuming they indicated a specific direction of causality. This issue is not addressed by Ajzen (2011) in his review of TPB critiques. Indeed, the theory proposes that Att, SN and PBC precede (and probably cause) behavioural intention which, in turn, precedes (and probably causes) actual behaviour. However, this assumption has primarily only been demonstrated statistically (not experimentally) in recent years and the statistical evidence is equivocal.

Inferring causality. The purpose of research in psychology is quite often to discover the reasons for behaviour; in other words, to answer the question, “what causes behaviour?” Indeed, this is precisely the question that Fishbein and Ajzen attempt to answer with their theory of reasoned action (1975) and theory of planned behaviour (1991). Each construct within these theories is postulated to cause another construct to change which, in turn, causes behaviour to change. However, the causal relations

between these constructs have not been conclusively demonstrated. In order to understand why, we should first consider the definition of causality.

A causal relation is one in which one variable influences another. In order to demonstrate a causal relation, several criteria have been defined. One definition is that in order to demonstrate that one variable, X , causes another variable, Y , (1) X must precede Y , (2) X must covary or correlate with Y , and (3) other variables that could explain Y must be controlled for (e.g., Tracz, 1992). As shown below, the first two criteria can be demonstrated statistically and without experimentation. For example, if gender is correlated with attitudes toward sci-fi action movies, researchers know that (1) gender must necessarily precede attitudes toward these types of movies (because people are most often born with their particular gender and are only exposed to movies later in life) and (2) males tend to prefer sci-fi action movies significantly more than females (based on a hypothetical significance level of $p < .05$). However, this is not enough to demonstrate that being born male is a *cause* of preference for sci-fi action movies.

To demonstrate causality, the third criteria must be met – one that cannot be fully addressed statistically. Although *known* confounding variables can be included and controlled for in statistical models, *unknown* confounding variables can only be controlled using a randomized controlled experiment. Randomization of participants to a treatment or control group allows researchers to account for all known and unknown confounding variables (if the power and sample sizes are large enough) and, thus, meet the third criteria for causality. Even less strict definitions of causality, such as the Bradford Hill criteria for medical epidemiology research (Hill, 1965) agree that

randomized control trials are the gold standard for demonstrating a causal relation between two variables.

Nevertheless, statistical models can be used to infer causality without clearly demonstrating it (see Retherford & Choe, 1993).⁶ These poorly named “methods of causal analysis” rely on statistically assessing regression coefficients and strengths of competing correlations in order to suggest a likely causal path. Although they cannot truly demonstrate causality, they can suggest a potential causal link between variables that are notoriously difficult to manipulate experimentally in a randomized control trial (e.g., smoking and depression).

Most studies of the TPB that claim to find directional associations among the constructs of Att, SN, PBC and Int use cross-sectional data investigated with regression or structural equation models (which are, essentially, more complex linear regression models – see Schumacker & Lomax, 2010). More than half of all published TPB studies use cross-sectional designs (see Armitage et al., 2013). This is problematic for several reasons (Elliott, Thomson, Robertson, Stephenson, & Wicks, 2013). First, cross-sectional tests of the TPB demonstrate only that between-participant differences in the model’s constructs are related to between-participant differences in intention and behavior; it says nothing about how individuals change over time or how a particular individuals’ Att, SN or PBC affects their intentions. Second, measuring all the TPB constructs simultaneously renders data vulnerable to consistency biases, which serve to inflate relations artificially (e.g., Budd, 1987). And finally, if self-reported behaviour is measured at the same time as

⁶ The term “demonstrate” is use rather than “prove” because, strictly speaking, theories can only be “disproven” and not “proven.” Empirical research is conducted in order to disprove or support theories; however no amount of support can result in “proving” a theory correct. At any time in the future, a study which has not yet been conceived of could disprove the theory.

the other TPB constructs, then any model based on that information can only actually predict “past” behaviour (not future behaviour, as the model is meant to predict). Indeed, when data is measured simultaneously, only associations can be inferred – directionality of influence and causality cannot be determined.

A structural equation or regression model can support the TPB if the model fits the data well when associations are included between Att, SN, TPB, Int and behaviour in the manner suggested by the theory. If alternative models fit the data better (say with associations not postulated by the TPB), then the TPB is not supported for that particular behaviour in that particular context. However, if the TPB model *does* fit the data well, a causal link is not necessarily established. A structural equation model showing associations between the TPB constructs in the expected manner is necessary but not sufficient evidence that constructs influence one another.

Cross-lagged correlations. A slightly more informative method of statistically modeling a causal relation involves variations of cross-lagged correlations. In its simplest form, a cross-lagged correlation between two variables (each measured at two time points) allows researchers to infer whether one variable is more likely to cause the other or *vice versa*.

By measuring X and Y at two time points (T_1 and T_2), researchers can determine three types of correlations (shown in Figure 3): synchronous ($X_{T_1}Y_{T_1}$ and $X_{T_2}Y_{T_2}$), autocorrelations ($X_{T_1}X_{T_2}$ and $Y_{T_1}Y_{T_2}$), and cross-lagged correlations ($X_{T_1}Y_{T_2}$ and $Y_{T_1}X_{T_2}$). Cross-lagged correlations are the primary outcomes of interest. If the strength of one cross-lagged relation is significantly greater than the other, then a particular direction of causality is statistically more likely. If $X_{T_1}Y_{T_2} > Y_{T_1}X_{T_2}$ then X is more likely to cause Y ,

and if $Y_{T1}X_{T2} > X_{T1}Y_{T2}$ then Y is more likely to cause X . However, in order to draw conclusions from the cross-lagged correlations, several assumptions must be met.

Namely, synchronous and autocorrelations must remain relatively constant.

Autocorrelations indicate stability of variables over time. If for example, attitudes at Time 1 are not strongly correlated with attitudes at Time 2, then the variable “attitudes” is not stable. As Rogosa (1980) demonstrates, cross-lagged correlations will be artificially inflated if variables are unstable. If one variable is unstable and the other is stable, then the unstable variable is more likely to predict the stable variable (based on a comparison of cross-lagged correlations).

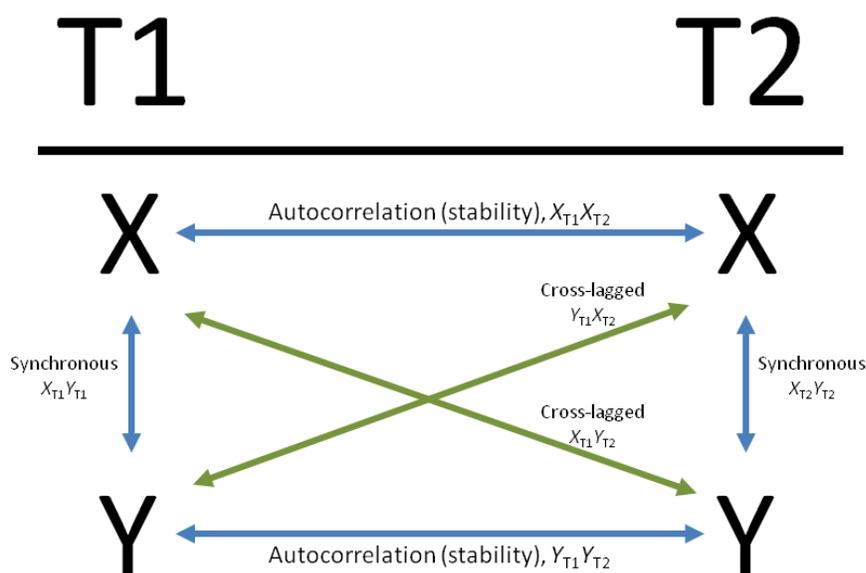


Figure 3. Correlations that may be derived from measuring two variables, X and Y at two time points, $T1$ and $T2$.

Synchronous correlations reflect the consistency or "stationarity" of a relation between X and Y . Perfect stationarity would occur when the synchronous correlations are

equal. Kenny (1975) and Randolph (1981) suggest checking stationarity, especially when rapid change may be expected. A significant change in synchronous correlations from T1 to T2 may indicate a possible influence of some extraneous variable(s) and Wanous (1974) proposes that the results are stronger when the cross-lagged correlations exceed the corresponding synchronous correlations.

Using a simple two-variable cross-lagged correlation based on a questionnaire administered at two time points, Tyagi and Wortuba (1993) demonstrated that intentions to quit a job were more likely to cause negative attitudes toward that job (a reverse-causal relation) than *vice versa*. This, highly relevant, example demonstrated statistically that *intentions* might cause *attitudes* to change.

More advanced versions of cross-lagged correlations involve more variables, more time points and more complex statistical analyses but remain based on the same basic premises as the simple two-variable example above. Cross-lagged two-wave panel studies and cross-lagged structural equation models have been used to statistically assess the causal links among TPB constructs. Interestingly, however, results from these analyses do not always provide unambiguous support for the TPB in its current form.

Three studies in two papers, however, *do* provide strong statistical support for causal relations among TPB variables in the expected direction. Armitage et al. (2013) and Elliot et al. (2013) conducted two-wave cross-lagged panel studies on driving behaviour in which participants received the same questionnaire twice (one month to one year apart).⁷ In each study, cross-lagged regressions demonstrated that Time 1 Att, SN and PBC significantly and independently contributed to Time 2 Int. However, they did

⁷ Armitage and colleagues (2013) conducted the only cross-lagged panel study on TPB variables concerning pro-environmental behaviour.

not hypothesize any additional relations among those TPB constructs and, thus, did not examine other cross-lagged regressions (including reverse-causal regressions). In one study that *did* present all cross-lagged regression coefficients among TRA constructs, both traditional and reverse-causal cross-lagged correlations were found (Bagozzi & Warshaw, 1992). Although the authors focus on the cross-lagged coefficients that confirm the traditional TRA model, they present a figure that clearly shows reverse-causal associations for some constructs.

For example, when examining self-reported intentions to lose weight at two time points, Att and SN at Time 1 significantly predict Int at Time 2 (traditional causal relation), but Int at Time 1 *also* significantly predicts Att and SN at Time 2 (reverse-causal relation). In fact, for the relation between SN and Int, the reverse-causal regression coefficient is larger than the traditional forward-causal coefficient, suggesting a potential reverse-causal relation is more likely than the traditional causal explanation for the SN-Int relation.

Several other TPB cross-lagged panel studies examined all possible cross-lagged relations among TPB variables in an exploratory fashion. Results from those studies are somewhat more ambiguous; sometimes providing support for the traditional TPB model and sometimes discovering alternative relations that are unexpected. For example, in an early TRA study of university students' intentions and self-reported bottle-return behaviour (Kahle & Beatty, 1987), several cross-lagged correlations were found. General ecological attitudes at Time 1 were significantly correlated with later intentions to return bottles (as expected), but self-reported behaviour at Time 1 also correlated with attitudes at Time 2 and, most interestingly, subjective norms at Time 1 were correlated with

attitudes at Time 2. Similarly, a more recent study of children's exercise behaviour (Hagger, Chatzisarantis, Biddle, & Orbell, 2001) found that Time 1 Att and Int significantly predicted Time 2 PBC, and Time 1 PBC significantly predicted Time 2 Att. This stands in contrast to the traditional TPB model that proposes Att, SN and PBC predict Int in a unidirectional manner.

Before the theory of reasoned action and theory of planned behaviour became the dominant models they are today, several researchers criticised the way that Fishbein and Ajzen separated the concepts of Att, SN and Int and put them in a causal sequence. One such criticism came from Liska (1984). He cites evidence demonstrating that Att, SN and Int may not be unique constructs, that beliefs may not cause attitudes, that beliefs may directly influence behaviour, and that the causal sequence postulated by the TRA may not be accurate. Furthermore, he points out that the TRA comes with an implicit assumption that current attitudes rather than past attitudes predict current behaviour.

Indeed, studies using cross-lagged regressions or structural equation models appear to support this notion. In the study of children's activity levels, Att, SN and PBC at Time 1 predicted Int at Time 1, and Att, SN and PBC at Time 2 predicted Int at Time 2, but a cross-lagged structural equation model did not find that that base components at Time 1 predicted intentions at Time 2 (Hagger et al., 2001). Similarly, Armitage and Connor (1999) conducted a two-wave cross-lagged panel study on intentions to follow low-fat diets and found strong associations between TPB base components and Int at Time 1 and Time 2 (respectively), but did not find strong evidence of causal relations (based on cross-lagged correlations between base components at Time 1 and Int at Time 2). This led Armitage and Connor to conclude that the TPB "is principally a predictive,

rather than causal model” (Armitage & Conner, 1999, p. 49). That is, at each time point, the TPB components predict each other as they are meant to, but cross-lagged correlations do not support a causal model. Critically, without a causal model that explains behaviour, one cannot conclude that an intervention aimed to change a particular base component may be effective in changing intentions or behaviour.

Cross-lagged correlations, therefore, appear to show that the traditional causal model of the TPB is possible, but also that other models including a reverse-causal model may be possible. However, Rogosa (1980) further presents several critiques of cross-lagged analysis procedure itself that should be considered when assessing the usefulness of these methods. Primarily, Rogosa explains that stable autocorrelations (of variables regressed on themselves over time) are a required assumption for cross-lagged correlations to be valid and that this assumption is unnecessarily restrictive. Furthermore, however, Rogosa also notes that when cross-lagged correlations are equal, two interpretations are possible – no causal relation between variables exists or two equally strong (and possibly significant) causal relations between variables exists. At least one researcher has interpreted the latter pattern as an example of a “reciprocal” relation between variables, and found that PBC and Int may, indeed, share this type of relation (Marsh, Papaioannou, & Theodorakis, 2006).

Finally, Rogosa notes that cross-lagged correlation studies require very large sample sizes in order to find significantly different cross-lagged correlations. Hence, some studies such as the intention-to-quit study (Tyagi & Wotruba, 1993) employ slightly less restrictive cut-offs for attaining a statistically significant result (e.g., $p < .1$). Nevertheless, all authors recognize that causality cannot be truly demonstrated without a

randomized control experiment. For example, Elliot and colleagues (2013) conclude their study by stating that “we do fully acknowledge that causal analyses, such as those conducted in the present research, do not definitively demonstrate cause and effect relations and that controlled experiments provide the most appropriate method for addressing this issue” (Elliott et al., 2013, p. 915).

TPB intervention studies. As explained earlier, when participants from a shared pool are randomly assigned to an intervention or control group in an experiment, then any difference between them is likely to result from differences in the experimental treatment. This is because known and unknown potential confounding variables are partialled out by the randomization procedure – both groups are expected to have roughly equal levels of these variables (if the groups are large enough). This is called a randomized control experiment and it can provide the strongest evidence for a causal relation between two variables. Several “intervention studies” have been conducted using a TPB framework, some of which used a randomization procedure. These were systematically reviewed by Hardeman et al. (2002).

In their review, Hardeman and colleagues (2002) carefully examined 24 distinct TPB interventions in 30 studies. Although the review was not restricted to health-related TPB studies, 21 of 24 studies were health-related and the PsycInfo database was not included in the search. No pro-environmental TPB studies were included in the review but, to the best of my knowledge, no such intervention study currently exists.

Hardeman (2002) found that, of the 24 interventions that were reviewed, 14 employed a randomized controlled design. In addition, most studies had a relatively small sample size ($N < 200$ participants) and only a short follow-up period (seven had follow-

ups longer than six months). Approximately half of the TPB intervention studies demonstrated that intentions changed as a result of the intervention, and approximately two-thirds found that TPB variables predicted the intention-behaviour relation (with a small to moderate effect size). Two studies reported that TPB variables (e.g., Att or PBC) moderated the effects of the intervention on behaviour.

However, the few TPB intervention studies that currently exist do not demonstrate a key aspect of the theory – that changing the base components influences a change in intentions which, in turn, influences a change in behaviour. Of all the interventions that were reviewed, none tested whether the intervention affected Att, SN or PBC. This was even the case when the TPB was used to develop the intervention (i.e., by using the concepts of Att, SN or PBC to create questionnaires).

Thus, most intervention studies still contain a number of shortcomings. They still measure Int, Att, SN and PBC simultaneously (making a causal link between them difficult to establish). They are often too small and do not assess whether TPB base components have changed (only whether intentions or behaviours have changed). And, most importantly for this project, they never explicitly test a reverse-causal hypothesis.

Outside the context of the TPB, several studies have shown that manipulating certain TPB-like constructs can affect other TPB constructs (suggesting a possible causal direction). For example, manipulating perceptions of subjective norms can affect intentions (Mezei, 1971), making a behaviour easier (increasing perceived behavioural control) can make it more likely (e.g., speeding up elevators, Van Houten, Nau, & Merrigan, 1981), and changing attitudes about a behaviour can lead to more instances of that behaviour (Ajzen & Fishbein, 1972).

However, these examples are surprisingly rare. Most research is correlational rather than experimental – it demonstrates that subjective norms, attitudes or perceived control are associated with behaviour without experimentally manipulating the dependent variables to determine if they *cause* behaviour to change. In the few studies that *do* experimentally manipulate Att, SN or PBC, outcome variables are often self-reported behaviour rather than actual behaviour, and models only include a single construct (i.e., Att, SN *or* PBC) rather than the entire TPB model. Occasionally, intention is measured rather than actual behaviour, but rarely both.

Very few studies have attempted to experimentally manipulate Att, SN or PBC in order to determine if those variables *cause* intentions to change. One early study of the TRA attempted to do so. This study demonstrated that both Att and SN may cause Int in different conditions (Ajzen, 1971). In this study, that did not include PBC, participants were asked to engage in a prisoner's dilemma game. In this game, cooperation by both parties earned points, defection by one party earned many points for that party and lost many points for the other party, and defection by both parties lost a few points for each. Some participants were told that the object of the game was to cooperate and consider the other player a "partner," others were told that the object of the game was to perform better than the other person.

After four rounds, participants were given a persuasive message intended to change their behaviour from competitive to cooperative or cooperative to competitive. This message either targeted the player's attitudes (it's more logical to pick option X [cooperate or compete]), or subjective norms (most people think that other players will pick option X [cooperate or compete]). Some participants in the competitive and

cooperative conditions were “controls” who did not receive a persuasive message. Thus, the study employed a 2 x 3 design shown in Table 1. A questionnaire subsequently ensured that Att changed in the “Att change” group and SN changed in the “SN change” group. It also measured intentions and found that intentions changed in tandem with Att or SN. In the cooperative condition, the SN change was associated with a change of Int (Att change made no difference to Int) and, in the competitive condition, Att change was correlated with a change of Int (but SN change made no difference to Int). Furthermore, actual behaviour in an additional 20 rounds of the game were correlated highly with participants’ intentions ($r = .82, p < .01$). This study demonstrates that Att and SN may cause Int (and that Int may cause certain behaviour changes later), but one may be more influential than the other depending on the situation.

Table 1

Results of Ajzen (1971). Participants playing a prisoner’s dilemma game with a cooperative scenario changed their behavioural intentions when their perceptions of subjective norms were changed. Participants in a competitive scenario changed their behavioural intentions when their attitudes were changed.

	Behavioural Intentions		
	Att Change	SN Change	Control
Cooperate	83.89	62.61**	86.06
Compete	46.94**	27.64	28.33

*Note: ** $p < .01$; Numbers represent percent of trials on which participants behaved cooperatively. There was generally more cooperation in the cooperative scenario, but this was significantly reduced by the competitive SN message. In the competitive*

scenario, there was generally less cooperation, but it was significantly increased by a cooperative attitudes message.

Two other studies on condom use attempted to manipulate Att or SN in creative ways in order to potentially change intentions. One of these did so via mood (Armitage, Conner, & Norman, 1999). The researchers manipulated people's moods to be positive or negative (by reading 20 statements) and then measured Att, SN and Int regarding condom use. Ostensibly a positive mood should lead participants to pay attention to superficial cues like norms, whereas a negative mood should lead participants to pay attention to consequences of action (Att). The researchers found that Int was predicted well in both cases ($R = .53$ and $.51$, for positive and negative mood, respectively), but for participants in a positive mood, SN was more important than Att (in predicting condom-use intentions) and, for participants in a negative mood, Att was more important than SN (as expected).

In a second study, researchers primed "private self" or "collective self" in order to manipulate Att or SN (Ybarra & Trafimow, 1998). They asked participants to think of either (1) what they have in common with friends and family or (2) what makes them different from friends or family. They expected participants primed to think of their "private self" to focus on primarily on Att, and participants primed to think of their "collective self" to focus primarily on SN. Again, they found that condom-use intention was predicted well in both conditions ($R = .68$ and $.71$), but Att was more important to predicting intentions in the "private self" condition, and SN was more important to predicting intentions for the "collective self" condition.

In a more recent study, Armitage and Reidy (2008) conducted a study in which perceived behavioural control and subjective norms were changed using a visioning task and participants' intentions changed in tandem. In this study, participants who were asked to do "process simulations" (envisioning themselves preparing to donate blood) subsequently experienced decreased anxiety about donating blood, increased beliefs that social norms supported donating blood and increased perceived behavioural control regarding donating blood. These increases were also accompanied by an increased intention to donate blood. Participants who were asked to engage in simulations about an unrelated task (getting a high mark in a class) did not show the same changes. Furthermore, for the process simulation group, a mediation analysis showed that the effect of the intervention on intentions was fully mediated by SN and PBC (as predicted by the TPB). Thus, this study demonstrates that experimentally manipulated changes in SN and PBC may influence changes in Int.

Although these studies may demonstrate that the base components influence intentions in the expected direction, the possibility remains that intentions may *also* influence base components in a reverse-causal direction (i.e., a reciprocal relation could exist – as suggested by some cross-lagged panel studies). No study has explicitly tested this possibility. That is, Int has not been experimentally manipulated to demonstrate that it may influence Att, SN or PBC. Today, studies tend to assume a direction of causality without testing it. Most frequently, TPB studies involve as, Fishbein and Ajzen (2010) suggest, measuring Att, SN, PBC and Int at the start of the study using a customized questionnaire and then measuring behaviour sometime in the future. This allows researchers to infer that Att, SN, PBC and INT may precede *behaviour*, but not that Att,

SN or PBC precede Int, or that any of the variables *cause* behaviour. Without systematically manipulating Att, SN, PBC, or Int researchers cannot conclude with certainty that these variables influence one another or a person's behaviour.

Measurement of intentions, attitudes, subjective norms and perceived behaviour control are particularly dubious. In studies of the theory of planned behaviour, Att, SN, PBC *and* Int are measured at the same time (in the same questionnaire). Thus, the theory's proponents may conclude that Att, SN and PBC are associated (correlated) with Int, but *not* that Att, SN and PBC necessarily precede or influence Int. Although this is a reasonable and intuitive assumption, it may not be accurate. A similar assumption, that emotions cause physiological reactions in the body (rather than vice versa), was successfully disputed by William James in 1894. Since this initial dispute, neurophysiological evidence has demonstrated that, in fact, physiological processes may precede *or* follow emotions, and that cognitions may precede or follow the experience of emotions as well (for a review of the history of the James-Lange theory see Lang, 1994). Clearly, intuitive assumptions can be wrong and causal assumptions should be tested before being treated as "fact."

Unfortunately, finding neurophysiological correlates of concepts as specific (and simultaneously vague) as attitudes, subjective norms, perceived behavioural control and behavioural intentions would be difficult. Therefore, demonstrating causality or reverse causality between the base components of the TPB model (Att, SN and PBC) and intentions cannot be done the same way that researchers demonstrated the reciprocal relation between emotions, cognitions and physiological responses. Instead, creative manipulation and measurement of each construct would be necessary.

Several lines of research in social psychology offer good reason to question the assumption that the TPB base components precede Int rather than only following it. These include research on *cognitive dissonance*, *public commitment*, *confirmation bias*, *implemental mindset*, and *the false consensus effect*. Each of these areas of research demonstrates, in some way, the common finding that once a decision is made (behavioural intention is set), attitudes, subjective norms or perceived behavioural control regarding that behaviour may *subsequently* change; in essence, that Att, SN and PBC may follow (rather than precede) behavioural intentions. Below is a description of each of these areas of research as well as a summary of findings specifically demonstrating how they show that intentions may influence Att, SN or PBC.⁸

Cognitive dissonance. The theory of cognitive dissonance was first proposed by Leon Festinger in his book *A Theory of Cognitive Dissonance* (1957) and then elaborated two years later (Festinger & Carlsmith, 1959). Essentially, the theory suggests that when a person holds two cognitions that contradict each other (are “dissonant”) the individual will feel discomfort and be motivated to bring the two cognitions into alignment. To quote Festinger (1957), the existence of two dissonant cognitions (“cognitive elements”) in a cognitive system is “...psychologically uncomfortable,” and “will motivate the person to try to reduce dissonance and achieve consonance” (Festinger, 1957, p. 3). Further, “...the strength of the pressure to reduce the dissonance is a function of the magnitude of the dissonance” (p. 18).

⁸ In their original conception of the theory of reasoned action, Fishbein and Ajzen (1975) do propose a feedback loop in which actual behaviour influences attitudes and subjective norms to change, but there is no mention of a possible reciprocal relationship between intentions and attitudes or subjective norms. Furthermore, this feedback loop was dropped from more recent conceptions of the TPB.

An implication of the theory of cognitive dissonance is that, once a decision is made to act in a manner that is counter-attitudinal, the individual is motivated to change his or her attitudes to match the new behaviour. This has been demonstrated using a variety of paradigms (summarized by Kenworthy, Miller, Collins, Read, & Earleywine, 2011). The induced compliance paradigm involves suggesting that participants do counter-attitudinal behaviours with “little external justification” to induce dissonance and consequent attitude change. The free-choice paradigm involves asking participants to choose between two similarly valued items and then, through a process of cognitive dissonance, end up preferring the chosen item significantly more than the rejected item. The insufficient justification paradigm involves telling participants (usually children) that they will receive a punishment for using an object or doing a behaviour in order to induce dissonance and trigger increased preference for that object or behaviour (the smaller the punishment, the greater the preference). The justification of effort paradigm requires that participants engage in significant effort in order to achieve a goal, and subsequently feel the goal was more desirable (because of the dissonance produced by the tremendous effort). The emotion most likely driving these feelings of discomfort followed by attitude change is guilt (Kenworthy et al., 2011).

Real-life examples of cognitive dissonance abound. In Stockholm, Sweden, attitudes toward tolls for cars driving through downtown changed dramatically from before the tolls were introduced to after (Börjesson, Eliasson, Hugosson, & Brundell-Freij, 2012; Eliasson & Jonsson, 2011). In 2004, when the left-leaning Green party imposed a trial period for the tolls, only 36% of the population supported the idea. However, during the six-month trial, support rose to 52% and, ultimately, 53% voted to

keep the tolls permanently. In 2011, support for the tolls rose further to 70% (Börjesson et al., 2012) and half of the drivers stated that they “always supported the tolls” (Mason, 2013). Some research suggests that the reasons for these changes in attitudes may go beyond simply *learning* that congestion was reduced by tolls; after all, even people who were not directly affected by the tolls changed their attitudes (Brundell-Freij & Jonsson, 2009). Given that most of the attitude change occurred in individuals who initially held the least support for the initiative, and that attitude change increased incrementally over time, cognitive dissonance may be a good explanation for the change in attitudes (Brundell-Freij & Jonsson, 2009).

In order for cognitive dissonance to result in attitude change, behavioural decisions should appear to be voluntary (Brehm & Cohen, 1959; e.g., Brehm, 1959; Chatzisarantis, Hagger, & Wang, 2008; Cohen, Terry, & Jones, 1959).⁹ Therefore, experimental manipulation of participants’ choices in cognitive dissonance studies is difficult. On the one hand, researchers would like to “force” participants’ choices in order to demonstrate that counter-attitudinal behaviour leads to dissonance but, on the other hand, if participants perceive that the choice was forced (or the behaviour is justified by external forces) then cognitive dissonance will occur to a lesser extent. In one famous demonstration, participants who were told they would be paid \$20 to explain a boring task to other participants experienced less attitude change than those who were paid only \$1 to do the same thing (Festinger & Carlsmith, 1959). Ostensibly, this was because participants who were told they would be paid more attributed their behaviour to external

⁹ Fishbein and Ajzen (1975) argue that the theory of cognitive dissonance actually explains a change in “behavioural beliefs” and not “attitudes.” According to them, behavioural beliefs, along with evaluation of those beliefs, are components of attitudes, but are not the same thing as attitudes *per se*. However, they also acknowledge that these concepts are highly related to one another, and most researchers conceive of the theory of cognitive dissonance as a theory of “attitude” change, not “belief” change.

factors and those who were told they would be paid very little attributed their behaviour to their own attitudes.¹⁰ Therefore, cognitive dissonance is only likely to occur if participants do not believe they are being coerced. Convincing participants to do a behaviour by offering them the opportunity to freely choose between multiple alternatives (e.g., Brehm, 1956) may be an effective method of inducing compliance while maintaining a sense of voluntary-ness.

Free choice paradigm. The free-choice paradigm, in which participants rate a series of choice alternatives, then choose between two alternatives that “happen” to have similar ratings, and then (at some later time) re-rate the same choice alternatives, is a common and effective means of demonstrating the effects of cognitive dissonance (Brehm, 1956). This is called the “free choice paradigm.” The appeal of this procedure is that, rather than induce compliance with a counter-attitudinal behaviour in a way that both “forces” a particular choice but also appears voluntary, participants are simply offered two choices and asked to decide between them.

Many studies have demonstrated that, following a choice of one alternative over another, participants subsequently prefer the chosen alternative more and prefer the rejected alternative less (e.g., Brownstein, Read, & Simon, 2004; Cottrell, Rajecki, & Smith, 1974; Gerard & White, 1983; Greenwald, 1969). One study showed that this effect may even occur among non-human primates (Egan, Bloom, & Santos, 2010). The effect has also been shown to affect implicit attitudes in the form of time spent looking at choice alternatives (O'Donnell & Brown, 1971) or latency in decision-making times

¹⁰ Interestingly, participants were not *actually* paid anything for their participation. After the experiment, they were asked to return the money. In addition, the findings from this study, unlike future studies, were less convincing than originally presumed. Only one question (of four) reflected a significant change in attitude of participants as a result of cognitive dissonance. Nevertheless, many similar studies have since replicated this effect.

(Denmark & Ritter, 1972). Post-decision dissonance in one “free-choice” study demonstrated that dissonance and attitude change can occur as a result of an intention *before enacting an actual behaviour* (Brownstein et al., 2004). Therefore, considerable evidence from free-choice paradigm research shows that attitudes may be changed as a result of making a decision and setting an intention even before people have an opportunity to act. This paradigm will be used in Study 2 (below) to demonstrate a possible reverse-causal effect between intentions and the base components of the TPB. Therefore, it will be explained in greater detail here.

Some research on the free-choice paradigm has sought to delineate factors that may mediate or moderate results of the procedure. For example, several studies have shown that if a decision is perceived as “reversible” then cognitive dissonance does not occur and a “spreading” of desirability ratings between alternatives does not happen (Frey, Kumpf, Irle, & Gniech, 1984; Gilbert & Ebert, 2002). If participants experience a delay before the consequences of their decisions, then the length of this delay can also affect ratings of chosen and non-chosen options (G. L. White & Gerard, 1981). The absolute ranking of the alternative choices that are offered to participants matters as well. If participants are offered two similarly ranked options at the “highly preferred” end of the spectrum then the chosen option will remain at the same rank, but the non-chosen option will drop to a lower rank, whereas the opposite will occur if the two options are at the “less preferred” end of the spectrum (Shultz, Léveillé, & Lepper, 1999).

Other research has served to criticise the free-choice paradigm (e.g., Beauvois et al., 1995; M. K. Chen & Risen, 2010; Harris, 1969; Risen & Chen, 2010). For example, one critique (although backed by a small under-powered study) suggested that the *act of*

agreeing to participate in a free-choice study, rather than the experimental manipulation within the study, causes cognitive dissonance that leads to attitude change. Essentially, Beauvois (1995) argues that dissonance studies work because people “agree to put themselves in compliance-inducing situations.”

However, the most damning criticism of the free-choice paradigm is that a *self-selection bias* may cause the observed spreading of alternatives rather than the subjective experience of cognitive dissonance (M. K. Chen & Risen, 2010). Participants asked to freely choose among two similarly ranked alternatives typically choose the option that they ranked slightly higher. However, some participants choose the option that they initially ranked slightly lower (Chen and Risen estimate that this may be as many as 25% of participants). Assumptions inherent in the paradigm (that participants should choose the option they ranked higher) mean that this minority of respondents (who chose the “wrong” option) are typically excluded from the analysis.

Meanwhile, none of the participants in the control condition are excluded because they are not offered the opportunity to choose between two alternatives (controls typically rate the options at the start and end of the study without being asked to choose between two similarly ranked options). Chen and Risen (2010) argue that this causes a self-selection bias in which the experimental group contains only participants who *definitely* preferred the option that they initially ranked higher, while the control group contains participants who may have preferred the option they initially ranked higher *but may also have preferred the option they initially ranked lower*. Consequently, the self-selected group should be expected to have a higher overall preference for the chosen option than

the mixed group (controls). For a clearer and more in-depth explanation of this critique see Chen and Risen's study on the subject (2010).

In response to this critique, one research team provided neurological evidence of cognitive dissonance in the free-choice paradigm (Izuma et al., 2010). They reported that striatum activity increases as a result of participating in the paradigm, and that this is "strong evidence" of choice-induced preference change. They also implicate the anterior cingulate cortex and dorsolateral prefrontal cortex areas of the brain as those most involved in tracking the degree of cognitive dissonance experienced. Together, these areas of the brain are responsible for a wide variety of functions including learning, motor control, planning, and some autonomic or emotion regulation (e.g., heart-rate, emotions, reward anticipation).

Chen and Risen (2010) also offered several solutions for changing the free-choice paradigm into a methodologically sound technique for studying cognitive dissonance. One of the proposed solutions involves subtly convincing participants to always choose a specific option (most likely the one they rated slightly higher in initially). This would ensure that any spreading of alternatives was a result of cognitive dissonance as opposed to a self-selection bias (because everyone made the same selection). If compliance is induced in a subtle way that allows the participant to believe the choice is still voluntary, then the effect of cognitive dissonance may still occur. Risen and Chen suggest explaining alternatives to participants in this way: "We would like to give you an art print for participating today. Based on your ranking, we have selected this print for you (show them the print they ranked #7). We do have one other print available, though (show them #9). I want to make it clear that the decision is entirely yours. Please sign here to state

that you have freely chosen this print (pointing to #7).” Similar techniques to gently guide participants’ decisions have been shown in other studies to be effective in both “forcing” the appropriate choice and evoking the dissonance associated with voluntary decisions (e.g., Sénémeaud & Somat, 2009). When presenting alternatives in a list, Russo et al. (2006) suggest that, in order to subtly induce a participant to choose a particular alternative (even a less desirable one) without feeling coerced, the forced alternative should be presented first (in the list) with supporting information right below it (before presenting any alternative options).

Public commitment. Cognitive dissonance may play a role in the effect of public commitment (e.g., Cohen, Brehm, & Latané, 1959; Festinger & Carlsmith, 1959). When individuals publicly state an intention to engage in a behaviour they are typically more likely to follow through with the behaviour than if they only set an intention privately (e.g., Cohen et al., 1959; Stults & Meesé, 1985). Therefore, encouraging people to state their intentions to engage in pro-environmental behaviours can be an effective method of increasing energy conservation (Pallak, Cook, & Sullivan, 1980; Shippee & Gregory, 1982; Sullivan & Pallak, 1976), curbside recycling (Burn & Oskamp, 1986; DeLeon & Fuqua, 1995), donations to charity (Burger & Cornelius, 2003), cooperation (by others) in a commons dilemma (Mosler, 1993), or installation of home water disinfection units (Kraemer & Mosler, 2012). This experimental data supports the TPB assumption that intention (especially when stated publicly) can predict actual behaviour. However, the act of public commitment to a behaviour or opinion (i.e., stating an intention), can also lead to a change in *attitudes* about that behaviour or opinion.

In one study (Cialdini, 1971) experimenters asked participants' to imply to others that they supported one side of an issue or another (by saying "good" when the others provided opinions that agreed with the participants' assigned positions). Subsequently, participants' private attitudes toward the issue became more supportive of the side of the issue they were made to publicly commit to. Similarly, after people publicly state their opinion on an issue they become less susceptible to persuasion regarding that issue (Gopinath & Nyer, 2009) and their opinions become more extreme (Jellison & Mills, 1969).

Public commitment to engage in a behaviour invokes several cognitive processes that both change attitudes and increase the likelihood of behaviour. When an individual states a public commitment, they experience a sense of reduced freedom (Pallak & Sullivan, 1979; Sullivan & Pallak, 1976) and engage in self-perception to gain insight into their own attitudes (Cialdini, 1971). This increased salience of one's attitudes provides an anchor for later communication and appeals to action (Holt, 1970). If this process of self-reflection brings to light cognitive elements that are inconsistent with the individuals' privately held opinions, then they will experience cognitive dissonance and possibly change their attitudes to become more extreme (Cohen et al., 1959). The process works by strengthening individuals' confidence in their attitudes (Pauling & Land, 1969).

Abelson (1986) makes the case that the act of publicly committing to an opinion (like elaborating an argument or suffering for a cause) solidifies beliefs as possessions that are "owned" by individuals. People find parting with those possessions after making a public commitment more difficult than before, which may explain why complicated 'cognitive acrobatics' are used to change attitudes instead of simply giving up them up.

Alternatively, commitment effects may be a result of impression management and the desire to appear consistent (although some have argued against this explanation; e.g., Joule & Azdia, 2003). Finally, public commitment may work because individuals enter a mental state of “defense motivation” in which they selectively process cognitive information that is *inconsistent* with their attitudes (Eagly & Chaiken, 1995). Whatever the reason, individuals appear to frequently change their attitudes *after* publicly committing to a position or behaviour (i.e., a reverse-causal or reciprocal relation).

Confirmation bias. The confirmation bias is an effect whereby people pay more attention to information that confirms their expectations than disconfirms it. This effect has been studied extensively in the fields of law and order in which researchers found that evidence confirming an initial suspicion is more often attended to and retained than disconfirming information (e.g., Eerland & Rassin, 2012; O’Brien, 2009; Palmer, Brewer, & Weber, 2012; Rassin, Eerland, & Kuijpers, 2010). Studies in which participants read other types of information have also demonstrated that individuals tend to pay more attention to confirmatory information (e.g., Davidsson & Wahlund, 1992; Knobloch-Westerwick & Meng, 2009).

This “unwillingness to change” may be associated with a variety of behavioural consequences. For example, individuals looking for a new home tend to ignore disconfirming information and, therefore, avoid changing their search criteria (Eckman & Kreuter, 2011), and psychiatrists often stick to initial diagnoses by paying less attention to disconfirming information than confirmatory information (Mendel et al., 2011). A meta-analysis conducted in 2009 showed that, across 66 studies, people have a moderate preference for information that confirms their opinions (Hart et al., 2009). Thus,

confirmation bias is one possible mechanism by which attitudes fall in line with a decision that is made (i.e., it could explain why intentions cause attitudes to change). Individuals selectively attend to information that supports the decision, and this facilitates attitude change. Attitudes toward the behaviour, opinion, statement or decision become stronger following a decision to support it.

Confirmation bias has been empirically demonstrated through experimentation. For example, when individuals are primed with “action” or “activity” words, they tend to look for information that supports action, whereas when they are shown “inaction” or “inactivity” words, they look less for information that supports action (Hart & Albarracin, 2012). Similarly, when individuals are asked to read a police case file (in a lab setting) and then follow-up by ordering additional investigations, they are likely to order investigations that confirm, rather than disconfirm their initial ideas about the suspect (Rassin et al., 2010). Unfortunately, this means that an initial suspicion of guilt may lead to ordering further guilt-confirming (incriminating) police investigations rather than guilt-disconfirming (exonerating) investigations that may be more useful and appropriate.

Cognitive dissonance may help to explain confirmation bias. In one of the earliest confirmation bias studies, car owners were shown ads for cars they already purchased and cars which they considered, but did not purchase (Ehrlich, Guttman, Schönbach, & Mills, 1957). New car owners, who were likely still going through the process of cognitive dissonance and strengthening their attitudes after buying their particular vehicle, spent more time reading about their own car than about non-purchased cars. Ehrlich and colleagues considered this to be evidence that individuals “seek out consonant or supporting information after an important decision in an attempt to reduce dissonance”

(Ehrlich et al., 1957, p. 102). Interestingly, however, new car owners in the study generally read more information about *all cars* than people whose cars were not newly purchased. This finding has since been replicated in other studies as well (Adams, 1961; Maccoby, Maccoby, Romney, & Adams, 1961). When experiencing cognitive dissonance, individuals apparently find it useful to seek out information about all options. Possibly, this is a natural part of working through cognitive dissonance and re-aligning attitudes.

In some cases, confirmation bias and cognitive dissonance may also result in undesired outcomes. This can happen if attitudes are re-aligned in the wrong way – by changing how incoming new information is perceived rather than re-adjusting old attitudes. Confirmation bias (preferentially attending to consonant information) may facilitate this process. When individuals ignore dissonant information, they can avoid integrating the information and changing their attitudes. When instituting a new law, for example, cognitive dissonance can lead to acceptance of the law or rejection of it. If individuals engage in the prescribed behaviour, they experience cognitive dissonance and, subsequently, come to like the law – as occurred in Stockholm when road tolls were introduced (Brundell-Freij & Jonsson, 2009). However, if a confirmation bias is too strong, then dissonant information may not be attended to and attitudes may not change. This may explain negative perceptions and non-acceptance of the VAT (a tax) in the UK, when it was first introduced. When people believed that prices of everyday products would increase substantially, they held on to those beliefs (and thought prices *did* increase) even in the presence of disconfirming information (Christandl, Fetchenhauer, & Hoelzl, 2011).

Several factors have been identified that make confirmation bias more or less likely. When people are motivated to accomplish a goal or determine “correctness-as-such” (perhaps using a decision rule), they are less likely to use a confirmation bias to justify or strengthen their existing opinions (Davidsson & Wahlund, 1992; Hart et al., 2009). Attitude certainty is also important; if people are already confident about their attitudes then they are likely to subsequently strengthen those attitudes by searching for new information using a confirmation bias (Knobloch-Westerwick & Meng, 2009). Similarly, when individuals are confident and familiar with a particular topic, they are more likely to be confident in their answers to questions on that topic, regardless of how right or wrong they are (Koriat, 2008). Confidence and attitude certainty, therefore, feed into the confirmation bias which, in turn, changes attitudes to become more extreme – a sort of feedback loop with reciprocal reinforcement.

Individual differences among people can also play a role in determining whether a confirmation bias will be employed when seeking new information. Some people tend to use a confirmation bias more often than others (e.g., Rassin, 2008) and, therefore, screening for these individuals in important judgment situations might be useful. When relying on eyewitnesses to identify a suspect in a crime, for example, police should consider beginning the identification process by showing the witness a “blank” lineup (without any suspects) and then the real lineup with (one or more actual suspects). Based on their pattern of identification in the blank lineup and the true lineup, police can determine if witnesses are likely to rely on a bias (confirmation or commitment) when making their decision (Palmer et al., 2012). This tendency for some individuals to rely

more heavily on a confirmation bias than others may be partly explained by genetics (Doll, Hutchison, & Frank, 2011).

A few researchers have criticised research on the confirmation bias. At least one study has found that human judgment is more complex than initially reported and, contrary to what some have concluded, clinging to an initial hypothesis may not necessarily be an indicator of a confirmation bias (Koslowski & Maqueda, 1993). Another critique is that, from a statistical perspective, a confirmation bias may be a logical and effective method for predicting future outcomes (Austerweil & Griffiths, 2011). That is, if people calculate the probability of a future event based on what they currently know (their own opinions), then they will ultimately make better predictions about the future.

In general, people naturally use a Bayesian approach to assess everyday probabilities and this approach appears to include the use of a confirmation bias. Therefore, a confirmation bias may be a logical and rational approach for collecting data rather than a bias resulting from some internal process such as cognitive dissonance (Austerweil & Griffiths, 2011). For a complete explanation, please see Austerweil and Griffiths (2011). Whatever the mechanism, confirmation bias does appear to affect attitudes following a decision to commit to those attitudes; thus suggesting a reciprocal relation between attitudes and decision-making.

Implemental mindset. Setting an intention changes people's mindsets, and this involves altering their attitudes and perceptions of behavioural control. Research on motivation, setting goals and taking action to achieve those goals demonstrates that, once a decision is made to act, people's thinking changes. Their attitudes toward the action

become more positive and they believe that completing the behaviour (reaching the goal) is easier than it was before. This supports a reverse-causal explanation that intentions affect attitudes and perceived behavioural control.

According to Heckhausen and Gollwitzer (1987), the rubicon model of action has four phases: predecisional, postdecisional, actional, and postactional. In order to carry out any action, individuals must go through each phase in sequence. Importantly, as people pass from stage to stage their mindset changes in order to meet the challenges of that stage. As Gollwitzer and colleagues (1990) put it, changes occur in “thought production, encoding and retrieval of information, and the inferences drawn on the basis of this information” (p. 1119).

A large number of studies have focused on the changes in thinking that accompany a move from predecisional to postdecisional (post-intention-setting) mindsets. In the predecisional phase, individuals have a *deliberative* mindset in which they are realistic about their various options, and they carefully consider the probability and value of each outcome (weighing the pros and cons). In the postdecisional phase (after making a decision but before initiating action), individuals change to an *implemental* mindset in which they focus on *when*, *where*, and *how* to implement the chosen action. During this phase, thoughts about the action’s expected value are distracting rather than useful, because they do not address implementation issues such as the timing or sequence of goal-oriented activities.

Many studies demonstrate that, after a decision is made and an intention is set, people’s thinking changes from deliberative to implemental. Typically, studies of this type involve inducing a deliberative or implemental mindset (e.g., by asking participants

to focus on a personal problem that involves a potential “change decision,” or on a goal they plan to achieve in the near future; alternatively, they might be asked to make a decision about an upcoming task, or just to do the task). Then participants are “interrupted” and asked to do an ostensibly unrelated task, such as completing a story by adding three sentences to a paragraph or recalling different types of information.

People induced to have an implemental mindset tend to display a confirmation bias. They become more “closed minded” (Fujita, Gollwitzer, & Oettingen, 2007) and attend more easily to information that supports the action than refutes it. They also develop more positive illusions about themselves, they feel better, and they look for self-affirming information that supports these (often unrealistically positive) thoughts (Bayer & Gollwitzer, 2005; S. E. Taylor & Gollwitzer, 1995). This is because, in order to move from the postdecisional to actional phase, focusing attention on information that is relevant to goal achievement is helpful (Beckmann & Gollwitzer, 1987). Therefore, their attitudes toward the behaviour become more positive and they perceive more control over the behaviour.

Once an intention is set and an implemental mindset is induced, the goal or purpose of the action begins to appear more desirable. That is, attitudes toward the behaviour change to become more positive *after* an intention is set and before action is taken. For example, mothers who had implemental mindsets regarding care giving decisions (knew what to do and simply needed to execute their plans) enjoyed parenting more than those who were in deliberative mindsets (Browder, 2002). German citizens who intended to enrol in further education perceived it more positively even before taking action and actually enrolling (Brandstätter, Heimbeck, Malzacher, & Frese,

2003).¹¹ In general, attention, in an implemental mindset, is focused *away from negative thoughts* about the desirability and attainability the goal (e.g., Gollwitzer et al., 1990; Heckhausen & Gollwitzer, 1987; S. E. Taylor & Gollwitzer, 1995).

Research on implemental mindset also suggests that once an intention has been set, the goal appears easier and more likely to be achieved, analogous to an increase in perceived behavioural control (e.g., Puca, 2004). When participants in a study were asked to (ostensibly) control the onset of a light by pressing (or not pressing) a button, those in an implemental mindset believed they had considerable control over the light when, in fact, the onset was completely unrelated to their actions (Gollwitzer & Kinney, 1989).

Similarly, individuals in an implemental mindset also develop illusions of invulnerability to both controllable and uncontrollable risks and are overly optimistic about the future of their relationships (Gagné & Lydon, 2001a; S. E. Taylor & Gollwitzer, 1995). When an implemental mindset is induced it influences people to think that they are better at games of skill – even when they may already have experience with those games and performed poorly (Armor & Taylor, 2003; Puca, 2001). Unrealistic optimism and positive expectations are useful during the postdecisional action phase partly because the expectation of success facilitates persistence in the face of obstacles (Carver & Scheier, 1982; Scheier & Carver, 1988).¹² These are examples of increases in perceived behavioural control.

¹¹ Contrary to the authors' conclusions, intentions may not have caused attitudes to change in this particular study. Both intentions and attitudes were measured simultaneously, therefore one cannot rule out that attitudes may have caused intentions to change (desirability of further education causing an intention to enrol in further education).

¹² Persistence in the face of obstacles is only facilitated by unrealistic optimism if the goal appears either feasible but not desirable or desirable but not feasible. If it is neither feasible nor desirable, even an implemental mindset will not help, and if it is both feasible and desirable an implemental mindset is not necessary (Brandstätter & Frank, 2002)

Mindset can also affect how we perceive others. When it comes to romantic relationships, holding an implemental or deliberative mindset may affect perception of partners and success of relationships. With an emphasis on “how to make it work,” implemental thinking is more likely to result in maintaining a relationship through a difficult transition period; deliberative thinkers only stay together if the relationship is already on a “successful trajectory” (Gagné, Lydon, & Bartz, 2003). Deliberative and implemental mindsets also differentially influence how positively romantic partners are perceived – a deliberative mindset is better when focusing on relationship goals, and an implemental mindset is better when focusing on non-relationship goals (Gagné & Lydon, 2001a; Gagné & Lydon, 2001b). Thus, holding an implemental mindset (i.e., setting an intention) can sometimes be associated with more positive attitudes toward significant others.

Conversely, competitors are seen as less threatening (worse performers) when individuals are in implemental mindsets (and, therefore, experiencing unrealistic optimism) than when in deliberative mindsets (Puca & Slavova, 2007). This suggests that individuals who have chosen to engage in an action (set an intention to act) might change the way they perceive others – thus potentially affecting their perception of norms regarding the behaviour. This is further demonstrated by the false consensus effect.

Research on implemental mindset supports a reverse-causal hypothesis in which intentions affect attitudes, perceived behavioural control and, to a lesser extent, subjective norms. However, research on implemental mindset rarely intersects with TPB research and this dissertation will be among the first to examine this link.

False consensus effect. People tend to overestimate the degree to which others agree with them; this is the premise of the false consensus effect (FCE). When individuals decide to do behaviours or state opinions, they are more likely to believe that others would also do the behaviours or take the same opinions. Often, researchers assume that FCE causes a change in intention or behaviour, but the direction of influence has not been clearly established. To the best of my knowledge, no study has attempted to manipulate FCE in order to observe changes in intention or behaviour (or manipulated intention or behaviour in order to observe changes in FCE). In fact, several studies (described below) suggest that perhaps FCE *follows* behavioural intention or actual behaviour.

The first study of FCE was conducted by Ross, Greene, and House (1977) and it involved four experiments. In the first two experiments, participants were asked to answer questions and estimate the percentage of others who would answer the same way that they did (i.e., shared the same opinions as the participants; Botvin, Botvin, Baker, Dusenbury, & Goldberg, 1992). In the third and fourth experiments, participants were asked whether they would wear an embarrassing sandwich board while walking around campus for 30 minutes (famously, in Study 4, the sandwich board read “Repent!”). In all four studies, participants tended to believe that others would answer questions the same way as they would and behave the same way they did, regardless of which answer they chose or how they behaved.

Notably, participants in Study 3 and Study 4 were asked to “state their intentions” to wear the sign and, without actually wearing it or not (i.e., *doing or not doing* the behaviour), they believed that others would make the same decision as they would. This

suggests that intentions may affect or be affected by the FCE (i.e., subjective norms) without the influence of *actual behaviour*. However, the direction of causality cannot be determined because FCE and behavioural intention were measured at the same time. If participants' intentions or sense of FCE were systematically manipulated, then one could determine which might cause the other.

Since the publication of the original FCE study by Ross et al. (1977), many other examples of FCE have been discovered. In Australia, a survey of 974 elite athletes revealed that those who have a history of illicit drug use overestimate the prevalence of drug use among athletes in general (M. Dunn, Thomas, Swift, & Burns, 2012). A Californian study similarly found that people usually believe that others like the same celebrities that they like (Bui, 2012), and a study of online groups found that most group members show a high correlation between personal and perceived opinions regarding federal laws and policies (Wojcieszak & Price, 2009). In a survey of female college students at one American university, more sexually experienced respondents also tended to provide higher estimates of peer sexual activity (Whitley, 1998). And in the field of environmental psychology, researchers have found that the participants who greedily harvest the most resources in a simulated commons dilemma believe that others are also greedy (Gifford & Hine, 1997), and those who fail to abide by a "shower ban" overestimate the number of others who also did (Monin & Norton, 2003).

A meta-analysis of 115 hypothesis tests conducted in 1985 (Mullen et al., 1985), confirms that the FCE is a common occurrence that has a moderate effect on estimates of others' behaviours or opinions. Estimations of similarity are "overestimations" that go beyond what would be naturally observed and what was estimated by individuals making

alternative decisions (or holding different opinions). However, in all of these examples, participants were asked about their perceptions of subjective norms and intentions (or behaviours) without manipulating one or the other in order to determine a causal sequence. Thus, on the basis of this research one cannot conclude that FCE is a cause or effect of behavioural intentions (although this does not prevent researchers from speculating).

Several factors have been proposed as influencers of the likelihood that individuals will display a false consensus effect when estimating the prevalence of a behaviour or opinion. In their original study, Ross, Greene and House (1977) suggest that motivation, selective exposure, availability, or ambiguity resolution may help explain the FCE. People may be motivated to see their own attitude or behavior as being in the majority for the purposes of fitting in or reinforcing their own beliefs. They may also perceive themselves as similar to others because they selectively expose themselves to others who are, indeed, similar. An “availability heuristic” may be operating, in which individuals more easily recall others who support their views as compared with alternative views. And when people have to resolve ambiguities about the nature or magnitude of situational influences, it affects their own choices and estimation of the frequencies of others’ choices.

Evidence from the FCE meta-analysis does not support the self-presentational or motivational explanations (Mullen et al., 1985). However, a study in which individuals received positive or negative feedback about a task (no threat to self-esteem versus threat) showed that an availability heuristic may explain FCE under low threat conditions, but motivational factors (to justify their decision as “normal” and reasonable) may explain FCE under high threat conditions (Sherman, Presson, & Chassin, 1984).

However, the college sexuality study determined that “selective exposure” was the most likely explanation for FCE, and neither motivational nor availability factors explained the results effectively (Whitley, 1998). A further study on the FCE and smoking found that selective exposure and motivational factors were possible drivers of the effect (Sherman, Presson, Chassin, Corty, & Olshavsky, 1983). Thus, under different conditions and for different behaviours or opinions, the selective exposure, motivation or availability factors may help explain the occurrence of the FCE.

Several other factors influencing the likelihood of a FCE have also been identified. FCE is stronger when people are asked to estimate the prevalence of a behaviour or opinion within their social groups than among “outsiders.” The FCE is more pronounced when people talk about their in-group than an out-group (Jones, 2004; Mullen & Hu, 1988). The FCE is also more likely to occur when people attribute their behaviour or decisions to external or situational factors than to themselves (Gilovich, Jennings, & Jennings, 1983; Zuckerman & Mann, 1979) – which occurs commonly (part of the fundamental attribution error). FCE also occurs more frequently when people are asked about alternatives they “like more” rather than “dislike less” (Gershoff, Mukherjee, & Mukhopadhyay, 2008), and when individuals are highly involved in the group they belong to or hold extreme opinions within that group. One interesting study of online groups found that neo-nazis and extreme environmentalists did not generally show more FCE than people who did not belong to these groups (i.e., they overestimated public support for their opinions just like everyone else did) but, for neo-nazis, more involvement was associated with more FCE and, for environmentalists, more extreme opinions were associated with more FCE (Wojcieszak, 2008). Usually, people who hold a

minority opinion within a group are those that overestimate the prevalence of that opinion (Mullen & Hu, 1988).

The false consensus effect describes a phenomenon in which people who make decisions to act believe that others would also make the same decisions. A logical assumption, therefore, might be that if people were influenced to make a different decision then the perception of others' behaviours would change to follow suit. However, a study of this type has not yet been conducted. Nevertheless, several studies do link FCE to actual behaviour (and, by implication, intention as well). Studies of smoking and drug use, for example, reveal that FCE is correlated with increased use of these addictive substances (Bauman & Geher, 2002; Botvin et al., 1992), and behaviour in a one-shot prisoner's dilemma is associated with the FCE (Watanabe & Yamagishi, 1997). One of these studies found that smoking FCE in seventh grade was associated with increased smoking in ninth grade (Botvin et al., 1992).

In a study of the theory of reasoned action, researchers found that "subjective norms" were heavily characterized by the FCE and that these flawed conceptions (along with attitudes) predicted intentions to engage in a variety of sexual or drug-related activities (Bauman & Geher, 2002). The researchers concluded that people based their intentions on false beliefs about social norms. Yet, in this study, intentions, subjective norms/FCE, and attitudes were, again, all measured simultaneously. In a second experiment, the researchers *did* manage to eliminate the false consensus effect by exposing participants to alternative viewpoints, but this manipulation was not followed up with testing for an effect on behavioural intentions. Without this link, or at least measurement of the components at different time points, the researchers could not

conclude that FCE and attitudes influenced intentions rather than intentions influencing FCE and attitudes.

Another research team also argues that FCE influences pro-environmental intentions (Hovardas & Korfiatis, 2012). After completing an environmental education course, students reported that intentions to donate to an environmental organization increased along with accuracy of estimation of others' behaviour (less overestimation *and* less underestimation). Environmental attitudes remained high from the beginning to the end of the course and did not change. Hence, they found that intention to donate was not associated with more positive attitudes, but was associated with *accuracy* of estimation of others' intentions. As accuracy increased (FCE and underestimation reduced), intention to donate increased. However, in spite of the researchers' conclusions, this does not necessarily mean that FCE (or subjective norms) influenced intentions. It simply means that FCE (along with *underestimation*) are related to intentions. Correlation is not equivalent to causation.

A few critiques of research on the FCE have been brought forward. First, the FCE does not always occur. In studies of certain behaviours, such as child aggressiveness and college student drinking habits, all individuals within those groups overestimated the degree to which the behaviours were accepted; regardless of whether they, personally, engaged in the behaviours or not (Henry, Dymnicki, Schoeny, Meyer, & Martin, 2013; Pollard, Freeman, Ziegler, Hersman, & Goss, 2000). Second, like the confirmation bias, predicting the opinions or behaviour of others using the FCE may statistically increase accuracy of estimation and, therefore, may be a rational approach to estimation rather than a result of the misguided belief that "others are like us" (Dawes & Mulford, 1996).

Dawes and Mulford (1996) suggest that because humans naturally use a Bayesian approach to predicting the behaviour of others, they (appropriately) rely on the only information they have (their own opinions) to make predictions. People base future predictions on past outcomes and update predictions as more info becomes available. They do not use base rates to make predictions because these are generally unknown for most behaviours. To explain their point they ask the reader to re-imagine the original Ross et al. study (1977) in which participants agreed to wear a sign saying “Repent!” and subsequently overestimated the number of others who also agreed. Theoretically, if participants did not make a decision to wear the sign themselves (or have access to their own opinions on the subject), but instead knew the decision of one *other* person, then a Bayesian solution would produce the same result as found in the study (estimation based on what is known about one person’s intentions).

Indeed, in the Ross et al. study (1977) the percentage of individuals who overestimated the intentions of others was almost identical to what would be expected from a Bayesian distribution with those prior probabilities. Furthermore, Dawes and Mulford (1996) found, in their own study of the FCE, that participants’ beliefs about the similarity of others’ responses was positively, not negatively, related to accuracy of estimation. That is, in a personality questionnaire with 130 items, participants’ *accuracy* in predicting the responses of others *increased* along with participants’ beliefs that others answered the same way that they did. Hence, they argue that FCE is a result of logical thinking rather than a self-serving bias that “everyone is like us.”

In sum, people’s behaviours are generally accompanied by ideas that others would act the same way. Whether this is because of logical thinking or a false belief in the

consensus of others is unknown. However, this effect could potentially demonstrate that subjective norms change as a result of setting behavioural intentions; once an intention is set, people begin to believe that others would also set the same intention. Thus far, however, most researchers who discuss the subject postulate that the causal link works in the opposite direction; that intentions are set because of a false belief about others. Nevertheless, experimental research in which intentions or FCE are systematically manipulated to determine if one causes the other has not been conducted.

Intentions influence attitudes, subjective norms and perceived behavioural control. Based on the research discussed above, Int may influence Att, SN and PBC. Attitudes toward a behaviour may change as a result of intentions to engage in the behaviour. Evidence from the study of cognitive dissonance suggests that the mere act of setting a behavioural intention can change the desirability of the behaviour. For example, when people pick a horse to win in a simulated race, their preference for the horse increases after deciding on which horse to place a bet; even before actual betting occurs (Brownstein et al., 2004). According to dissonance theory, this is because choosing between similarly valued options means rejecting an option that might be better than the one that was accepted. This causes psychological discomfort which triggers a motivation to re-align attitudes so they match the decision. Consequently, the chosen option becomes more valued and the rejected option becomes less valued. If the two options were two different behaviours, then setting an intention to do one of the two behaviours (e.g., betting on one horse rather than another) would result in more positive attitudes about the chosen behaviour in relation to the rejected option.

Research on public commitment and the confirmation bias demonstrate a similar effect. Once a public commitment is declared, individuals tend to selectively attend to information that confirms the declared opinion or behaviour, and attitudes about the opinion or behaviour thereby become more extreme and supportive of it. This occurs in a reciprocal manner; the confidence and strength of previously held attitudes also contribute to the likelihood that a confirmation bias will occur and further strengthen the attitudes.

Mindset research also shows that attitudes toward a behaviour can change as a result of setting a behavioural intention. In the rubicon model of behavioural action phases, when people move from predecisional to postdecisional action phases, they focus less on the negative aspects of the behaviour and begin to see the goal as more desirable. The implemental mindset that accompanies the postdecisional phase is defined by closed-mindedness and a singular focus on how to enact the behaviour. Hence, confirmation bias may also be considered part of the implemental mindset (and a reason for changes in attitudes). By changing attitudes toward the behaviour to be more positive, individuals become more motivated to initiate action and enter the next phase in the rubicon (the actional phase).

Subjective norms may be affected by behavioural intentions, but this link has not yet been conclusively established. The false consensus effect (the belief that others are likely to behave and think the same way we do), is associated with behavioural intentions. Research shows that once a behavioural intention is set, individuals are likely to believe that others would also set the same intention. However, no study has attempted to manipulate participants' intentions in order to determine if false consensus emerges as

a result. Therefore, the causal direction between subjective norms and intentions is, at this point, speculative.

Finally, perceived behavioural control may be influenced by intentions. Once an intention is set to engage in a particular behaviour, people become unrealistically optimistic about the behaviour and believe it is easier to accomplish. Mindset research shows that people in implemental mindsets (after intention but before action), develop illusions of control over (even uncontrollable) aspects of behaviour. This may occur because optimism increases the likelihood of persistence. Indeed, individuals in implemental mindsets are also more likely to accomplish goals than those in deliberative (predecisional) mindsets.

Together, research on cognitive dissonance and implemental mindsets strongly support the notion that attitudes and perceived behavioural control can be influenced by setting a behavioural intention. These studies employ randomized controlled designs and, therefore, suggest possible causal links from intentions to attitudes or perceived behavioural control. Research regarding confirmation bias and public commitment may be less conclusive, but nonetheless suggests that intentions *possibly* precede attitudes. The false consensus effect provides evidence for *how* subjective norms may be influenced by behavioural intentions (i.e., they may fall in line with each other), but research on the false consensus effect neither supports the notion that intentions cause subjective norms to change nor vice versa. A randomized, controlled experiment should be carried out to establish the causal link between intentions and subjective norms.

Feedback loops and active participation in the theory of reasoned action. In their original description of the TRA, Fishbein and Ajzen (1975) touch on the notion that

unacknowledged “feedback loops” may exist within their theory. They state that their description of the theory “omits feedback loops at various stages of the process,” and explicitly acknowledge that “performance of a particular behavior may lead to new beliefs about the object, which may in turn influence the attitude” (p. 15). Hence, they admit that behaviour may cause a change to attitudes and subjective norms (via changes in underlying beliefs), but they do not explicitly discuss the possibility that intentions may also change attitudes or subjective norms, and discussion of “feedback loops” ended entirely after the publication of *Belief, Attitude, Intention and Behavior* in 1975.

Feedback loops have not been discussed by Ajzen as part of the TPB (Ajzen, 1991).

Fishbein and Ajzen (1975) also discuss how cognitive dissonance and free choice may be integrated into the TRA. These methods for changing attitudes, along with role-playing, counter-attitudinal behaviour and interracial contact, are described by Fishbein and Ajzen as “strategies of change” using “active participation.” Studies regarding each of these effects show that actively engaging in some sort of behaviour subsequently leads to attitude change. For interracial contact studies, prejudiced individuals are thought to have more favourable attitudes toward other races after (than before) they meet people of those races.¹³

Similarly, changes in Att can also follow role playing. When people are made to use a wheelchair to complete a task, for example, they subsequently display more positive attitudes toward the wheelchair-bound experimenter (Clore & Jeffery, 1972). After people engage in cognitive dissonance-inducing tasks such as counter-attitudinal or “choice” behavior, they also change their attitudes. Asking participants to voluntarily

¹³ This is a hypothesized effect. Only one study apparently investigated the effect (Cook, 1970) and results were inconclusive.

debate an issue from the opposite position than their personal opinions, or asking participants to voluntarily choose between two similarly rated items can result in a more favourable attitude toward the position (especially if they are told they “won” the debate) or toward the chosen item (e.g., Gerard & White, 1983; Scott, 1957; Scott, 1959).

Fishbein and Ajzen (1975) explain the effects of “active participation” strategies by claiming that active participation leads to changes in beliefs which, in turn, lead to changes in Att or SN (or PBC, as Ajzen would probably suggest in the TPB). Active participation strategies encourage people to look through their belief systems to find arguments supporting the positions they have been assigned; consequently changing Att and SN (and probably PBC) beliefs. In addition, the cover stories and subtle manipulation strategies used in cognitive dissonance studies may also “attack” certain beliefs separately from engaging in the behaviour. For example, participants in cognitive dissonance studies may also hold the belief “I did the task voluntarily” or “I only did the task because I was paid.”¹⁴ The task itself may change beliefs, but so do the cover story and the context surrounding the behavior.¹⁵

The idea that performing a behaviour (actively participating) can lead to a change in Att or SN (or PBC) fits well with Fishbein and Ajzen’s (1975) original TRA. As shown in Figure 2, this model explicitly acknowledges a feedback loop between behaviour and Att/SN. However, in some cases, merely *stating an intention* to engage in a counter-attitudinal behaviour can lead to changes in Att. When a person agrees to write an essay that opposes his or her personal opinions, for example, his or her attitudes may

¹⁴ These beliefs may be “attacked” subtly (without conscious awareness of the participant) or explicitly.

¹⁵ The contexts of most cognitive dissonance studies may, in themselves, be important factors in belief change. Several scientists believe that the experimental situation may set the stage for belief change because participants agree to place themselves in the situation and rarely feel comfortable declining to participate (Beauvois, Bungert, & Mariette, 1995; Steiner, 1970).

change even before *actually writing* the paper (Brehm & Cohen, 1962; Rabbie, Brehm, & Cohen, 1959). Fishbein and Ajzen understand that this occurs, but fail to recognize that this is *de facto* evidence that intentions may influence Att and SN to change in a reverse-causal sequence: "...the mere fact that a person commits himself to engage in a counterattitudinal behavior should be sufficient to arouse dissonance and hence produce 'attitude' change" (Fishbein & Ajzen, 1975, p. 434). Therefore, I believe the TRA and TPB should be revisited and revised to include a reciprocal relation between the base components of the TPB (Att/SN/PBC) and Int.

Summary

The original TPB model postulates that Att, SN and PBC influence Int which, in turn, influences behaviour. However, evidence from cross-lagged studies and experimental studies to support this notion are relatively weak, particularly in the area of pro-environmental behaviour research where the causal relation between TPB constructs was only investigated statistically in one study (and never experimentally). Furthermore, no studies (in environmental domains or others) have experimentally tested a possible *reverse-causal* relation between these TPB constructs. Considerable evidence from research on cognitive dissonance, public commitment, confirmation bias, implemental mindset, and the false consensus effect suggests that a reverse-causal relation is possible.

Objectives

The primary objective of this dissertation is to investigate a possible reverse-causal relation between intentions and the base components of the theory of planned behaviour. In order to accomplish this objective, three related studies will be conducted. The first will be non-experimental and involve measuring Att, SN, PBC and Int at two time points (followed by behaviour at a third time point) to statistically examine a possible reverse-causal relation (using a cross-lagged panel design). The second will be an in-lab experimental test of a reverse-causal relation between intentions and base components using a free-choice paradigm. And the third will be a field experiment in which intentions are targeted in an attempt to change Att, SN and PBC, along with pro-environmental behaviour.

Rationale

Modifying the theory of planned behaviour to include a reciprocal relation between the base components and intentions could have important consequences for understanding behaviour. By positioning the three base components of the model (Att, SN and PBC) both before and after behavioural intentions, we may be able to better predict changes in behaviour as well as changes in base components. Given the breadth of research relying on the TPB, this addition to the theory could have wide-reaching implications. Encouraging individuals to set behavioural intentions could overturn negative attitudes, perceptions of norms, or perceptions of control that initially discouraged the behaviour. And the Att, SN and PBC of individuals who mildly

supported the behaviour before setting an intention would become more positive afterward.

This research will be the first to address TPB assumptions in a pro-environmental behaviour context. If intentions can influence the three base components, then this would provide additional support for pro-environmental organizations or governments to encourage behavioural intentions directly (rather than via attitude change). For example, governments implementing pro-environmental laws could do so with the confidence of knowing that participating citizens may subsequently be more likely to change their attitudes to be in line with the initiative after they have adopted it. As demonstrated in the cases of bottle-deposit laws, seatbelt laws or curbside recycling, policy changes can eventually lead to changes in attitudes, perceived subjective norms and perceived behavioural control.

Research in this area has not yet investigated potential reverse causality in the intentions-base components relation and has not yet tested an intervention to increase actual pro-environmental behaviour using a TPB model. To my knowledge, it will also be the first series of TPB studies in environmental psychology to measure *directly observed* behaviour rather than using only survey data.

CHAPTER 3

Study 1 – Cross-Lagged Correlation

Objective

The objective of Study 1 was to investigate a potential reverse-causal relation between intentions and base components using a cross-lagged correlational design. This type of design involves measuring the same two variables at two time points and then comparing the relative strengths of the correlations among them. No experimental manipulation was involved.

Method

Participants

Three-hundred and sixty-one undergraduate students from the University of Victoria were recruited to participate in exchange for course credit. Participants who came to part three of the study ($n = 279$) reported their ages, genders, and probable fields of study while in university. Across participants, 25% were male, the average age was 20 years ($SD = 3.67$, $range = 17$ to 51 years), and the most common areas of study were psychology, biopsychology, and biology.

Procedure

Participants were informed that the study would include three parts and that, after the third part, they could *choose* to take action to support a local environmental organization (the Ancient Forest Alliance). Participants were thus aware that, after the

end of the study, they would be provided all the materials they would need to sign a petition, write a letter, donate money, etc (up to seven potential support actions).

At Time 1 (T1), participants ($N = 361$) read the section of the environmental organization's website that described their goals, approach, values and current activities. They then *completed an online TPB questionnaire* about supporting that organization by engaging in one or more of the support actions provided at the end of the study (signing a petition, signing a pre-written letter, reading more information, writing a letter, donating money, purchasing merchandise, or registering for a newsletter). The questionnaire measured (1) the base components of the TPB model (attitudes, subjective norms, and perceived behavioural control) regarding supporting the organization, and (2) intentions to actually take any of the seven support actions at the end of the study. These two elements (base components and intentions) were presented to participants in a random order.

At Time 2 (T2), 11 to 31 days later ($M_{days} = 23.23$, $SD = 2.65$), participants ($n = 310$) completed the same questionnaire again (measuring base components and intentions). At Time 3 (T3), zero to eight days after T2 ($M_{days} = 4.13$, $SD = 2.33$), participants ($n = 280$) came to the lab to complete an unrelated "distracter questionnaire" about place attachment and personality. Along with the distracter questionnaire, participants received a folder with materials for supporting the environmental organization in up to seven ways (described above). Participants were instructed that the reason they were asked to come to the lab was to complete the distracter questionnaire but that, after they finished, they could also choose to use any of the materials in the folder to support the environmental organization described in T1 and T2 of the study.

Fifty-eight percent of participants chose to engage in at least one support action ($n = 162$ of 280).

Questionnaire design

The TPB questionnaire was designed according to steps described by Fishbein and Ajzen (2010). Using a separate sample of participants from the same pool as Study 1 ($n = 20$), the first step was to administer a qualitative questionnaire with nine open-ended questions about attitudes, subjective norms and perceived behavioural control regarding supporting the environmental organization. This questionnaire is available in Appendix 1. The four members of the research team independently examined answers to these questions for common themes. I then assembled these themes to create Draft 1 of the quantitative questionnaire used to measure Att, SN and PBC for supporting the environmental organization.

Draft 1 of the quantitative questionnaire contained 25 question stems (e.g., Supporting the Ancient Forest Alliance makes me feel...), each with one to nine semantic differential leaves (e.g., “good-bad,” “favourable-unfavourable,” “satisfied-unsatisfied”). This version was distributed among other environmental psychology researchers at the University of Victoria as well as friends and family of the research team ($N \approx 7$). The comments and answers provided by this group were used to fine-tune each question, and improve the questionnaire’s overall legibility to create Draft 2 of the questionnaire.

Draft 2 of the TPB questionnaire included questions about each of the TPB base components, as well as questions about participants’ intentions to actually support the

organization using each of the suggested actions.¹⁶ In total, 31 question stems were created, each with one to nine semantic differential leaves (participants provided a total of 72 answers). As suggested by Fishbein and Ajzen (2010), each semantic differential item was rated on a seven point scale (e.g., “Protecting old growth forests is... Important [1] [2] [3] [4] [5] [6] [7] Unimportant”). This questionnaire can be seen in Appendix 2.

Draft 2 of the questionnaire was administered to an independent sample of participants ($n = 26$) drawn from the same pool as Study 1. Participants’ answers indicated a ceiling effect for many items. All items had means above five (out of seven), with the exception of three SN items and four PBC items. Furthermore, the mode for all but three Att items was six or seven (out of seven) and only eight items showed “complete” variability (i.e., from one to seven). Participants’ (hypothetical) intentions also showed little variability – if asked, all participants indicated they would absolutely read more information, sign a petition or register for a newsletter ($M = 7$ out of 7, $SD = 0$), but would *not* become a member of the organization ($M = 1$ out of 7, $SD = 0$).

Despite the lack of variability in answers, the pilot study of Draft 2 of the questionnaire did provide some guidance for the creation of the final questionnaire. Given that reliability of the Att and SN measures were high (Att $\alpha = .96$ with 62 items; SN $\alpha = .92$ with 12 items) and that most items had corrected inter-item correlations above .4, an exploratory factor analysis of each sub-factor was employed to help choose which items to keep for the final questionnaire. The factor analysis of Att items revealed three primary categories of Attitudes: (1) general attitudes toward the Ancient Forest Alliance and specifically about preserving old growth forests, (2) instrumental attitudes toward

¹⁶ In the first and second drafts of the questionnaire, only six behaviour options were provided. “Write a letter” was added as a seventh option in Draft 3.

protecting forestry jobs and, (3) affective attitudes toward protecting forestry jobs. Attitudes toward the Ancient Forest Alliance and preserving forests were generally higher than those toward protecting forestry jobs (despite the organization's stated goal of both protecting forests *and* jobs). Conversely, SN items loaded entirely on one factor. PBC items demonstrated low reliability ($\alpha = .57$ with 8 items), and an exploratory analysis showed that this was because items were distributed among two distinct sub-factors: (1) control and (2) ease. Participants gave high scores to PBC items asking if participants felt "in control" of their decision to support the organization, but lower scores to items asking about the ease or difficulty of the behaviour.

The goal of Draft 2 of the questionnaire was to determine which 10 to 20 items should be included in the final questionnaire, as well as optimizing the delivery of the questionnaire itself. To evaluate each item, theoretical, practical and statistical considerations were weighed against one another. Brevity of the questionnaire was important in the event that it might be used again for Study 2 (in which the same questionnaire would be administered four times, about four different organizations, within one testing session). Coverage of theoretical factors for each sub-component was important to include as well (i.e., instrumental and affective attitudes, injunctive and descriptive norms, control and ease of behaviour). Thus, four to six items with good statistical reliability and distributions were selected for each component of the TPB (Att, SN and PBC).

The questionnaire was further optimized by modifying the scales to mitigate the ceiling effect. This was accomplished by modifying the labels for each item and by changing the style of answer format. Similar to Schwartz' (1992) values survey, the

upper bounds of each item were expanded and lower bounds were reduced. In Schwartz' survey, most people rated values as important (producing little variance), thus each value rating item was modified to range from -1 (*opposed to my principles*), to 0 (*not important*) to 7 (*of supreme importance*). Items in the current TPB questionnaire were similarly modified – response options ranged from 1 “*bad*” to 2 “*somewhat good*” to 7 “*extremely good*” (for example). In addition, rather than using seven-point likert scales, each item was rated along a continuum in which participants could state their agreement anywhere along a line.¹⁷ Points along the continuum were then translated by the computer software into ratings between 0 and 100, with a rating of approximately 20 to 30 being the neutral point (participants did not see these numbers).

One additional finding from the Draft 2 questionnaire provided insight into a common misperception regarding the environmental organization. Based on participants' responses, many did not understand that the Ancient Forest Alliance had the dual goals of both preserving old-growth forests *and* preserving forestry jobs (through lobbying for more sustainable logging practices).¹⁸ However, this information was clearly presented in the information page about the organization that participants were meant to read. Therefore, participants were encouraged to read the description more carefully before moving on to the questionnaire. This was accomplished by adding three short content questions about the goals of the organization. The questions had to be answered correctly before participants could continue to the rest of the questionnaire. The questionnaire itself

¹⁷ Theoretically, I believe the continuum rating scale is a better reflection of participants' actual preferences than traditional likert type scales that require participants to categorize their preferences. This type of question could be used because the questionnaire was created using an online tool called Qualtrics.

¹⁸ Hence, the organization is an “alliance” between both groups.

also contained questions about instrumental and affective attitudes toward both preserving forests *and* preserving jobs.

Intention items were not modified for the final questionnaire, however the option to “become a member” of the Ancient Forest Alliance was dropped. Participants unanimously indicated that they would not do this action, nor was the action different enough from “registering for the newsletter” or “donating money” to warrant its own category. The action “write your own letter” was added to the list of potential actions. The final questionnaire contained 21 TPB questions and three content questions about the mandate of the organization. Demographics questions about age, gender, and probable university major were asked at T3, when participants came to the lab to complete the distracter questionnaires and (optionally) engage in support behaviours.

Results

Excluded Participants

Data entry was conducted by two independent researchers who double-entered 1,107 data points (24% of the data). Only 7 disagreements were found (0.6% error rate), thus data entry was considered accurate. Of the 361 participants who enrolled in the study, 279 completed all three parts (T1, T2 and T3), 31 only completed T1 and T2, 50 only completed T1, and one only completed T1 and T3. Participants who completed T1 and T2 could be included in cross-lagged correlation analyses between base components and intentions. Actual behaviour was assessed at T3, therefore only participants who did that part could be included in the behavioural analyses.

Fourteen additional participants were excluded because they were already involved with the environmental organization, or because they provided answers indicative of not paying attention (i.e., they failed at least two attention items embedded within either questionnaire or they provided extreme answers, above $z = 3.0$, on measures of Att, SN, PBC or INT). Of the excluded participants, nine had completed all three parts of the study, three only completed T1 and T2, and two only completed T1. Therefore, of the participants included in the final analyses, 270 completed all three parts of the study, and an additional 28 only completed T1 and T2. Within the final sample, responses to items were normally distributed with no outliers.

Reliability

The reliability of the Att, SN, PBC, and Int factors were calculated using all possible participants at each time point. Cronbach's alpha was acceptable for each factor at each time point ($\alpha > .7$), therefore six composite variables were created (Time 1 and Time 2 attitudes = ATT_{T1} and ATT_{T2} ; Time 1 and Time 2 subjective norms = SN_{T1} and SN_{T2} ; Time 1 and Time 2 perceived behavioural control = PBC_{T1} and PBC_{T2}). The composite variables were the means of items within the factors and, hence, ranged from 0 (bad) to 100 (good). Details of the reliability of each factor can be seen in

Table 2 below.

Table 2

Reliability of TPB components

Factor	Cronbach's Alpha	N of Items	N	Mean*	SD*
Time 1 ATT	.76	5	361	68.86	15.13
Time 2 ATT	.80	5	309	70.46	15.41
Time 1 SN	.86	4	361	63.19	21.55
Time 2 SN	.86	4	309	64.56	21.32
Time 1 PBC	.72	4	361	70.6	17.43
Time 2 PBC	.71	4	309	70.27	16.04
Time 1 INT	.77	7	361	36.0	17.82
Time 2 INT	.77	7	309	36.56	17.63

*Note: ATT = attitudes; SN = subjective norms; PBC = perceived behavioural control; INT = Intentions; *Mean and SD are calculated without the 14 excluded participants described above.*

Predicting Intentions and Base Components

For each base component (Att, SN, PBC), a cross-lagged correlation analysis was conducted with intentions. However, in order for the cross-lagged correlation to be valid, autocorrelations and synchronous correlations were checked for stability and stationarity. As seen in Table 3, autocorrelations for Att, SN, PBC and Int were all strong and significant. Synchronous correlations were strong and significant for Att, SN, and Int, but not for PBC. In the case of PBC, the relation between PBC and Int was weak, but became

stronger over time. This may indicate the influence of one or more extraneous variables.

Nevertheless, this did not appear to influence the cross-lagged correlations.

Table 3

Cross-lagged correlation analysis

Relation	Autocorrelations	Synchronous Correlations	Forward cross-lagged correlation	Reverse cross-lagged correlation	Cross-lagged difference z-score*
Attitudes and Intentions	ATT _{T1} ATT _{T2} , $r = .72$ INT _{T1} INT _{T2} , $r = .73$	ATT _{T1} INT _{T1} , $r = .46$ ATT _{T2} INT _{T2} , $r = .44$	ATT _{T1} INT _{T2} , $r = .43$	ATT _{T2} INT _{T1} , $r = .43$	0
Subjective Norms and Intentions	SN _{T1} SN _{T2} , $r = .74$ INT _{T1} INT _{T2} , $r = .73$	SN _{T1} INT _{T1} , $r = .46$ SN _{T2} INT _{T2} , $r = .46$	SN _{T1} INT _{T2} , $r = .40$	SN _{T2} INT _{T1} , $r = .44$	-.81
Perceived Behavioural Control and Intentions	PBC _{T1} PBC _{T2} , $r = .61$ INT _{T1} INT _{T2} , $r = .73$	PBC _{T1} INT _{T1} , $r = .05^{\phi}$ PBC _{T2} INT _{T2} , $r = .20$	PBC _{T1} INT _{T2} , $r = .12$	PBC _{T2} INT _{T1} , $r = .11^{\delta}$.16

*Note: ATT = attitudes; SN = subjective norms; PBC = perceived behavioural control; INT = Intentions; T1 = Time 1; T2 = Time 2. *Z-scores were calculated using Kenny's (1975) method; negative values suggest reverse-causality. All correlations were significant at the $p < .001$ level, unless otherwise indicated. $^{\phi} p = .35$ $^{\delta} p = .06$*

As seen in the table above, individual cross-lagged correlations were generally moderately strong and significant (except for PBC-Int). Using Kenny's (1975) method for comparing cross-lagged correlations, the forward-causal relations were not significantly stronger than the reverse-causal relations for any of the variables. The cross-lagged correlations between SN and Int indicated that a reverse-causal sequence was

more likely, but this difference was not significant ($z = -.81$). These findings suggest a reciprocal relation between Att and Int, SN and Int, and PBC and Int, such that each influences the other (within each pair). A graphical version of these relations can be seen in Figure 4 below.

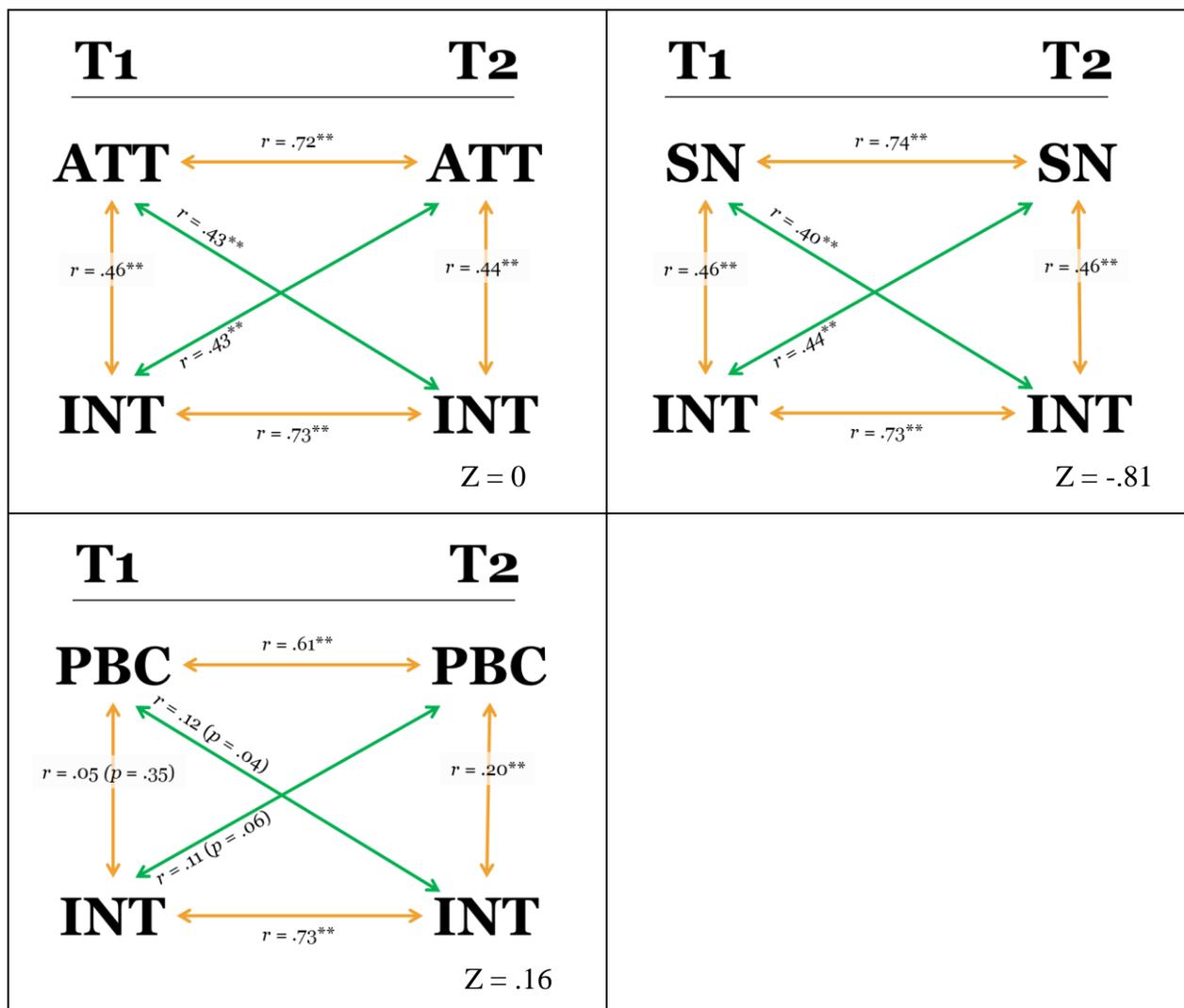


Figure 4. Cross-lagged correlations for ATT (attitudes), SN (subjective norms), PBC (perceived behavioural control) and INT (intentions).

One issue with conducting multiple zero-order correlation analyses is that the shared variance among the predictor variables could drive all of the correlations. In order to determine the unique contribution of T1 base components to T2 intentions, and T1 intentions to T2 base components, a regression was conducted on T2 intentions and T1 intentions.

A regression model was created with INT_{T2} as the target variable, and ATT_{T1} , SN_{T1} and PBC_{T1} as predictors. The model was significant, $R^2 = .21$, $F(3, 293) = 26.39$, $p < .001$, with ATT_{T1} and SN_{T1} both acting as unique predictors of INT_{T2} , ATT_{T1} : $\beta = .30$, $t(293) = 4.50$, $p < .001$; SN_{T1} , $\beta = .23$, $t(293) = 3.35$, $p < .01$. Similarly, in a regression with INT_{T1} as the target variable, and ATT_{T2} , SN_{T2} , and PBC_{T2} as predictors, the model was also significant, $R^2 = .25$, $F(3, 293) = 33.33$, $p < .001$. According to this reverse-causal model, INT_{T1} shared a significant unique association with ATT_{T2} , SN_{T2} and PBC_{T2} , SN_{T2} : $\beta = .33$, $t(293) = 5.29$, $p < .01$, ATT_{T2} : $\beta = .29$, $t(293) = 4.74$, $p < .01$, PBC_{T2} : $\beta = -.13$, $t(293) = -2.25$, $p < .03$. Time 1 attitudes and subjective norms were therefore significantly and positively associated with intentions at Time 2, and Time 1 intentions were significantly associated with Time 2 attitudes, subjective norms and perceived behavioural control (positively with attitudes and subjective norms, negatively with perceived behavioural control). Although not directly comparable (because the two models were not nested), the reverse-causal model appeared to explain slightly more variance than the forward-causal model ($R^2_{Forward} = .21$, $R^2_{Reverse} = .25$).

Armitage and Connor (1999) suggested that the TPB is primarily a “predictive, rather than causal model” because components measured at the same time point correlate with one another, but those measured at Time 1 do not predict those measured at Time 2. In order to test this idea, I ran the same two regressions as above, but controlled for within-time factors at each time point. That is, in the first step of the first regression (forward causal regression, with INT_{T2} as the target variable), I entered the T2 base components (ATT_{T2} , SN_{T2} , PBC_{T2}). In the second step, I added the “forward-causal” variables. The model was significant at Step 1, $R^2 = .27$, $F(3, 296) = 35.21$, $p < .001$, and

Step 2, $R^2 = .29$, $F(6, 290) = 19.42$, $p < .001$, with a significant increase in R^2 from the first model to the second, R^2 change = .02, p change = .03. In the second model, the only T1 base component that predicted T2 intentions was ATT_{T1} , $\beta = .19$, $t(290) = 2.43$, $p = .02$. This suggests that, when controlling for the effect of within-time factors at Time 2, Time 1 attitudes may have influenced INT_{T2} .¹⁹

Similarly, in a reverse-causal regression, INT_{T1} was the target variable, ATT_{T1} , SN_{T1} , and PBC_{T1} were entered in the first step, and ATT_{T2} , SN_{T2} and PBC_{T2} were entered in the second step. Once again, the model was significant at Step 1, $R^2 = .33$, $F(3, 293) = 48.79$, $p < .001$, and Step 2, $R^2 = .35$, $F(6, 290) = 26.29$, $p < .001$, with a significant increase in R^2 from the first model to the second, R^2 change = .02, p change = .04. In the second model, the only T2 base component that was uniquely associated with T1 intentions was SN_{T2} , $\beta = .19$, $t(290) = 2.53$, $p = .02$. This suggests that, when controlling for the effect of within-time factors at Time 1, Time 2 subjective norms may have influenced by T1 intentions.

Taken together, these two regression analyses suggest that attitudes toward supporting an environmental organization influence the intent to actually support the organization, *and* that setting an intention to support the organization subsequently influences the perception of subjective norms about supporting the organization. Thus, both a forward-causal and reverse-causal model of intentions may hold credence, as depicted in Figure 5 below.

¹⁹ This is equivalent to checking cross-lagged correlations while controlling for synchronous correlations.

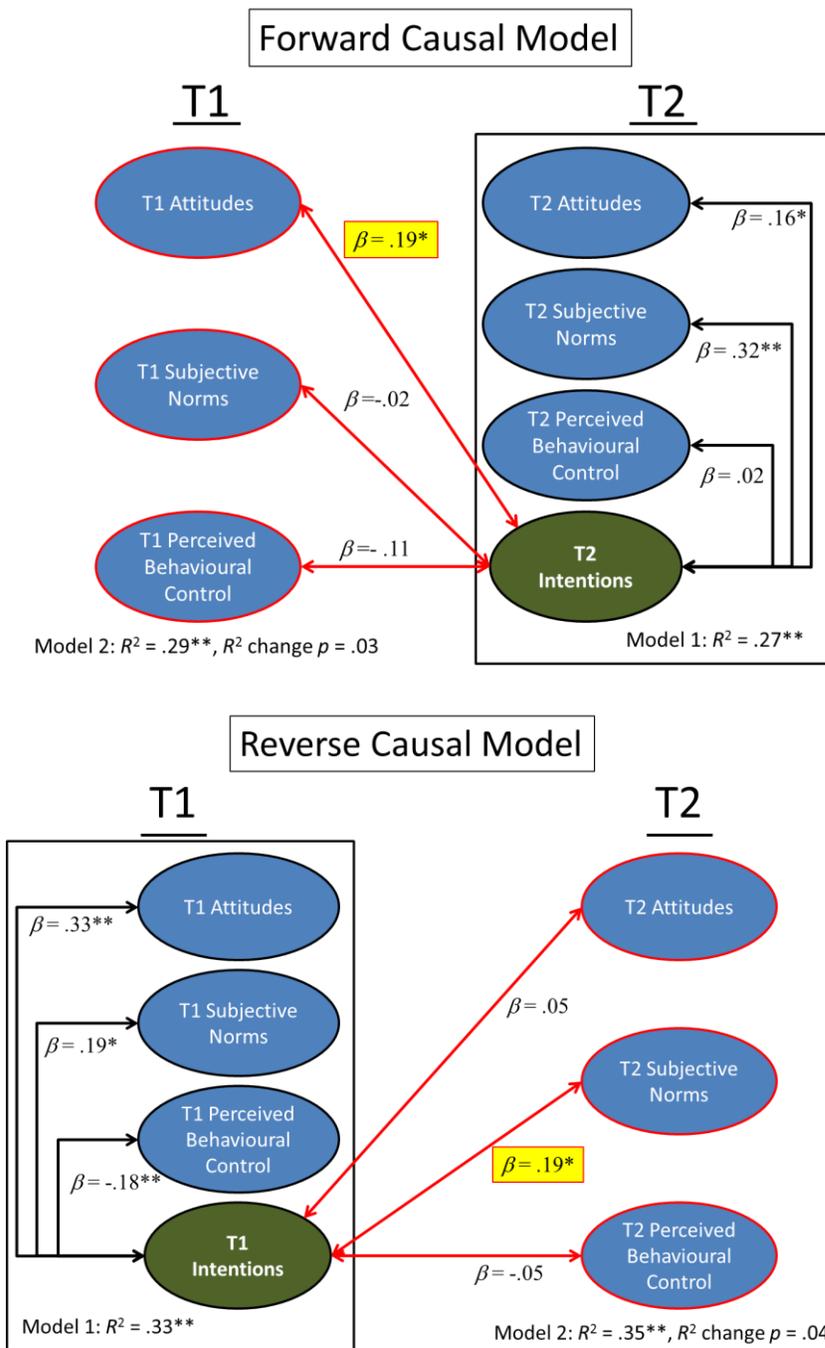


Figure 5. Forward and reverse-causal theory of planned behaviour models. When controlling for within-time variables, Attitudes at Time 1 influence Intentions at Time 2 and Intentions at Time 1 influence subjective norms at Time 2. $*p < .05$, $**p < .01$

Behaviour

Although the primary objective of Study 1 was to determine if intentions could influence attitudes, subjective norms or perceived behavioural control, an interesting additional objective was to determine which of these factors predicted behaviour.

Of the 271 participants who completed the third part of the study (T3) and were included in the analysis, 47% signed the petition, 29% read additional information about the environmental organization, 21% signed a pre-written letter to be sent to the provincial government, 9% donated money ($M_{donation} = \$2.06$, $SD = 2.06$), 4% registered for the newsletter, 3% purchased greeting cards ($M = 1.38$ cards), and none (0%) wrote their own letter to the provincial government. In total, 24% did one action to support the environmental organization, 21% did two behaviours, 9% did three behaviours, 4% did four behaviours, and 2% did five behaviours. Thirty-two percent of participants chose not to engage in any action to support the organization.

A regression model was constructed with *number of support actions* as the dependent variable, and the following predictors: INT_{T2} , INT_{T1} , ATT_{T2} , ATT_{T1} , SN_{T2} , SN_{T1} , PBC_{T2} , and PBC_{T1} . The model was significant, $R^2 = .28$, $F(8, 261) = 12.97$, $p < .001$, and, as suggested by the TPB, the best predictors of behaviour were INT_{T2} , $\beta = .25$, $t(261) = 3.06$, $p < .01$, and INT_{T1} , $\beta = .29$, $t(261) = 3.36$, $p < .01$. Additional significant predictors of behaviour included PBC_{T2} , $\beta = .15$, $t(261) = 2.13$, $p = .03$, and PBC_{T1} , $\beta = .13$, $t(261) = 1.94$, $p = .05$.

Discussion

Using a series of cross-lagged correlations and regressions, Study 1 demonstrated a reciprocal relation between base components of the TPB (Att, SN and PBC) and intentions. The original formulation of the TPB proposed that base components precede and influence intentions but, in the case of supporting environmental organizations, this forward-causal relation was only part of the story; a moderately strong and significant reverse-causal relation was also found. That is, in this study base components influenced intentions, *and* intentions influenced base components (with the possible exception of PBC, discussed later).

Contrary to Armitage and Connor (1999), Study 1 demonstrated that the *reciprocal* TPB model was both “predictive” and somewhat “causal.” When within-time factors were controlled, the cross-time relation between base components and intentions remained significant. In particular, attitudes were most influential in causing intentions to be set, and intentions significantly influenced subsequent perceptions of subjective norms. Participants who held positive attitudes toward the Ancient Forest Alliance and its objectives were more likely to subsequently set an intention to support the organization. Those who set an intention to support the organization were more likely to subsequently believe that others would support (or approve of supporting) the organization as well (subjective norms).

According to Ajzen (2005), the base components that are active in influencing intentions and actions are specific to the behaviour, context and individual. Rarely do all three base components of the TPB play an active role in influencing intentions or action.

Therefore, the finding that two of the three base components (Att and SN) were involved in actions to support an environmental organization was not out of the ordinary.

In Study 1, the measure of perceived behavioural control was not related to intentions or actions as expected. In many cases, the association of PBC with these constructs was not significant or was slightly negative. One would expect a significant positive correlation of PBC with intentions and actions; therefore this finding was somewhat surprising. A few contributing factors may have led to these results.

First, the behaviour itself was perceived as “easy” by most participants because they knew they would be provided materials to engage in the behaviours immediately following the study. This was reflected in mean PBC scores ($M_{PBC\ T1\ and\ T2} > 70$ out of 100, $SD_{PBC\ T1\ and\ T2} > 16.00$). Therefore, a possible ceiling effect and reduction in variability within the measure could have made finding a significant effect more difficult. Second, considerable variability existed in the ease or difficulty of potential support actions. Although all the behaviours together were labelled “support actions,” participants’ perceptions of the difficulty of “engaging in a support action” varied greatly because the actions themselves varied in difficulty (e.g., signing a petition to writing a letter). Third, the measure was composed of items that each measured PBC in different ways – for example, although questions about “personal control” over the behaviour received high scores, the question about “expensive or cheap” received a range of answers. Finally, PBC became a better predictor of intentions and actions as they came closer (in time) to the opportunity to actually act. This was possibly because the idea of actually taking action became more salient closer to the time of acting. For these reasons, the relation between intentions and PBC was considered tenuous or non-existent. In

Study 2, many of the PBC measurement issues were addressed; behaviours were more specifically defined, they varied in difficulty, and they were measured with reliable items that correlated better with one another.

As a side note, it was interesting to examine the actions participants chose to actually engage in. Participants in Study 1 completed a range of support actions, from nothing at all (32%) to five behaviours (2%). A large number of participants engaged in one (24%) or two (21%) support actions. Of those who took action, the largest number chose to sign a petition (47%). As expected from the TPB, intentions were the best predictor of the number of actions performed by participants. The large number of participants who engaged in at least one action suggests that the sample population may have had pre-existing pro-environmental ideals.

According to Kaiser and Byrka (2011), the difficulty of completing a given pro-environmental behaviour can be roughly inferred by the proportion of people who engage in it. Thus, the percentages who chose to engage in each action may also suggest that easiest behaviours may have been signing a petition, reading additional information, or signing a pre-written letter. On the other hand, donating money, registering for the newsletter, purchasing greeting cards or writing letter were, perhaps, more difficult.

Conclusion

Study 1 suggests that, in terms of actions to support an environmental organization, a pure forward-causal relation between base components and intentions is unlikely. Rather, a reciprocal relation between those components explained the data better. For these types of support actions, attitudes influenced intentions and intentions

influenced subjective norms. The influence of intentions on subjective norms could be explained by the false consensus effect; once an intention to support the organization was set, participants began perceiving that others would also engage in those behaviours or approve of them. Nevertheless, this correlational study was insufficient for conclusively supporting a causal explanation of intentions influencing base components of the TPB. For additional support, an experimental method would be required. Study 2 was designed for this purpose.

CHAPTER 4

Study 2 – Experimental Lab Study

Objective

Results from Study 1 suggested that a reverse association between intentions and base components was *possible*. The objective of Study 2 was to use an experimental lab study to further support the hypothesis that intentions may *cause* a change in attitudes, subjective norms or perceived behavioural. The study was conducted in a lab setting where participants could be randomly assigned to control or intervention groups and extraneous variables could be controlled. The free choice paradigm, developed by Brehm (Brehm, 1956), which had effectively supported the theory of cognitive dissonance in a number of studies (e.g., Brownstein et al., 2004; Cottrell et al., 1974; Gerard & White, 1983; Greenwald, 1969) was adapted for this experiment. Research using the free choice paradigm suggests that the act of selecting one alternative and rejecting another causes subsequent attitudes toward each alternative to change.

The purpose of Study 2 was to extend research using the free choice paradigm beyond attitudes to include perceptions of subjective norms and perceptions of behavioural control in order to demonstrate that setting an intention to engage in one behaviour option rather than another would result in changes to these constructs. The study also tested the reported ability of the free choice paradigm to modify attitudes in response to *setting an intention* rather than taking action, and it applied the paradigm using alternative behaviour options rather than objects to acquire (which was the traditional approach).

The hypothesis of Study 2 was that, if participants were forced to choose between setting an intention to support one of two organizations, they would subsequently display more positive Att, SN and PBC toward that organization, and more negative Att, SN and PBC toward the rejected organization, thus supporting the hypothesis that intentions may influence TPB base components in a reverse-causal sequence.

Method

Participants

Two-hundred and ninety-five undergraduate students from the University of Victoria were recruited to participate in exchange for course credit.²⁰ Of these, 149 were assigned to the control group and 146 were assigned to the intervention group. Across participants, 19% ($n = 55$) were male, the median age was 21 years ($range = 18$ to 60 years), the most common area of study was psychology (sometimes in combination with other majors, $n = 147$), and the majority were born in Canada ($n = 242$).

Procedure

Time 1. The study took place in two parts, each occurring between one and 14 days apart ($M_{delay} = 3.34$ days, $SD = 2.39$). At Time 1 (T1), participants came to a computer lab on campus and completed an online base components questionnaire about supporting each of four organizations (similar to the base components questionnaire used in Study 1). The questionnaire for each organization was preceded by a brief video about that organization (taken from the organization's website or YouTube channel). In Study 1

²⁰ Participants in Study 1 were excluded from taking part in Study 2.

participants often failed to read information carefully if it was provided in text form. Therefore, in Study 2, videos were used rather than text. This also provided control over the time that participants spent learning about each organization, and made the study more engaging. Each 22-item questionnaire asked participants about their attitudes, perceptions of social norms and perceptions of behavioural control regarding supporting each of the specific organizations in specific ways (e.g., signing a petition for the Ancient Forest Alliance, or volunteering for the Rocky Point Bird Observatory). The specificity of behaviours were increased in Study 2 (as compared to Study 1) in order to improve reliability of the PBC subscale. Organizations were presented in a random sequence (with a 45-second break after the second organization), and the order of questions within each questionnaire were randomized.

Setting an intention. Following the four questionnaires, participants were asked to rank order each of the four organizations in terms of which they were *most likely to support* (on their own after the second part of the study). As is typical of studies employing a free-choice paradigm, participants in the intervention group were asked to choose between two alternatives. In this case they were advised that the research team had partnered with two of the four organizations and they must choose which of the two they would prefer to set an intention to support. The two organizations were those ranked second and third (out of four) because choosing between similarly ranked options in the middle range of preference has been shown to maximize the process of cognitive dissonance while avoiding a “ceiling” or “floor” effect (e.g., Shultz et al., 1999). Through this process, a *spreading of alternatives* was expected for the intervention group, such that base components for the chosen option would become *more* supportive at Time

2 and base components for the rejected option would become *less* supportive at Time 2. Control group participants were not asked choose between two organizations and thus alternatives were expected to remain the same or come together as a result of regression to the mean.

Most participants voluntarily chose the organization they ranked second rather than the organization they ranked third. However, a minority of participants unexpectedly did the opposite. An essential part of Study 2, therefore, was avoiding a sampling bias in the intervention group caused by excluding participants who chose the third-ranked option rather than the second-ranked option. Using a method described by Chen and Risen (2010) to avoid this systematic bias (present in most free choice paradigm studies), participants in the intervention group were guided to select the option which they ranked highest (i.e., number two). This was done by presenting the higher ranked option first, and in a brighter font colour. If participants in the intervention group nevertheless insisted on selecting the lower-ranked option (which occurred 19.7% of the time), they were told “Error... Sorry, [organization ranked third] is no longer a partner for this study but we haven't had a chance to overhaul the questionnaire yet. Would you mind supporting the [organization ranked second] instead? ... Thank you.” Then they were asked to click the box next to the statement “I will support [organization ranked second] at the end of the study by [doing the behaviour associated with second-ranked organization].”²¹ In this way, no participants had to be excluded for choosing the lower-ranked option and all

²¹ At T1, when participants in the intervention group were asked to rank-order the four organizations and choose between the second and third ranked organizations, those who chose the organization ranked third also showed a significant preference for the third-ranked organization in terms of Att, $t(145) = 4.01, p < .001$, SN, $t(145) = 4.6, p < .001$, and PBC, $t(145) = 6.84, p < .001$. Thus, for whatever reason, rankings did not reflect base components ratings for those participants. When asked to justify supporting the second-ranked organization, 14 of these participants (of 29) still provided appropriate justification. Removal of these participants did not significantly affect results of the study.

participants in the intervention group made identical choices (a requirement for a truly randomized controlled experiment).

Participants in the intervention group were asked to explain (in a few sentences) why the higher-ranked organization should be supported. This step was included in order to maximize self-perception and cognitive dissonance.

Ensuring a genuine intention. Prior to beginning the questionnaires, participants were told the names of the four environmental organizations and the specific means by which each could be supported. Before watching any videos or reading descriptions of the organizations, they were asked if they would be “willing to commit to supporting one of the environmental organizations” after the second part of the study was completed. The full description of how this was done can be found in Appendix 3. Participants who were not willing to commit to supporting one of the organizations *before beginning the study* were asked to complete the questionnaire “hypothetically.” Each participant (regardless of commitment) was randomly assigned to control or intervention conditions. Basic demographic information was requested at the end of T1.

Time 2. At Time 2 (T2), participants were asked to complete the same base components questionnaires again for each organization in random order. This time the questionnaires were completed at home (online) instead of in a computer lab on campus, and participants were not required to watch the videos (although they could if they wished). Embedded within each group of questionnaires at T1 and T2 were nine “attention items” intended to assess if participants were responding mindfully (e.g., If you are paying attention, please put the slider all the way to the left, under “Attention.”).

Participants who “failed” at least four attention items (of nine) from T1 or T2 were excluded from the analysis.

Behaviour was measured at the end of T2. Participants in the intervention group were provided a web link that could be used to follow through with the action they set an intention to complete (i.e., supporting the organization they ranked second). Participants in the control group were provided web links for all four organizations. The presentation of these web links was not expected by the participants who were led to believe that they would be required to follow through with the behaviour on their own time. Immediately after presenting the web links to participants, they were asked to self-report if they clicked on the link and followed through with an action (or explain why they did not).

Questionnaire Design and Pilot Studies

In order to inform the creation of the final base components questionnaires, a first pilot study was conducted with 94 students earning course credit for participation (an independent sample drawn from the same pool as the main study who did not participate in Study 1). The first pilot study involved each participant completing a base components questionnaire for only one of the four environmental organizations. In addition to the base components questions, which were adapted from Study 1, the questionnaire also included several questions about the length of the study, the incentives used for the study and general questions about how the final study could be conducted in the future.

Results of the first pilot study indicated that the questionnaire was an appropriate length but also that participants would actually prefer to complete a longer questionnaire (and receive more course credit). The pilot study also showed that most participants

would agree to commit to supporting an environmental organization prior to watching a video about that organization and that the base components questionnaires were generally reliable and valid. However, as in Study 1, the perceived behavioural control subscale of the questionnaire was not as reliable as the others. Therefore, several PBC items were added and changed for the main study. The final base components questionnaire used for each organization in Study 2 can be seen in Appendix 4.

A second pilot study was conducted with 90 participants to test the final base components questionnaire and the final procedure for the study (as described in the subsection titled “procedure”). This group of participants was also independently drawn from the same pool as the main study (and excluded participants from Study 1 or the first pilot). Results indicated that asking participants to complete four base components questionnaires in one sitting was not overly burdensome, and that the updated PBC subscale was highly reliable ($\alpha > .8$ for each organization). However, the computer programming required for randomization of questions, recalling participants’ information and presenting online videos was rather complicated. A programming error resulted in 14% of the data being unusable ($n = 13$). This error was corrected in the final version of the study.

Results

Excluded Participants

Of the 295 participants, 275 completed both T1 and T2. Nineteen participants were excluded because of careless responding.²² A surprisingly high number of responders stated that they had supported at least one of the organizations in the past ($n = 35$), but these were not excluded from the analyses.²³

Twenty-three percent of participants ($n = 69$) stated at the outset that they were not “willing to commit” to supporting one of the organizations before the study began. These participants’ responses were compared to those who were “willing to commit.”

Reliability and Descriptive Statistics for Base Components

For each organization ($n = 4$), reliability was assessed for each subscale (Att, SN and PBC) at both time points (T1 and T2). In all cases, the subscales were reliable ($\alpha > .8$) and had high corrected inter-item correlations ($r > .4$). All Att subscales had $\alpha > .9$, all SN subscales had $\alpha \geq .83$, and all PBC subscales had $\alpha \geq .89$. Composite variables were therefore created for Att, SN and PBC at each time point for each organization. The second- and third-ranked organizations at each time point were identified for each participant to create “Rank 2” and “Rank 3” combined composite variables (at each time point for each subscale). These were the primary outcome variables of interest and they were derived from the mean of items within each subscale. Hence each composite variable ranged from 0 (bad) to 100 (good). These composite variables were generally

²² Of the careless responders, $n = 13$ failed over three attention items at T1 or T2, and $n = 6$ completed T2 extremely quickly (within the top 2.1% shortest times, less than 7:43min).

²³ A preliminary analysis with these participants excluded did not produce different results from the same analysis with the participants included.

normally distributed. Only two outliers were found within the twelve composite variables and these were not overly influential within the dataset, nor did they stand out in terms of attention errors or short completion time. Therefore, these two outliers were not removed or changed. Descriptive details regarding the twelve composite variables can be seen in Table 4, below.

Table 4

Theory of planned behaviour base components for each organization at T1 and T2

	Subscale		Mean	SD	Skewness	Skewness SE	Kurtosis	Kurtosis SE
T1	Rank 2	Att	65.07	20.76	-.37	.14	-.4	.28
		SN	65.06	20.29	-.25	.14	-.72	.28
		PBC	72.65	23.12	-.60	.14	-.73	.28
Rank 3	Att	Att	54.9	21.37	-.18	.14	-.55	.28
		SN	53.96	20.38	-.02	.14	-.43	.28
		PBC	56.92	25.97	.01	.14	-.98	.28
T2	Rank 2	Att	67.13	21.12	-.64	.15	-.25	.3
		SN	65.5	20.96	-.34	.15	-.66	.3
		PBC	71.77	23.58	-.7	.15	-.41	.3
Rank 3	Att	Att	56.69	21.9	-.26	.15	-.66	.3
		SN	54.63	21.45	-.05	.15	-.78	.3
		PBC	54.8	25.65	.01	.15	-.94	.3

Note: Mean scores may range from 0 to 100. ATT = attitudes; SN = subjective norms; PBC = perceived behavioural control; T1 = Time 1; T2 = Time 2; "Rank 2" and "Rank

3” refer to the organizations ranked second and third by participants at T1 (T2 Rank 2 is the same organization as T1 Rank 2 and T2 Rank 3 is the same organization as T1 Rank 3).

Reverse-Causal Influence of Intentions on Base Components

The free choice paradigm (Brehm, 1956) was designed to engage cognitive dissonance through decision making and therefore result in individuals preferring a chosen alternative more and a rejected alternative less. Therefore, I hypothesized that participants who were made to choose between options ranked second and third (intervention group) would subsequently show more positive Att, SN and PBC toward the second-ranked option and less positive Att, SN and PBC toward the third-ranked option, when compared to a control group. I expected control group participants’ perceptions of Att, SN and PBC for the second- and third-ranked options to remain consistent, or perhaps naturally regress to the mean (second-ranked option decreasing, third-ranked option increasing). Therefore, I examined the results for a *spreading of alternatives* in the intervention group as compared to the control group.

As shown below, the expected pattern of results was clearly visible only for participants who were *not* “willing to commit” to supporting one of the four organizations prior to beginning the study. The participants who *were* “willing to commit” showed a more-or-less fixed pattern of preferences from T1 to T2. This interesting result was counter to my prediction.

Two-way repeated measures ANOVA. This type of analysis was used because it was ideal for examining differences in change over time between two groups. The constructed models included two within-subject independent variables: *Time* (T1 to T2) and *Difference between ranks* (i.e., spread of difference between organizations ranked

second and ranked third). They also included one between-subjects variable: *Group* (intervention versus control). Analyses were run independently for individuals who agreed to make a genuine commitment to supporting one of the organizations before beginning the study, and those who were not. Assumptions of normality were met and sphericity was automatically assumed because each variable had only two levels.

Individuals who were “willing to commit,” displayed little change in ratings of Att, SN or PBC for organizations ranked second or third. The only exception was a slight but significant spreading of alternatives for attitudes of participants in the intervention group, but not the control group, Time*Rank*Group: $F(1,192) = 4.02, p = .05, \eta_p^2 = .02$. No significant spreading of alternatives or regression to the mean was observed for SN, $F(1,192) = 0.36, p = .55, \eta_p^2 = .002$, or PBC, $F(1,192) = 0.23, p = .63, \eta_p^2 = .001$. These patterns can be seen in Figure 6 below.

As seen in Figure 6, the spreading of alternatives for Att was primarily a result of an *increase* in attitudes toward the second-ranked organization, rather than a *decrease* in attitudes toward the third-ranked organization. This was confirmed by a one-way repeated measures ANOVA with Rank 2 attitudes as the dependent variable, $F(1, 193) = 4.56, p = .03, \eta_p^2 = .02$, and a separate ANOVA with Rank 3 attitudes as the dependent variable, $F(1, 192) = 0.21, p = .65, \eta_p^2 = .001$.

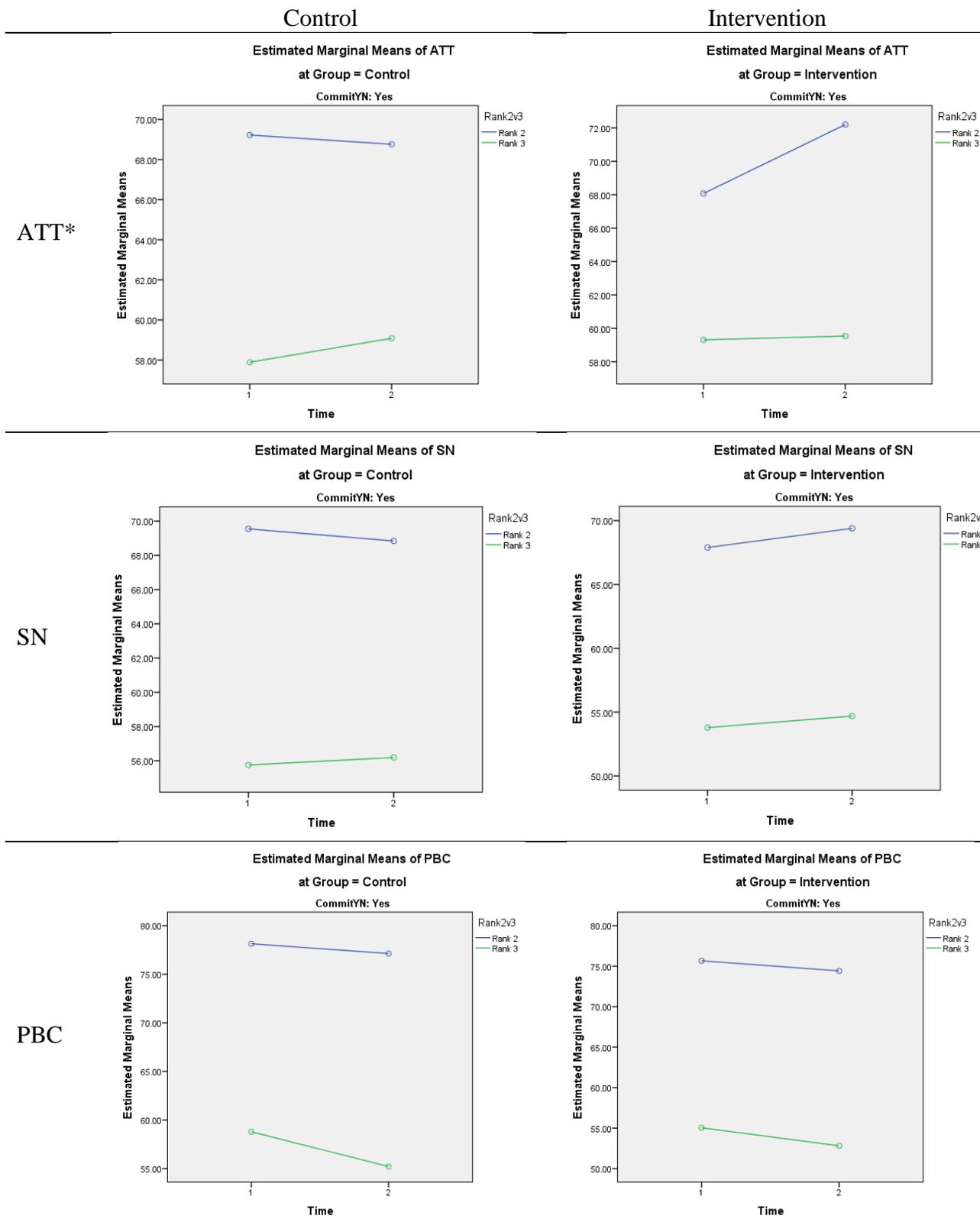


Figure 6. Participants “willing to commit” to support an environmental organization before start of study. ATT = attitudes; SN = subjective norms; PBC = perceived behavioural control. * $p < .05$.

Individuals who were *not* “willing to commit” displayed significant (or borderline significant) changes in ratings of all three base components (Att, SN and PBC). These changes were two-fold: a spreading of alternatives in the intervention group, complemented by a regression to the mean (compression of alternatives) in the control group. Thus, the three-way Time*Rank*Group interaction was significant for Att, $F(1,58) = 14.12, p < .001, \eta_p^2 = .2$, significant for SN, $F(1,58) = 6.09, p = .02, \eta_p^2 = .1$, and borderline significant for PBC, $F(1,58) = 2.99, p = .09, \eta_p^2 = .05$. These patterns can be seen in Figure 7 below.

As seen in Figure 7, the spreading of alternatives for PBC and SN in the intervention group were primarily results of *decreases* in ratings regarding the behaviour associated with the *third-ranked* organizations, rather than *increases* in ratings regarding the *second-ranked* organizations. For PBC this was confirmed by a one-way ANOVA with Rank 3 PBC as the dependent variable, $F(1,58) = 4.56, p = .04, \eta_p^2 = .07$, and a separate ANOVA with Rank 2 PBC as the dependent variable, $F(1,59) = 0.24, p = .62, \eta_p^2 = .004$. For SN, the results were borderline significant for Rank 3 SN, $F(1,58) = 3.15, p = .08, \eta_p^2 = .05$, and non-significant for Rank 2 SN, $F(1,59) = 2.6, p = .11, \eta_p^2 = .04$. For attitudes, the spreading of alternatives was both a result of significantly *increased* attitudes toward the *second-ranked* organizations, $F(1,59) = 4.94, p = .03, \eta_p^2 = .08$, and significantly *decreased* attitudes toward the *third-ranked* organizations, $F(1,58) = 9.74, p < .01, \eta_p^2 = .14$.

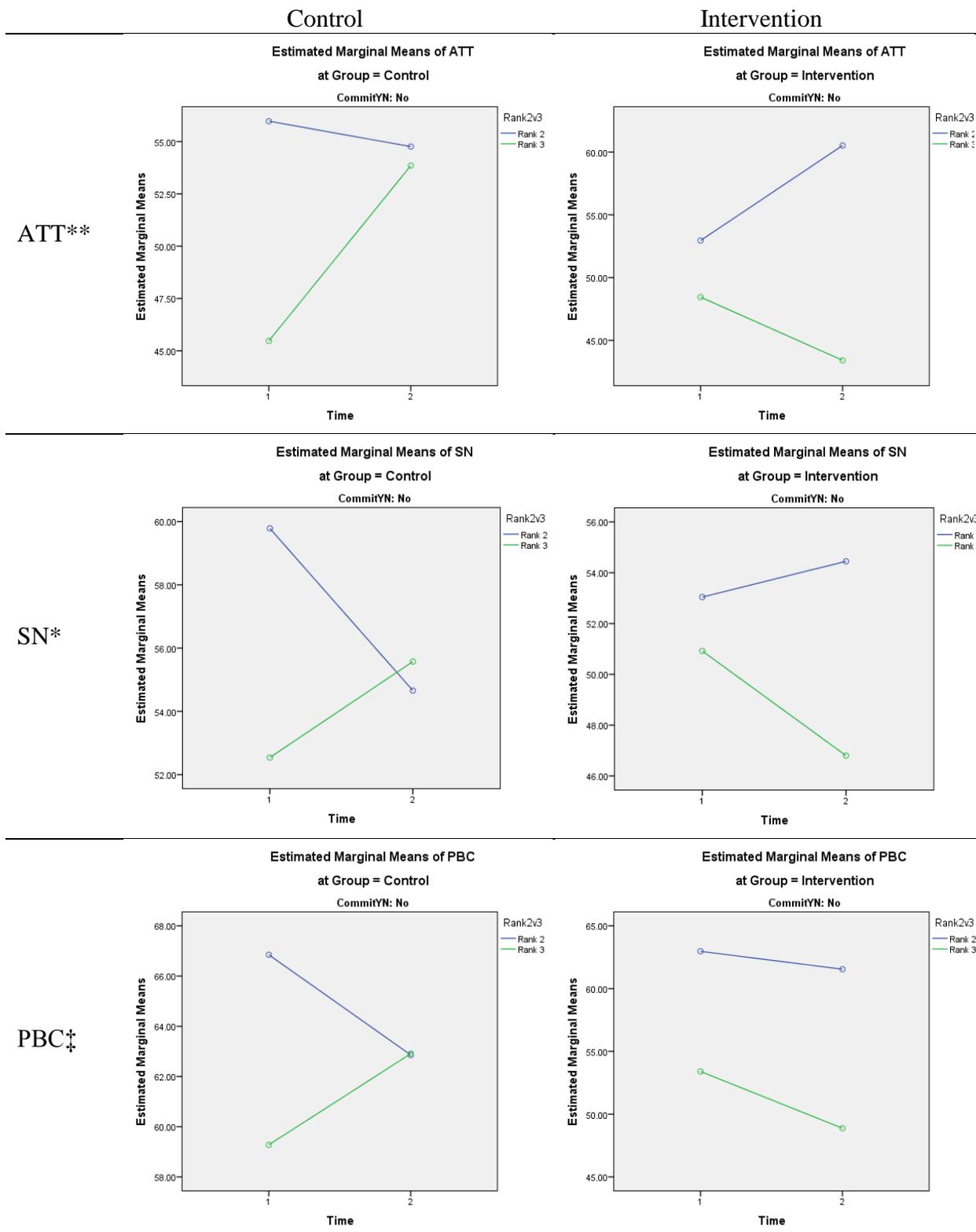


Figure 7. Participants not “willing to commit” to support an environmental organization before start of study. ATT = attitudes; SN = subjective norms; PBC = perceived behavioural control. * $p < .05$, ** $p < .01$, ‡ $p = .09$

Rank change. Previous studies using the free choice paradigm (Brehm, 1956) often compared rank orderings of alternatives after a choice was made. Again, chosen alternatives were expected to increase in rank, while rejected alternatives were expected to decrease in rank. Traditionally, this was interpreted as a change in attitudes toward each alternative but, in this study, a change in rank could have reflected a change in Att, SN, PBC or a combination of factors. A potential rank change would, therefore, be difficult to interpret. Nevertheless, a rank change analysis was conducted to remain consistent with previous research.

Similar to patterns in base component ratings, rank orders changed (or did not change) depending on whether individuals initially agreed to commit to supporting an environmental organization before the study began. For those who were *not* “willing to commit” to support an environmental organization, alternatives significantly *spread apart* for the intervention group and *regressed to the mean* for the control group. The second-ranked organization decreased slightly in ranking for control group members ($M_{control} = -.52$, $SD = .78$, $n = 33$), and increased slightly in ranking for intervention group member ($M_{intervention} = .33$, $SD = .62$, $n = 27$), $t(58) = -4.69$, $p < .001$. The third-ranked organizations showed a reverse pattern: a slight increase in ranking for control group members ($M_{control} = .30$, $SD = .77$, $n = 33$), and a slight decrease in ranking for intervention group members ($M_{intervention} = -.04$, $SD = .59$, $n = 27$), $t(57.75) = 1.94$, $p = .06$.

Participants who *were* “willing to commit” to supporting an environmental organization before the study began did not significant change their rankings, regardless of whether they were part of the intervention or control groups. The second-ranked

organization remained relatively similar in ranking for the control group ($M_{control} = -.04$, $SD = .71$, $n = 101$), and the intervention group ($M_{intervention} = .05$, $SD = .80$, $n = 93$), $t(192) = -.86$, $p = .39$. And the third-ranked organization also remained relatively similar in ranking for both the control group ($M_{control} = .16$, $SD = .76$, $n = 101$), and the intervention group ($M_{intervention} = 0$, $SD = .78$, $n = 93$), $t(192) = 1.43$, $p = .15$.

Behaviour

As a secondary outcome measure, participants' behaviours were examined to determine if, as suggested by the theory of planned behaviour, intentions predicted behaviour. For these analyses, 11 participants were excluded because they stopped the survey prior to engaging in any behaviour and 21 participants from the intervention group were excluded because a programming error resulted in not presenting the option to act. Action was defined as a dichotomous dependent variable ("took action" versus "did not take action").²⁴

Participants in the control group were presented with the option of supporting any of the four organizations in the study (and often chose to support their top-ranked organization). Participants in the intervention group were only offered the option to support the second-ranked organization (the one they had chosen to support rather than the third-ranked organization).²⁵ Given that participants in the intervention group were not given the option to support their initially top-ranked organization, participants in the

²⁴ In a small number of cases, participants in the control group engaged in multiple actions. These were simplified to "took at least one action," in order to allow comparison with the intervention group that was only offered one behaviour option.

²⁵ Recall that, in the intervention group, participants were told that "for the purposes of this study, we have partnered with two of the organizations." To remain consistent, only the organization they "chose to commit to" was presented at the end of the study (organization ranked second).

control group were 1.7 times more likely to take action than those in the intervention group, $\chi^2(1) = 3.9, p = .05$. Participants who indicated a willingness to commit to supporting one of the organizations before the study began were 19.31 times more likely to take action at the end of the study than those who were not, $\chi^2(1) = 61.93, p < .001$.

Evidently, an additive effect of group (control versus intervention) and initial commitment were observed. Within the control group, participants who indicated they would be willing to commit to supporting one of the organizations were 31.15 times more likely to take action than those did not make an initial commitment, $\chi^2(1) = 51.08, p < .001$. Within the intervention group, participants who indicated they would be willing to commit to supporting one of the organizations were 13.81 times more likely to take action than those did not make an initial commitment, $\chi^2(1) = 16.08, p < .001$. The complete frequencies of action in each group can be seen in Table 5 below.

It seems that individuals who indicated a “willingness to commit” genuinely set an intention to support one of the organizations and were more likely to follow through with their intention. However, they were not “willing to commit” to support *any* organization, they were willing to commit to support their top-ranked organization. When they were not allowed this option (i.e., in the intervention group), they were less likely to follow-through.

Table 5

Frequency of behaviour

	No Commitment	Yes Commitment
Control	11.8% (4/34)	80.2% (81/101)
Intervention	10% (2/20)	60.3% (47/78)

Note: This table is presented for descriptive purposes only. Chi-square tests could not be conducted on data as presented in this table because of small cell counts in two cells.

Qualitative Data

When participants chose not to take action to support an environmental organization, they were asked to provide an open-ended explanation as to why. Twenty-four control group participants and 40 intervention group participants chose to provide an explanation. The primary reasons provided by participants in both groups were lack of time or money (*Control* = 50%, $n = 12$; *Intervention* = 30%, $n = 12$). In the control group, participants also expressed concerns about the effectiveness of the actions or doubts about the organizations (wanting more information about them, 25%, $n = 6$). Control group participants also sometimes indicated that they “didn’t feel like it,” “didn’t care” or that action would require too much effort (25%, $n = 6$).

Participants in the intervention group sometimes also indicated that they “didn’t feel like it” or didn’t care (18%, $n = 7$), but equally frequently indicated that they *would* have taken action to support an organization if not “forced” to choose an option they did not initially want to support (18%, $n = 7$).

When asked for “any additional comments,” seven participants reported enjoying the study, finding it interesting or believing it was important, and four participants reported finding the study boring, repetitive or un-interesting. Five participants indicated

that they were tired or had some minor difficulties completing the questionnaire (they were not excluded and their answers did not deviate significantly from other participants). Three participants mentioned that they did not like the quality of some videos or that they were significantly influenced by the production quality of the videos.

Discussion

Study 2 supports the theory that intentions can affect base components in a reverse-causal sequence. The study demonstrated, using a controlled laboratory experiment, that attitudes, subjective norms, and perceived behavioural control regarding support for an environmental organization can be influenced by setting an intention to support that organization (and not supporting an alternative organization). This suggests that the theory of planned behaviour could be modified to include a reverse-causal sequence from intentions back to base components of the theory, and that cognitive dissonance procedures can be used to influence perceptions of subjective norms and behavioural control as well as attitudes.

One particularly interesting finding was that participants who *did not* initially commit to supporting an environmental organization were those that were *most likely* to modify their base component ratings from T1 to T2. Not only did participants in the intervention group display a *spreading of alternatives* for Att, SN and PBC, participants in the control group displayed *regression to the mean* (compressing of alternatives) for those base component measures. Among participants who *did* make an initial commitment to support one of the organizations, those in the intervention and control groups did not change their base component ratings significantly (with the notable

exception of attitudes which significantly increased for Rank 2 organizations in the intervention group). Therefore, individuals who were “willing to commit” to supporting an organization before the study began subsequently had more rigid ratings that were less susceptible to change from T1 to T2.

Asking participants if they would be “willing to commit” to supporting an environmental organization before the study began was intended to ensure that any intention that was later set as a result of choosing one organization over another would be genuine. Only a genuine intention to support an organization was expected to result in subsequent preference for that organization (in terms of Att, SN and PBC). However, the accidental consequence of asking participants to commit to supporting an organization before the study began was to encourage them to mentally commit to one particular organization – their most preferred, top-ranked organization. After doing so, they became quite rigid in their perceptions of the second and third-ranked organizations and did not change much from T1 to T2. Their base component ratings of second-ranked and third-ranked organizations did not regress to the mean or spread apart as they did for participants who did not set an initial commitment. Although individuals who agreed to make an initial commitment were more likely to follow through with some action, they were particularly likely to do so when they could engage in their top-ranked option (i.e., when they were in the control group). Indeed, if participants took no action they often stated in an open-ended response that it was because they were not allowed to do their most preferred action.

The finding that individuals with strong pre-existing commitments were less likely to change their perceptions in response to a free-choice paradigm was consistent

with previous research showing that strongly held (more certain) attitudes tend to be less likely to change than weakly held attitudes (e.g., Clarkson, Tormala, & Rucker, 2008; Prislin, 1996).

For participants who agreed to make an initial commitment, perceptions of the organizations might also have increased in *importance*. Individuals who made an initial commitment to take action were, in fact, more likely to take action. Thus, perceptions of the organizations became important considerations for these people as they dictated, or were related to, real behaviour. For individuals who did not make this commitment, perceptions of the organizations became less important (and therefore more flexible) because they knew they would not be needed to later justify their actions. Potentially, the importance of these perceptions may have moderated the degree of change or flexibility accompanied them.

Conclusion

Study 2 indicated that intentions may cause a change in attitudes, subjective norms and perceived behavioural control. In particular, this was most likely to occur for less important or less strongly held beliefs. However, the study was limited in external validity because it was conducted in a strictly controlled laboratory setting. The purpose of Study 3 was to test the possibility of intentions influencing TPB base components in a real-world setting.

CHAPTER 5

Study 3 – Field Experiment

Objective

The objective of Study 3 was to examine whether manipulating intentions in the real world could cause a change in base components. This study involved systematic manipulation of an independent variable (intentions) and quasi-random assignment to a control or intervention group (i.e., a quasi-experimental design). The intentions of participants in an intervention group to engage in a pro-environmental behaviour were strengthened, and their subsequent attitudes, subjective norms and perceived behavioural control regarding that behaviour were assessed. Changes in the intervention group were compared to the control group.

A secondary objective was to investigate how chemistry lab users at the University of Victoria could be encouraged to use the Setback switches on their fume hoods more frequently in order to save energy. This information was collected and presented to the Office of Campus Sustainability at the University of Victoria in order to test a potential method for energy conservation. The procedure was developed using the DO-RITE method for active research (Geller, 1992).

Method

Setting

Study 3 was conducted in conjunction with the University of Victoria's "Green Labs" initiative to modify chemistry labs to become more environmentally friendly. This

particular initiative focused on use of chemistry lab fume hoods. Fume hoods, depicted in Figure 8, are enclosed work tables approximately five feet wide and two feet deep in which chemistry experiments with dangerous or unpleasant materials may be safely conducted. Air within the fume hoods is continuously evacuated through a vent in the top of the hood and a chimney on the roof of the building. The fume hoods are normally accessed through sliding windows at the front of the enclosure, but the entire front may also be opened by way of a sash that can be raised or lowered. Fume hoods consume a great deal of energy because they require electricity to force air out through the roof of the building and gas or electricity to re-heat the room that houses the fume hood. For safety reasons, fume hoods may not be turned off but, if the windows and sash are closed, these particular fume hoods can be safely switched to “Setback Mode” overnight to reduce electricity use and heating. The Office of Campus Sustainability estimates that if all fume hoods were put in Setback Mode overnight, the university would reduce electricity use by two percent and save \$7,000 to \$10,000 in energy annually. Thus, encouraging lab users to adopt the simple behaviour of “hitting the switch” each night could have dramatic repercussions for both carbon footprints and costs to the university. This was the target behaviour for Study 3.



Figure 8. A typical chemistry lab fume hood at the University of Victoria. In this case, the fume hood windows are completely open and the sash is down.

Chemistry labs in the building that was observed for Study 3 were divided among two floors, as depicted in Figure 9. Twenty-one fume hoods were located on the North side of the second floor (among three lab groups), 23 hoods on the South side of the second floor (among four lab groups), and 11 fume hoods on the third floor (among two lab groups and a private company). Each lab group had between 2 and 12 lab users working at fume hoods. Approximately five fume hoods were used for “waste” or other shared purposes and two fume hoods on the third floor were run by an outside company that did not participate in the study. The remaining fume hoods were either assigned to one user each or shared by up to four. Lab occupants rarely used fume hoods belonging to other members of their lab and never used those belonging to other labs. They tended to know and talk with one another socially within their side of the hall, but less with those on the other side of the hall and even less with those on other floors.



Figure 9. Floor plans of Chemistry wing of Bob Wright Building at the University of Victoria. Fume hoods are labelled as yellow rectangles.

Participants

Based on responses to a baseline questionnaire ($n = 52$), chemistry lab users in the observed building were primarily graduate (46%) and undergraduate (52%) students who used the hoods every time they came to the lab (73% male). Undergraduate students usually conducted experiments under the direction of graduate students. Faculty members (supervising the graduate students) were rarely present in the labs. Unless writing a dissertation or thesis, most lab users were present in the labs five or six days a week (57%) and two or more weekends each month (58%). Graduate students often worked at the same fume hoods for two to four years and, conversely, undergraduates were only present for one or two semesters. Therefore, the end of each semester was a period of lab user “turnover,” when between 10% and 50% of lab users would leave or be replaced. A typical chemistry lab user is depicted in Figure 10.



Figure 10. A typical fume hood user working in a lab north of the hall on the second floor.

Preliminary research and questionnaire design

Preliminary research took place between September 2013 and January 2014 and involved four main parts: observation, informal discussion with stakeholders, learning about the general operation of chemistry labs, and qualitative structured interviews with lab users.

Naturalistic observation, without interference, was first used to understand how the space was used. During this time, informal discussions with lab users about thoughts on the setback switch also took place. Later, faculty members who supervised students in the chemistry labs were interviewed one-on-one, and experts (Facilities Management, Office of Sustainability, Occupational Health and Safety) were engaged in discussions about physical features of the hood and how they could be used more efficiently. As

primary investigator, I also underwent standard health and safety training for chemistry lab users to learn more about fume hood usage protocols.

As in Study 1, a qualitative questionnaire was administered to a small subsample of the population ($n = 10$) to inform the creation of a TPB base components questionnaire. As suggested by Fishbein and Ajzen (2010), the questionnaire included six open-ended questions asking about attitudes, subjective norms and perceived behavioural control for using the setback switch.²⁶ The questionnaire is available in Appendix 5. It was administered to a convenience sample of lab users who happened to be in the lab when the researchers conducted the survey.

The qualitative questionnaire identified two popular, but incorrect, beliefs that discouraged use of the setback switch. The first belief was that if a chemical reaction was happening in the fume hood, it was unsafe to use Setback mode.²⁷ The second belief was that the switch “did not do anything.” That is, users either believed that their switch was not working (because they could not sense a change in air flow) or they believed that the behaviour of using the switch was inconsequential considering the overall amount of electricity used by the lab. Other common themes that students considered were costs to the university, environmental impacts, the behaviour of graduate students in the labs, and the ease or difficulty of reaching or noticing the Setback switch. These results were used to create questions for final base components questionnaire (to be used at baseline and after the intervention) as well as to create the intervention strategy.

²⁶ Initially, the lab users were asked about their thoughts on using the setback switch when away from the fume hood for even two minutes, but later this recommendation was changed to using the switch “overnight” for safety and legal reasons.

²⁷ In fact, a member of UVic’s health and safety office conducted a test to determine the amount of air escaping from the hood and found that, as long as the windows and sash are closed, Setback mode is completely safe to use – even if a reaction is taking place in the hood.

After comments from other environmental psychology researchers and preliminary testing on friends and family, the sixth and final revision of the TPB base components questionnaire consisted of 13 questions. As seen in Appendix 6, the questionnaire asked about instrumental and affective attitudes (six questions), injunctive and descriptive norms (three questions), and ease and sense of personal control (PBC, four questions). It also asked about demographic characteristics of the lab users and included a map on which they could mark the fume hood which they use most frequently. The questionnaire was designed to be maximally informative with the fewest number of questions; it could be completed in about five minutes.

Procedure

Study 3 took place in two parts: baseline and intervention. During the baseline phase, the quantitative base components questionnaire was administered to every available lab user. Given the small number of available lab users, members of the research team went to the labs during various times of day and spoke to lab users in person to request their participation. Questionnaires were also taped to fume hoods of users who were not present, and lab users who were present offered to talk to others about completing the questionnaire. Thus, nearly every available user completed the survey. Baseline questionnaires were administered twice in order to achieve a larger sample size. They were first administered between February 27, 2014 and March 6, 2014 and then again to new lab users at the beginning of the summer (May 5, 2014 to June 19, 2014). This was a period of turnover in many labs, during which users were in the process of starting or finishing experiments.

In total, 40 lab users completed the questionnaire during the first round of baseline data collection (February 27 to March 6, 2014) and an additional 13 completed it during the second round (May 5 to June 19, 2014). Therefore, 53 lab users completed the baseline questionnaire. The follow-up questionnaire, immediately following the intervention, was completed by 41 lab users (July 28 to August 6, 2014). Twenty-six lab users completed the questionnaire both at baseline and follow-up (Intervention: $n = 13$, Control: $n = 13$).

The intervention portion of the study took place over two weeks at the end of the summer (July 28, 2014 to August 6, 2014). During this time, I was invited to speak to each lab group during one of their regular lab meetings. Labs that were assigned to the intervention condition participated in *mental contrasting with implementation intentions* and *public commitment* exercises to encourage use of the setback switch (described later). Immediately following this exercise (before the opportunity to act), participants in both the intervention and control conditions completed the baseline questionnaire again (this was the second time completing the questionnaire for most lab users).

Behaviour. Before, during and after the study (January 14, 2013 to October 13, 2014) use of the setback switch for each fume hood was automatically logged in a central database. This automatically logged information was used to measure actual behaviour of lab users during the baseline and intervention phases, as well as several months after the intervention. In particular, the dependent variable was the state of each fume hood's setback switch each night (i.e., at 3am, when no one was in the lab).²⁸

²⁸ The state of the setback switches at 3am was used to determine “overnight” use of the switch. Based on interviews with lab users and one month of in-person daily observations, the lab was always empty after 11pm and before 7am.

Intervention. The intervention portion of the study took place over two weeks at the end of the summer (July 28, 2014 to August 6, 2014) and involved attending meetings for each individual lab group. During the meetings, I began by verbally addressing some common misunderstandings about fume hoods (i.e., using the switch when a reaction is happening, and using the switch making a difference), and asking lab users to stick a small sign on their fume hoods saying “I use setback mode at night” (public commitment, seen in Figure 11). I then asked lab users to engage in a brief exercise consisting of mental contrasting, implementation intentions and public commitment to help motivate the use of Setback mode. This intention-strengthening exercise was accompanied by a worksheet that each user completed, which can be seen in Appendix 7.

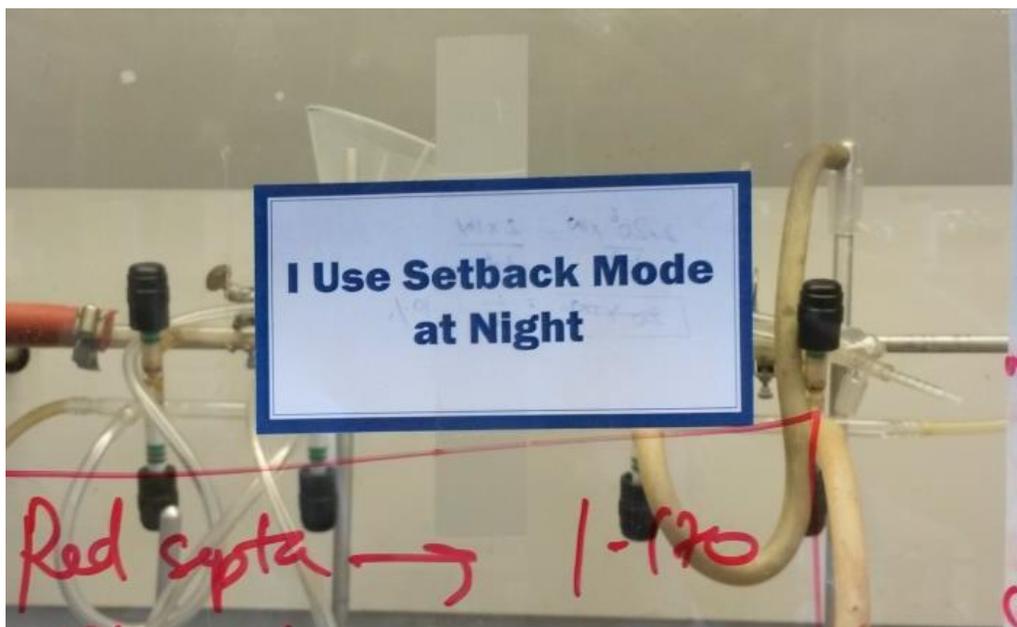


Figure 11. Participants in the intervention condition were asked to stick this sign to their fume hoods to indicate their public commitment to using the setback switch more often.

This brief intention-strengthening exercise consisted of asking participants to (1) set a goal, (2) visualize the goal, and (3) make a plan for how to achieve the goal. The *mental contrasting with implementation intentions* method for encouraging behaviour change was based the work of Gollwitzer and his colleagues (e.g., Gollwitzer & Sheeran, 2006) and was effective for changing behaviour in other contexts (e.g., Stadler, Oettingen, & Gollwitzer, 2009; Stadler, Oettingen, & Gollwitzer, 2010).

Based on a random coin flip, labs on the South side of the second floor were assigned to the control condition. During the intervention phase, these lab groups were informed about common misunderstandings about fume hood use *but not asked to engage in the motivational exercise*. Labs on the third floor and North side of the second floor were assigned to the intervention condition. During the intervention phase, they received the same information as the control group and also did the complete intervention described above. Both groups also completed the standardized questionnaire at the end of the lab meeting.

Results

Base Components Questionnaire

The baseline questionnaire (T1) was completed by 53 lab users, and the post-intervention follow-up questionnaire (T2) was completed by 41 lab users. Of these, 26 users completed the questionnaire at both T1 and T2. Attitude (Att) items, $n = 6$ (including one reverse-scored item), were each normally distributed at T1 and T2, and showed good reliability as a subscale (Cronbach's $\alpha_{T1} = .72$, $\alpha_{T2} = .82$). Therefore, a composite Att variable was created (i.e., the mean of all six Att items). Overall, Mean Att

scores were rather high, even at baseline ($M_{T1} = 5.06$, $SD_{T1} = 1.21$) but, nevertheless, they increased slightly from T1 to T2, ($M_{T2} = 5.3$, $SD_{T2} = 1.25$). At T1 (before the intervention), participants in the control condition ($n = 18$, $M = 5.07$, $SD = 1.39$) did not differ significantly from those in the intervention condition ($n = 35$, $M = 5.05$, $SD = 1.13$) on ratings of Att regarding use of setback mode overnight, $t(51) = .07$, $p = .94$. At T2, results were similar - participants in the control condition ($n = 19$, $M = 5.32$, $SD = 1.32$) did not differ significantly from those in intervention condition ($n = 22$, $M = 5.28$, $SD = 1.21$) on ratings of Att regarding use of setback mode overnight, $t(39) = .08$, $p = .94$.

Subjective norms were measured with three SN items: “Most graduate students use setback mode when they leave for the lab for the day... [agree = 7] to [disagree = 1],” “My direct supervisor in the lab would approve of me using setback mode when I leave the lab for the day... [agree = 7] to [disagree = 1],” and “UVic’s occupational health staff would approve of me using setback mode when I leave the lab for the day... [agree = 7] to [disagree = 1].” As a result of the small number of items, the SN scale was not reliable at T1 (Cronbach’s $\alpha = .56$) or T2 ($\alpha = .58$). Nevertheless, the all three items were normally distributed at T1, with a slight kurtosis (kurtosis for one item = 2.15, $SE_{kurtosis} = .72$) or negative skew (skewness for two items = -1.49 and -1.46, respectively; $SE_{skewness} = .37$) at T2. The three individual items did not receive extreme ratings indicative of a ceiling effect at T1 ($M_{T1} = 3.7$ to 5.8, $SD_{T1} = 1.37$ to 1.94). Therefore, these three items had room to potentially increase after the intervention. More importantly, these lower-rated items could have been related to the behaviour of setback switch use. Therefore, without combining the three items together, each item was examined individually, as a sub-measure of subjective norms (each covering a unique aspect of the construct).

Overall, mean ratings of *supervisor approval* increased slightly from T1 to T2 ($M_{T1} = 5.68$ to $M_{T2} = 5.98$, $SD_{T1} = 1.42$ to $SD_{T2} = 1.37$), ratings of *health and safety officers' approval* increased slightly from T1 to T2 ($M_{T1} = 5.79$ to $M_{T2} = 6.34$, $SD_{T1} = 1.14$ to $SD_{T2} = .97$), and ratings of *other graduate students' behaviour* decreased slightly from T1 to T2 ($M_{T1} = 3.7$ to $M_{T2} = 3.6$, $SD_{T1} = 1.94$ to $SD_{T2} = 1.61$). At T1, before the intervention, participants in the control condition ($n = 18$) did not differ significantly from participants in the intervention condition ($n = 35$) on any of the SN items:

supervisor approval ($M_{control} = 5.67$, $M_{intervention} = 5.69$), $t(51) = -.05$, $p = .96$; health and safety approval ($M_{control} = 5.89$, $M_{intervention} = 5.74$), $t(51) = .46$, $p = .65$; other graduate students behaviour ($M_{control} = 3.61$, $M_{intervention} = 3.74$), $t(51) = -.23$, $p = .82$. After the intervention, participants in the control condition ($n = 19$) also did not differ significantly from participants in the intervention condition ($n = 22$) on any of the items: supervisor approval ($M_{control} = 5.79$, $M_{intervention} = 6.14$), $t(39) = -.78$, $p = .44$; health and safety approval ($M_{control} = 6.16$, $M_{intervention} = 6.50$), $t(39) = -1.14$, $p = .26$; other graduate students behaviour ($M_{control} = 3.63$, $M_{intervention} = 3.57$), $t(38) = .12$, $p = .91$.

PBC was not a useful measure for this particular behaviour. At T1, the PBC subscale was reliable (Cronbach's $\alpha = .79$) despite each item having a negative skew ($skewness = -1.47$ to -2.29 , $SE_{skewness} = .327$) and receiving generally high ratings ($M_{T1} > 6$ out of 7 for each item). At T2, the PBC subscale was less reliable (Cronbach's $\alpha = .53$), primarily because of two items: "Using setback mode when I leave the lab for the day would make my work...[more = 1] to [less = 7] difficult" and "For me, the setback switch is... [difficult = 1] to [easy = 7] to reach." These two items had low corrected item-total correlations ($r < .4$). All four items were negatively skewed at T2 ($skewness = -$

1.81 to -3.45, $SE_{skewness} = 3.69$ to 3.74) with high ratings, ($M_{T2} > 6$ out of 7). Two of the items were kurtotic at T1 ($kurtosis = .9$ to 4.4 , $SE_{kurtosis} = .64$ to $.67$) and all four were kurtotic at T2 ($kurtosis = 3.21$ to 14.79 , $SE_{kurtosis} = .72$ to $.73$). The most common rating for PBC items (at both T1 and T2) was seven out of seven (with the exception of the “easy-difficult” question at T1, which most commonly received six out of seven). The strong ceiling effect and non-normally distributed data indicated that participants perceived the behaviour as easy and “under their control” from the beginning of the study. The lack of reliability of the scale at T2 and the high ratings at T1 (and T2) indicated that PBC was not a useful measure to include in the final analyses.

Repeated measures ANOVA. In order to determine whether participants in the intervention group developed more positive attitudes or perceptions of subjective norms than participants in the control group, a one-way repeated-measures ANOVA was used for each variable (Att, Supervisor Approval, Health and Safety Approval, Graduate Student Behaviour). This procedure allowed simultaneous examination of between- and within-participant differences (i.e., the differences in ratings over time and across conditions).

Ratings of one perceived subjective norm (perceived approval of the behaviour by the health and safety officer) increased significantly more in the intervention than control group. For this particular injunctive norm, the interaction between Time and Condition was significant, $F(1, 24) = 4.91$, $p = .04$, partial eta = $.17$. There was also a significant main effect of Time on its own, $F(1, 24) = 7.33$, $p = .012$, partial eta = $.23$, but no significant main effect of Condition on its own, $F(1, 24) = .43$, $p = .52$, partial eta = $.02$. Hence, participants in both groups increased their ratings of this injunctive norm, but the

increase was significantly greater in the intervention group than the control group. This interaction is depicted in Figure 12. Repeated measures ANOVAs for attitudes and the other two SN items did not show significant main effects or interactions ($p > .05$).

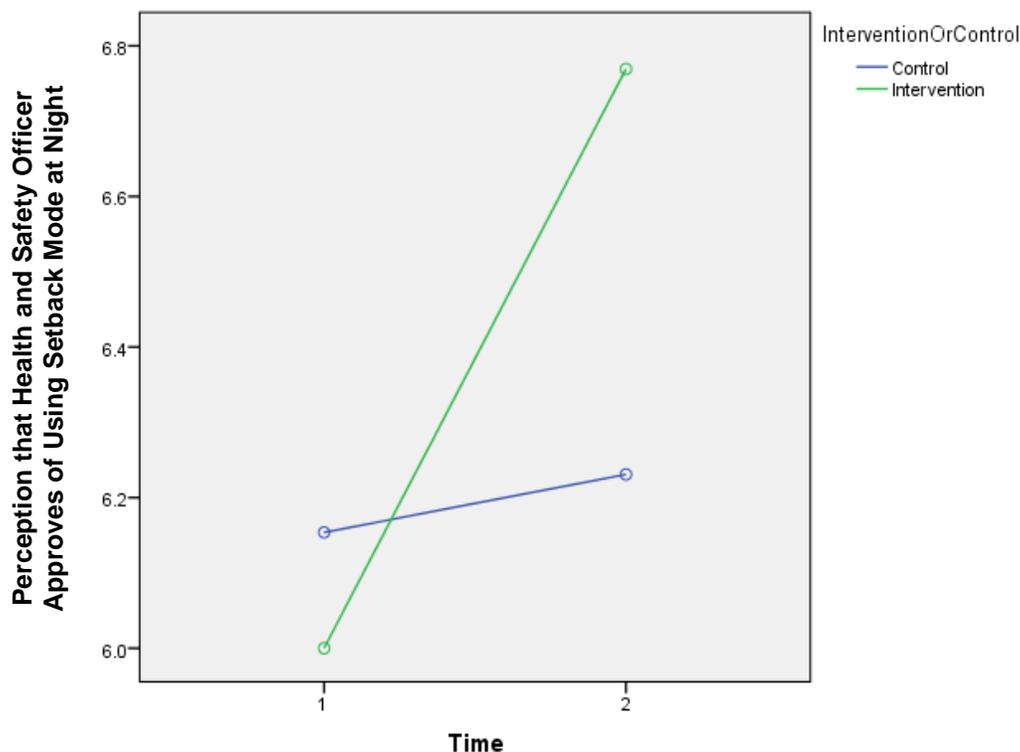


Figure 12. Interaction between Time and Condition for the SN item “approval of behaviour by health and safety officer.” Participants who engaged in an intention-strengthening exercise to encourage use of the setback switch, subsequently displayed a larger shift toward endorsing this subjective norm item than participants in the control group.

In order to be included in a repeated-measures analysis of variance, participants had to complete the base components questionnaire at both baseline and follow-up. Of the 67 participants who completed either questionnaire, 53 completed the baseline (T1) questionnaire, 41 completed the follow-up (T2) questionnaire, and 26 completed both questionnaires. Of those that completed both questionnaires, exactly half were in the

intervention group ($n = 13$) and half were in the control group ($n = 13$). Therefore, the remaining sample was rather small and many participants were not included in the analysis. With this relatively small sample size, finding the significant interaction between Time and Condition for an SN item indicated a relatively strong effect.

Arguably, examining the change in behaviour in only those participants who were involved in the study from the beginning could be the optimal approach for analysis of the data. Only for these participants could a genuine change (or absence of change) in base components be actually observed. Nevertheless, given that many participants had to be excluded from the analysis because of missing data, another potential problem could exist – a biased sample. Therefore, a linear mixed model analysis could be used as an alternative approach. For this approach, all participants' data was used, even those who did not complete both questionnaires. Although a real change in base components could not actually be observed in participants who only completed T1 or T2 questionnaires, these participants' information could be used to statistically infer a potential relation.

Linear Mixed Model Analysis. Using the lme4 package (Bates, 2005) in R, a separate model was constructed for the attitudes composite variable and each of the three SN items. For each model, the base model included the random effect of Participant. The effect of Time (baseline vs. follow-up) was added in the first step, then Condition (control vs. intervention) in the second step, and finally the Time*Condition interaction in the last step. Of particular interest was whether the addition of the *Time*Condition interaction* would explain significantly more variance than the other variables in the model. This would indicate that participants in the intervention group significantly increased (or decreased) their scores on those items as a result of the intervention (i.e.,

that strengthening intentions was associated with a change in at least one TPB base component following the intervention). Each model included a total of 93 base component observations across all 67 participants (who completed the questionnaire at T1 or T2).

For the SN item *approval of behaviour by health and safety officer*, the base model, which included only the random effect of Participant ($AIC = 279.14$, $df = 3$), was significantly improved by adding *time* as a fixed covariate ($AIC = 272.39$, $df = 4$), $\chi^2(1) = 8.74$, $p < .01$, but not further improved by adding *condition* as a fixed covariate ($AIC = 274.33$, $df = 5$), $\chi^2(1) = 0.06$, $p = .81$. However, adding the *Time*Condition* interaction did improve the model significantly beyond the main-effects-only model ($AIC = 272.21$, $df = 6$), $\chi^2(1) = 4.13$, $p = .04$. Therefore, after the intervention, participants in the intervention group significantly increased their perception of university health and safety officer approval of using SB mode overnight. This aligns with the findings from the repeated measures ANOVA reported earlier. Parameter estimates for each main effect and interaction can be seen in Table 6 below.

Table 6

*Fixed Effects for the model: Health and Safety Approval ~ Time + Condition + Time*Condition + (1 | Participant)*

	Estimate	Std. Error	t value
(Intercept)	5.88	0.24	23.98
Time: T2	0.14	0.22	0.67
Condition: <i>Intervention</i>	-0.21	0.31	-0.68
Time*Condition: T2 <i>Intervention</i>	0.61	0.3	2.1*

* $p < .05$

For the SN item *approval of behaviour by supervisor*, the base model, which included only the random effect of Participant ($AIC = 316.70$, $df = 3$), was not significantly improved by adding *time* as a fixed covariate ($AIC = 316.44$, $df = 4$), $\chi^2(1) = 2.27$, $p = .13$, nor was it further improved by adding *condition* as a fixed covariate ($AIC = 318.35$, $df = 5$), $\chi^2(1) = 0.08$, $p = .77$. Adding the *Time*Condition* interaction also did not further improve the model ($AIC = 320.34$, $df = 6$), $\chi^2(1) = .02$, $p = .9$.

For the SN item *behaviour of other graduate students*, the base model, which included only the random effect of Participant ($AIC = 364.23$, $df = 3$), was not significantly improved by adding *time* as a fixed covariate ($AIC = 366.06$, $df = 4$), $\chi^2(1) = 0.17$, $p = .68$, nor was it further improved by adding *condition* as a fixed covariate ($AIC = 368.03$, $df = 5$), $\chi^2(1) = 0.02$, $p = .88$. Adding the *Time*Condition* interaction also did not further improve the model ($AIC = 369.56$, $df = 6$), $\chi^2(1) = .47$, $p = .49$.

For the *attitudes* composite score, the base model, which included only the random effect of Participant ($AIC = 283.65$, $df = 3$), was not significantly improved by

adding *time* as a fixed covariate ($AIC = 283.35$, $df = 4$), $\chi^2(1) = 2.31$, $p = .13$, nor was it further improved by adding *condition* as a fixed covariate ($AIC = 285.30$, $df = 5$), $\chi^2(1) = 0.04$, $p = .84$. Adding the *Time*Condition* interaction also did not further improve the model ($AIC = 286.99$, $df = 6$), $\chi^2(1) = .32$, $p = .57$.

Behaviour

As a secondary objective, the effect of the intervention on participants' actual use of the setback switch was evaluated. For these analyses, fume hoods were excluded if they were shared by entire lab groups rather than assigned to specific lab users (e.g., used for chemical waste or special apparatuses, $n = 5$), if they had malfunctioning setback switches ($n = 2$), if they were used for light-sensitive chemical reactions²⁹ ($n = 2$) or if they were rented to private companies ($n = 2$). In all, 11 fume hoods were excluded and 44 were retained for the behavioural analyses. The dependent variable was dichotomous: for each fume hood on each night, the setback switch could be on ('1') or off ('0'). Before June 15, 2013 the automatic logging system did not have complete data for all fume hoods. Beginning on the first night that data was automatically logged (January 15, 2013), and ending on the last night of the study (October 24, 2014), 25,488 observations of fume hood setback switches were recorded. Of these, 10,560 took place from the beginning of the baseline period (Feb 27, 2014) to the end of the study. Fume hood setback switches were in the "on" position overnight for 56.7% of fume hood

²⁹ Fume hoods with light-sensitive reactions had windows that were always closed. Normally, lab users opened and closed the windows of their fume hoods regularly. Given the nature of these chemical reactions, these fume hoods could not be used "normally" and, thus, were excluded from the behavioural analyses.

observations overall, and 65.8% of observations beginning during the baseline phase of the study.

Attitudes, Subjective Norms and Behaviour. As part of the base components questionnaire, lab users were asked to indicate, on a map, the fume hood that was assigned to them. By correlating their responses with automatically logged data about the state of the setback switch for their particular fume hood, an association could be examined between base components and actual behaviour.

In all, 56 users indicated, on the map, which fume hood they used.³⁰ Fifteen of these only provided this information during the baseline phase,³¹ 13 only provided it during the post-intervention phase and 25 provided it during both the baseline and post-intervention phases. When a fume hood was shared by multiple users, their attitude composite measures and subjective norms items were averaged together (this happened for seven fume hoods at baseline and seven fume hoods during the post-intervention period). Thus, each fume hood identified by lab users had an associated attitudes composite variable and three subjective norms items for each night of the study.³² During the first baseline, these measures reflected all the data collected from participants during the first baseline period. During the second baseline, these measures further included all the data collected during the first and second baseline. During intervention period, these measures were collected again and, therefore, the measures of attitudes and social norms

³⁰ Many lab users did not identify their fume hood on the map because they wished to remain anonymous.

³¹ "Baseline," in this case, refers to the entire baseline period. Questionnaires were administered twice during this period to collect baseline data.

³² One of the difficulties of conducting field experiments is an inability to control participants' environments. Ideally, each participant would be assigned a unique fume hood and, thus, each participant's behaviour could be specifically related to his or her questionnaire responses. Unfortunately, this was not the case and, hence, this method of averaging was used to estimate the degree to which participants' attitudes and subjective norms corresponded with actual behaviour.

associated with each fume hood during and after the intervention period only reflected data collected during the intervention period (not during the baseline period).

During the two baseline periods, attitudes and subjective norms were significantly correlated with use of setback mode, but during and after the intervention period only attitudes were borderline significantly correlated with setback mode. The correlations between the percentages of nights fume hoods were left in setback mode and the associated attitudes or SN are generally moderate and positive. During and after the first baseline period, use of the setback switch was significantly correlated with attitudes ($r = .58, p < .01, n = 20, n_{nights} = 67$), and perceived supervisor approval ($r = .58, p < .07, n = 20, n_{nights} = 67$). During and after the second baseline period, it was correlated with attitudes ($r = .55, p < .01, n = 24, n_{nights} = 67$), perceived supervisor approval ($r = .43, p = .04, n = 24, n_{nights} = 84$), and perceived use of the switch by other graduate students ($r = .44, p = .03, n = 24$).³³ During and after the intervention period, use of the switch was borderline significantly correlated with attitudes ($r = .35, p = .07$), but not any of the three SN items (all p 's $< .05, n = 28, n_{nights} = 89$). These correlations can be seen in Table 7 below.

³³ During the second baseline period, base component scores were carried over from the first baseline period for fume hoods that did not have new data collected by the second baseline questionnaire.

Table 7

Correlations of percentages of nights using setback mode with ratings of attitudes, perceptions of supervisor approval, perceptions of health and safety approval and perceptions of other graduate students' behaviours

	First Baseline (<i>n</i> = 20)	Second Baseline (<i>n</i> = 24)	Intervention (<i>n</i> = 28)
Attitudes	<i>r</i> = .58**	<i>r</i> = .55**	<i>r</i> = .35‡
Supervisor Approves	<i>r</i> = .58**	<i>r</i> = .43*	<i>r</i> = .23
Health and Safety Approves	<i>r</i> = .29	<i>r</i> = .33	<i>r</i> = -.28
Perception of Graduate Students' Behaviour	<i>r</i> = .34	<i>r</i> = .44*	<i>r</i> = .1

Note: First baseline is during and after first baseline questionnaire was distributed (Feb 27 – May 4, 2014, 67 nights), *Second baseline* is during and after second baseline questionnaire was distributed (May 5 – Jul 27, 2014, 84 nights), *Intervention* is during and after intervention period (Jul 28 – Oct 24, 2014, 89 nights).

* *p* < .05, ** *p* < .01, ‡ *p* = .07.

Descriptive statistics of overall setback use. Detailed logs of the state of the setback switches were automatically compiled beginning January 15, 2013. However, a technical error resulted in the data from fume hoods on the South side of the second floor (later to become the “Control Group”) not being logged until June 15, 2013. Therefore, statistical analyses on the control group could only be conducted on data beginning after June 15th, 2013 (well before the baseline phase of the study). As seen in Figure 13, the percentage of fume hoods left in setback mode overnight (i.e., at 3am) generally

increased from 2013 to 2014, and may have increased after each contact with lab users (i.e., when questionnaires or interventions were administered).

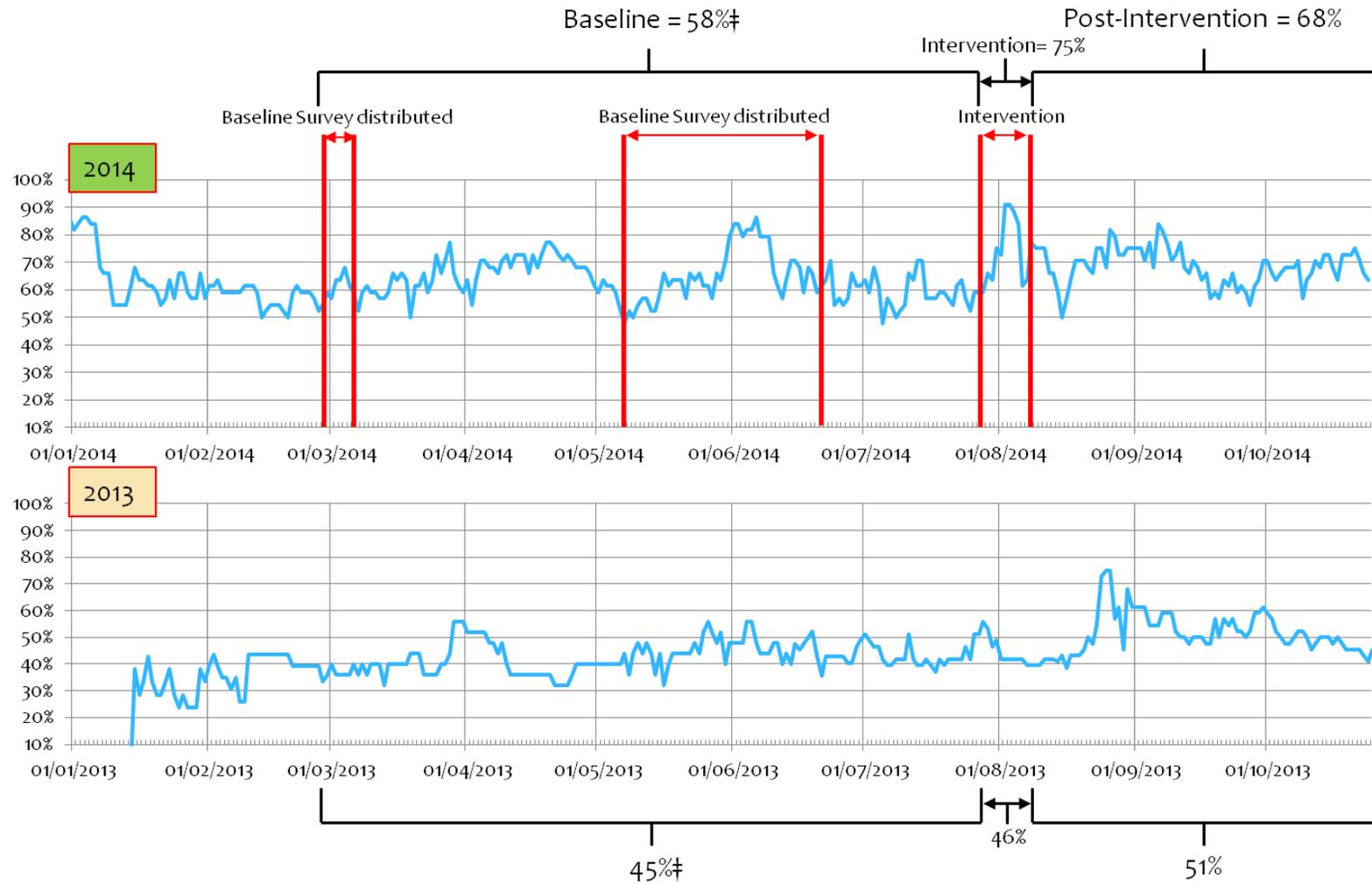


Figure 13. Percentage of fume hoods in setback mode at 3am. Overall percentage increased from 2013 (before any surveys or intervention were conducted) to 2014 (when the study took place). ‡Note: Only fume hoods that had data from February 27 2013 to July 27 2014 were counted during this period. For the other periods, data from all fume hoods was available and, therefore, percentages include all fume hoods.

Although use of setback mode generally increased from 2013 to 2014, small increases in use of the switch were also observed each time the researchers entered the labs or interacted with lab users (often just to inquire, via questionnaire, about use of the switch). During the period of administering the baseline questionnaire for the first time (February 27 to March 6, 2014), an increase in use of the Setback switch overnight for the fume hoods on the third floor and North side of the second floor (later to become the “intervention group”) was observed. Setback switch use increased from 51% to 56%, and then further increased to an average of 58% until the actual intervention began (July 28, 2014). During the same period in 2013 (February 27 to July 28) an average of 45% of setback switches were on each night.³⁴

The intervention period was two weeks long (July 28 to August 6, 2014) and, during this time, I met with each lab group individually (intervention and control groups). While interventions were ongoing, the mean percentage of setback switch use rose to 75% (across all labs). During the same period in 2013, no similar increase was observed (i.e., setback switch use remained at 46%).³⁵ In the months following the intervention (August 7 to October 24, 2014), setback switch levels remained relatively high (68%) compared to the year before (51%).³⁶

In comparing the control and intervention groups visually (by means of a graph seen in Figure 14), an increase in setback switch use after the intervention period appeared to primarily occur only for the intervention group (not the control group). Compared to the control group, the intervention group had initially lower levels of

³⁴ Only the intervention group data is included in this comparison because 2013 data for the control group was only available from June 15, 2013.

³⁵ Including fume hoods from both control and intervention groups.

³⁶ Including fume hoods from both control and intervention groups.

setback switch use *before* the intervention (*Intervention* = 58% vs. *Control* = 71%), but higher levels than the control group *after* the intervention (*Intervention* = 70% vs. *Control* = 66%).

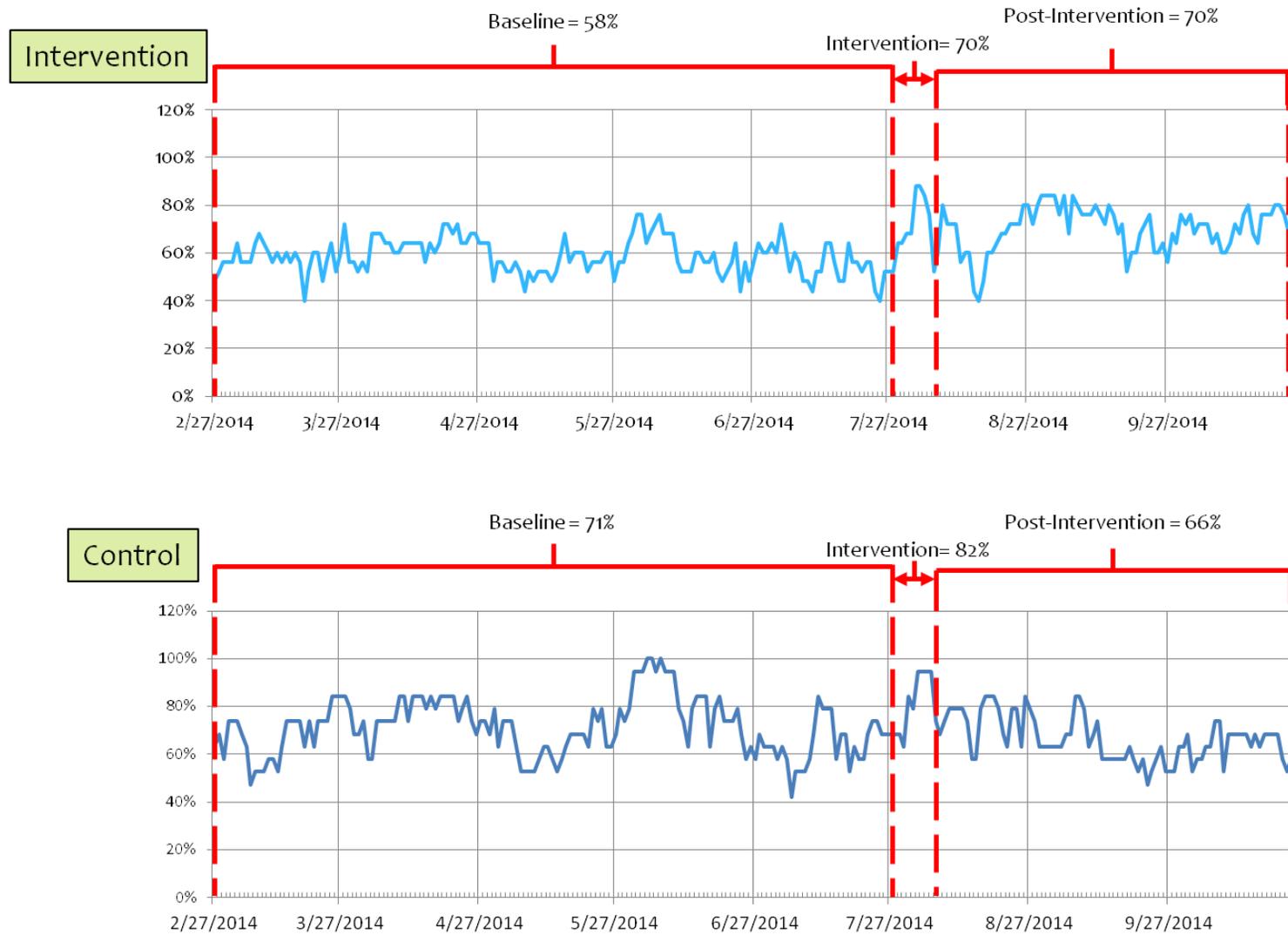


Figure 14. Percentage of fume hoods in setback mode at 3am (Feb 27 to October 24, 2014). Following the intervention, the percentage of fume hoods in setback mode increased for intervention group only.

Linear Mixed Effects Logistic Regression. A mixed effects model was used to determine if the state of the setback switch (on vs. off) could be predicted by study *Phase* (before vs. after intervention), *Condition* (intervention vs. control), or the *Phase*Condition* interaction. Of particular interest was the *Phase*Condition* interaction; participants in the intervention condition were expected to increase their use of setback mode *more* than participants in the control condition *after* the intervention. The base model consisted of only the random effect of *Fume Hood* and each main effect and interaction was added individually in subsequent steps. The base model made use of all 25,448 observations in 44 fume hoods, and each subsequent step included 10,120 observations across the same 44 fume hoods (observations during the baseline or post-intervention phases).

The base model ($AIC = 25817.3$, $df = 2$) was significantly improved with the addition of the *Phase* main effect ($AIC = 9068.3$, $df = 3$), $\chi^2(1) = 16751$, $p < .001$. Adding the *Condition* main effect did not further improve model fit ($AIC = 9069.7$, $df = 4$), $\chi^2(1) = 0.64$, $p < .42$. However, the addition of the *Phase*Condition* interaction did significantly improve model fit above and beyond the main-effects-only model ($AIC = 8967.3$, $df = 5$), $\chi^2(1) = 104.35$, $p < .001$. Thus, lab users generally used the setback switch more frequently after the intervention than before and, although there was no significant general difference between groups, those who were in the intervention group increased their use of the switch significantly more than the control group *after* the intervention. This relation can be seen in Figure 15. As shown Table 8 below, the odds of a fume hood being on SB mode overnight in the intervention condition were 1.68 times higher after the intervention ($1384/591 = 2.34$) than before ($2200/1575 = 1.28$). For the

control group, the odds of a fume hood being on SB mode overnight were slightly higher *before* ($2040/829 = 2.46$) than after the intervention ($996/505 = 1.97$), *odds ratio* = 0.8.

Table 8

Frequency of setback switch set to “on” overnight across phases and between conditions

	Baseline	Post Intervention	Odds Ratio
Control	$n = 2040$	$n = 996$	
	71.1%	66.4%	
	Odds = 2.46	Odds = 1.97	0.80
Intervention	$n = 2200$	$n = 1384$	
	58.3%	70.0%	
	Odds = 1.40	Odds = 2.34	1.68

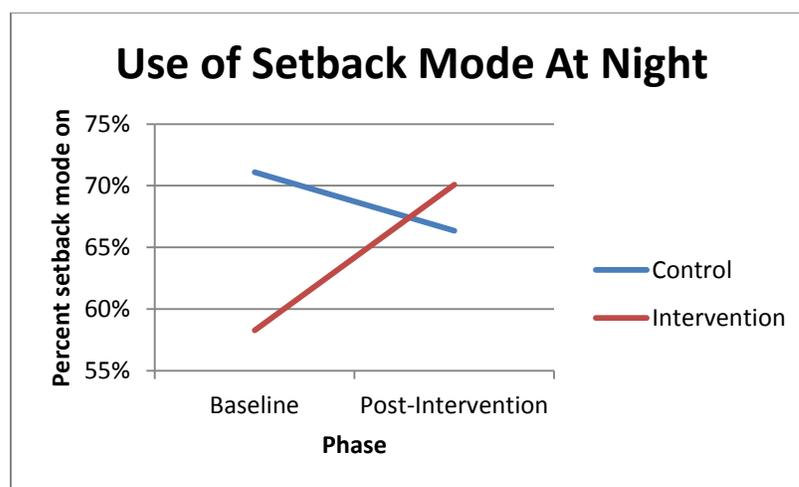


Figure 15. Percentage of observations of fume hoods set to setback mode overnight rose significantly in the intervention condition and decreased slightly in the control condition.

Interestingly, the intervention may have influenced an increase in use of setback mode despite (what appeared to be) only minimal participation in the actual intervention exercise. Among lab users in the intervention group, all agreed to engage in the intervention exercise, but some participants ($n = 8$) did not explicitly agree to put the “I use setback” sign on their fume hoods (i.e., they may have disagreed or they may have forgotten to check the box on the form which said “I agree”), and some ($n = 6$) did not explicitly set a goal to increase their use of the switch (because they stated they already used the switch 100% of the time). Casual observation of the labs approximately three weeks following the intervention also revealed that only three to four fume hoods in the intervention group (of approximately 20 that were individually assigned) had “I use setback” signs appended to them. Nevertheless, the intervention was successfully followed by a significant increase in switch use compared to controls.

Discussion

Potential Reverse Causality

Using a real-world setting, Study 3 successfully demonstrated that at least one base component can be influenced by intentions. In this case, one particular aspect of the base component *subjective norms* appeared to be affected. Lab users who set an intention to use the setback switches on their fume hoods more frequently, subsequently increased their perception that the university’s occupational health and safety officer approved of the behaviour (an important social referent, as determined by preliminary interview). During the intervention period, both the intervention and control groups were told that the occupational health and safety officer approved of using the setback switch overnight

(even if a chemical reaction was happening in the fume hood). However, only participants who also engaged in the intention-strengthening exercise (including *public commitment* and *mental contrasting with implementation intentions*) actually changed their perceptions significantly. Those who were not instructed to set an intention did not change their perceptions of health and safety officer approval. This, once again, suggests that intentions may potentially affect some aspects of subjective norms in a reverse-causal manner.³⁷

Changes in subjective norms following the setting of an intention are consistent with the false consensus effect (Ross et al., 1977). That is, once an individual sets an intention to engage in a behaviour, he or she subsequently begins to perceive that others also engage in that behaviour or approve of it – more than before the intention was set or action completed. Such may be the case for drug use; in which increased levels of use are associated with increased belief in a false consensus (e.g., Bauman & Geher, 2002; Botvin et al., 1992).

That this change in perceptions of approval of the health and safety officer was noted in a relatively small sample could indicate a robust effect. Attitudes, perceptions of other graduate students' use of setback mode, and perceptions of supervisor approval were not significantly affected by the intervention. Perceived behavioural control was an unreliable predictor of this behaviour (in this context), thus changes in the construct could not be assessed. In a larger sample, or using a different target behaviour, some of these other base components may have potentially been affected by intention-setting as well.

³⁷ Participants' Att, SN and PBC regarding setback mode were assessed immediately after their lab meetings, before the opportunity to actually use setback mode. Therefore, the change in ratings for "Health and Safety Officer approval" could only attributed to the intention-strengthening exercise and not to behaviour change.

Indeed, in addition to having only a small sample to work with, most participants also provided relatively high ratings for each base component from the beginning of the study. Therefore, little room remained for increases following the intention-strengthening intervention. However, Fishbein and Ajzen (1975) also explain that not every base component plays a significant role in every behaviour. If, for example, if a behaviour is always easy and under a participant's control, then perceived behavioural control (PBC) would not be a determining factor. Similarly, attitudes and subjective norms are not expected to be significant predictors in every case.

Although perceptions of approval by the university's health and safety officer may have increased significantly for the intervention group, this particular factor did not appear to play a role in actual use of the setback switch. For the subsample of participants who chose to indicate which fume hood they used at baseline or post-intervention, other factors, such as attitudes toward using the switch, approval of the behaviour by their direct supervisor and the perceptions of other graduate students' use of the switch, were more strongly related to actual setback switch use. Attitudes toward use of setback mode, in particular, were most strongly related to actual use of the switch during each time period. Perceived approval of the behaviour by the health and safety officer *was not correlated with behaviour* at any of the three time points. This could potentially indicate that this idea was less important, as it was not involved in the decision to act. Similar to Study 2, perceptions that were relevant to the behaviour were less flexible and changeable than perceptions that were irrelevant to the behaviour. Similarly, weakly held beliefs, and beliefs of people who are not highly involved in a behaviour, tend to be more easily changed than strongly held beliefs (Petty, Haugtvedt, & Smith, 1995). Additionally,

attitudes that are deemed important to an individual are more resistant to persuasion than unimportant attitudes (Jacks & Devine, 2000; Zuwerink & Devine, 1996).

Behaviour – Actual Use of Setback Mode Overnight

One promising additional finding from Study 3 was that participants in the intervention group significantly increased their use of setback mode overnight as compared to the control group. The *mental contrasting with implementation intentions* (MCII) exercise, combined with a public commitment component may have influenced a positive change in behaviour. This extends previous research on the MCII to the realm of pro-environmental behaviour. Traditionally, this method of self-motivation was primarily restricted to health-related behaviours (e.g., eating fruits and vegetables - Stadler et al., 2010). These results were presented to the University of Victoria Office of Sustainability and plans are being developed to use this intervention in other, potentially similar, contexts. Experience with this study also elucidated several potential improvements for the intervention that could be implemented (e.g., better encouragement of public commitment).

Interestingly, participants' use of setback mode appeared to increase slightly any time the research team interacted with them *for any reason*. Questionnaire administration during each baseline period lasted several weeks and, during that time, members of the research team were in the chemistry labs regularly, asking lab users to complete the questionnaire. Each time researchers entered the labs to simply ask questions about lab use (i.e., during administration of baseline questionnaires), use of setback mode overnight increased. Setback mode rates were especially high *during* the intervention period, when

I met with each lab during their official lab meetings. Although, use of setback mode appeared to generally increase from 2013 (before the study) to 2014, an additional effect of *study phase* was also observed. During any point in which researchers interacted with lab, users a slight increase in behaviour was observed – even if researchers only administered a questionnaire asking lab users about their thoughts on using the switch without an explicit plea to use the switch more often. Personal values and attitudes may only affect behaviour if they are salient at the moment when the behavioural opportunity arises. Possibly, the questionnaire made lab users’ positive attitudes toward using setback mode more salient, and this motivated behaviour in the moment, or lab users felt accountable to the researchers for enacting the behaviour (that they reportedly supported).

In the context of the current study, the presence of researchers in the lab could not be empirically *proven to cause* the increased use of setback mode, although this remains the most likely explanation. Anecdotally, there appeared to be a sense of accountability and guilt on the part of lab users for not using the switches when researchers were present. After all, answers on the base components questionnaire suggested that most lab users endorsed use of the setback switch and felt it was important. When the researchers were present, lab users may have felt the pressure of these beliefs more strongly. After the first day of baseline questionnaire administration, one lab user spontaneously decided to append a hand-written reminder to her fume hood stating “Set back mode at night.” Thus, an additional recommendation to the University of Victoria Sustainability Office was simply to survey lab users about their opinions on using setback mode once every few months.

Limitations and Future Research

As with most field studies, external validity for this study was relatively high but many variables were difficult to control. As such, the primary limitation was the quasi-random (rather than completely random) assignment of participants to control or intervention groups. Although a coin flip was used to determine which lab groups were assigned to control or intervention conditions, the members of those labs could not be further randomized to particular fume hoods. Hence, the general “culture” of each lab could have been influential in how they responded to the intervention. That is, the characteristics of each lab user and lab group could be an alternative explanation for the observed change in behaviour and perceptions of subjective norm.

Another limitation was the lack of reliability for the SN and PBC subscales. At least two explanations are possible for why these variables were not measured more successfully. First, as a result of the requirement of brevity, only three questions could be employed for measuring subjective norms. The three items that were chosen reflected a wide breadth of ideas within the construct of “subjective norms” but, with only three questions, not enough shared variance existed among them to achieve an acceptable alpha level. The second explanation was that participants had surprisingly strong positive thoughts about using setback mode from the beginning of the study. For PBC, the ceiling effect was particularly high. If the target behaviour was made to appear more difficult, or if questions could be answered using a continuous off-centre scale (as in Study 1 and 2) rather than a standard 7-point likert scale, then the likelihood of a ceiling effect would be reduced and more variability would be observed among scores. Unfortunately, given that

the questionnaires were completed on paper, rather than computer, continuous-format questions were not feasible.

Future research could build on Study 3 by examining other behaviours, or by examining the same behaviour with multiple different types of interventions. In this study, the effects of mental contrasting, implementation intentions, goal setting, obstacle brainstorming, and public commitment could not be teased apart. In a future study using this style of intervention with a larger group of participants, researchers could implement several different sub-types of the intervention on several different groups. If each intervention consisted of only one or two components of the intervention that was used in Study 3, then researchers could compare groups to determine which aspects of the intervention were most important (or if the combination of components was required).

CHAPTER 6

Overall Discussion

Taken together, results from Study 1, Study 2 and Study 3 support the hypothesis that intentions may affect attitudes, subjective norms and perceived behavioural control in a reverse-causal direction. These studies also showed that intentions were good predictors of behaviour and that strengthening intentions could increase the likelihood of action. Interestingly, however, the most malleable base components (those most likely to change) were the ones that were least associated with behaviour.

Intentions Influencing Base Components: Reverse Causality

Using cross-lagged correlations (Study 1), a laboratory-based experiment (Study 2) and a field experiment (Study 3), this dissertation successfully demonstrated that the TPB model of behaviour should be updated to include a reverse-causal relation between intentions and base components (Att, SN, and PBC). Although a traditional forward-causal TPB model is certainly plausible, this series of studies suggests that a reciprocal model is also plausible, as shown in Figure 16.

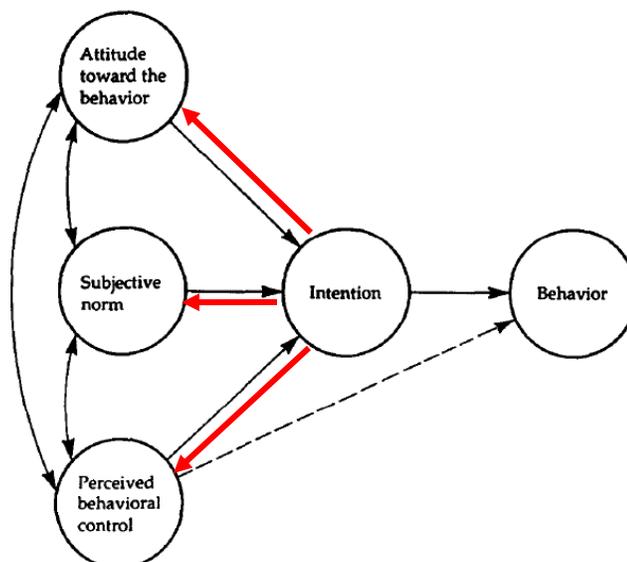


Figure 16. Modified theory of planned behaviour (TPB).

Study 1 used cross-lagged correlations to examine, statistically, if forward-causal associations between base components and intentions were more likely than reverse-causal explanations. Cross-lagged correlations for Att-Int and SN-Int indicated that forward-causal and reverse-causal explanations were both equally plausible and, in fact, a reciprocal relation was most likely.³⁸ After partialling out the effects of auto-correlations and shared variance among base components, attitudes were found to be most likely to influence intention-setting and intention-setting was, in-turn, most likely to influence subjective norms. That is, Study 1 demonstrated that attitudes toward supporting the Ancient Forest Alliance led participants to set an intention to do so (forward-causality) but in addition, once an intention was set, that decision led subjective norms to fall in line with the intention (reverse-causality). Thus, both forward- and reverse-causal models appeared plausible. Study 1 employed a correlational design and, in discussing causality,

³⁸ The reverse-causal model was slightly (non-significantly) stronger than the forward-causal model for SN. Both models were equally probable for Att and PBC.

randomized control trials (rather than cross-lagged correlations) are widely agreed to offer the most conclusive evidence.

Study 2 employed a randomized controlled experiment to find that attitudes, subjective norms and perceived behavioural control could change as a result of intention-setting. Using a free-choice paradigm, individuals who decided between supporting two similarly ranked environmental organizations subsequently displayed a larger positive difference between the chosen organization and the rejected organization in terms of attitudes, subjective norms and perceived behavioural control. Primarily, this was a result of reduced support for the rejected organization (Att, SN and PBC) but, in the case of attitudes, an increase in support for the chosen organization was also noted. Individuals who were randomly assigned to the control group (and not asked to make this choice) did not experience this pattern of shifting Att, SN or PBC.³⁹ Study 2 was the clearest demonstration that setting an intention can affect TPB base components. However, the chief limitation of the study was that it was conducted in a laboratory setting with strictly controlled external variables.

Study 3 built on the findings of Study 1 and Study 2 in a quasi-random field experiment. The purpose was to test the reverse-causal model in a more “real-world” setting. By strengthening the intentions of chemistry lab users to change their behaviour, participants subsequently became more positive in their perceptions of one aspect of social norms; they were more likely to perceive that the university health and safety officer approved of their behaviour. More specifically, if participants were guided to use the MCII method and state a public commitment to use their fume hoods’ Setback

³⁹ As discussed later, this was particularly clear for individuals who did not voluntarily make an initial commitment to support an organization before the study began.

switches more frequently, they subsequently believed that this important social referent would approve of their behaviour. Participants randomly assigned to the control group did not experience this shift in perception.

Relevance to behaviour. One particularly interesting addendum to the findings of Study 2 and Study 3 was that base components that were most likely to be influenced by intentions were those that were least likely to be relevant to actual behaviour. In Study 2, the individuals who were “willing to commit” to supporting one of the four environmental organizations before the study began were *most likely to actually take action* to support that organization but also *least likely to experience a shift in Att, SN or PBC*. These participants showed a relatively fixed pattern of Att, SN and PBC regardless of whether they were made to choose an organization to support during the study or not.

Individuals who *did not* make an initial commitment to one of the organizations had generally more malleable Att, SN and PBC ratings for the organizations ranked second and third. If they were made to choose between two organizations to hypothetically support (ranked second or third), they subsequently displayed a *spreading of alternatives* between the chosen and rejected options (in terms of Att, SN and PBC). If they were not made to choose between two organizations, they showed the opposite pattern (compression of alternatives because of regression to the mean). Participants who made an initial commitment to supporting an organization before the study began displayed neither a significant spreading of alternatives, nor a significant regression to the mean.⁴⁰

⁴⁰ One notable exception for individuals who made an initial commitment: they displayed a *spreading of alternatives* in terms of their attitudes toward the chosen (versus rejected) organization. After choosing between second and third-ranked organizations they showed significantly more positive attitudes toward the chosen organization.

In Study 3, participants significantly increased their perceptions of approval by the health and safety officer after setting intentions to engage in the behaviour of fume hood Setback switch use. However, this particular aspect of social norms (safety officer approval) was not significantly correlated with the actual behaviour of Setback switch use before or after the intervention.⁴¹ Thus, in both Study 2 and Study 3, attitudes, subjective norms and perceived behavioural control were liable to change after setting an intention, but they were less likely to change if they were relevant and important for predicting behaviour.

Perhaps the best explanation for this effect is that *important* perceptions are less susceptible to change than less important perceptions. In this case, justifying behaviour using particular base components may raise the importance of those base components. If, for example, a participant thinks “I am doing this behaviour primarily because everyone else is doing it” then the importance of subjective norms is mentally increased for this participant and, thus, the perception of subjective norms will be less likely to change as a result of setting an intention. Attitudes (e.g., “this behaviour is important”) and perceived control (e.g., “this behaviour is easy”), on the other hand, might be less important and, thus, potentially more likely to change. This idea stems from research on attitudes, in which stronger (and more central) attitudes are less likely to change than weaker (and more peripheral) attitudes (Jacks & Devine, 2000; Petty et al., 1995; Zuwerink & Devine, 1996).

⁴¹ Overall attitudes toward using Setback mode, perception of supervisor approval, and perception of other graduate students’ behaviour *were* associated with actual use of Setback mode before (and somewhat after) the intervention.

Intentions and Behaviour

As suggested by the theory of planned behaviour, intentions were the best predictor of behaviour in all three studies. In Study 1, intentions to support the Ancient Forest Alliance were measured at two time points along with Att, SN and PBC, and the best predictor of actual behaviour at Time 3 was intentions (at T1 and T2).

In Study 2, participants were asked if they were willing to set an intention to support an environmental organization before the study began. Those who stated they were “willing to commit” were 19.31 times more likely to take action than those were not “willing to commit.” If they were allowed the option of supporting their top-ranked organization (i.e., they were in the control group), they were 31.15 times more likely to support the organization if they set an initial intention than if they did not.

In Study 3, chemistry lab users in the intervention group participated in intention-strengthening (MCII) and public commitment exercises. Those participants subsequently increased their rates of fume hood Setback switch use from 58% to 70%, while those in the control group decreased their use of Setback mode slightly from 71% to 66%.

Together, results from all three studies support the TPB model’s assertion that intentions may be the best predictor of behaviour. Furthermore, Study 3 empirically demonstrated that a strategy of *mental contrasting* plus *implementation intentions* and *public commitment* could potentially increase the likelihood of real action. This could be a useful method of encouraging action among motivated individuals.

Implications and Applications

The theory of planned behaviour is among the most well-known and thoroughly investigated explanations for action (or inaction) in psychology. With well over 1,000 studies evaluating and applying the theory, its influence is far-reaching. Yet, the basic premise of the theory and the implied causality among its constructs had not been well studied. In addition to presenting a modification of the theory, the purpose of this dissertation was to bring to light some of the basic issues regarding theory testing in psychology.

Often, theories in social and environmental psychology are presented and tested exclusively with cross-sectional self-report data. Many of these theories propose relations among constructs that are unidirectional or contain (implied or explicit) causal pathways. However, the “proof” for these pathways stems from survey data and statistical analyses rather than experimental manipulation of independent variables and observation of actual behaviour. In re-examining one of the most well-known and well-established theories in social psychology, I found that systematic experimentation, randomized control trials and field-testing were rarely conducted. Indeed, these types of experiments may be challenging to construct, and require considerable creativity, but ultimately offer the highest level of support for a psychological theory to explain human behaviour. Future psychology theories should strive for this level of rigorous testing and support.

In addition to the theoretical implications of this research, practical policy implications may be drawn as well. In particular, this research serves to better explain the relation between pro-environmental behaviour, intentions, attitudes, subjective norms and perceived behavioural control. The better these constructs are understood, the better one

may understand how to change them and encourage pro-environmental thoughts, feelings and behaviours. In particular, this research suggests that, in some cases, directly encouraging pro-environmental behavioural intentions may have the dual benefit of increasing behaviour and changing attitudes, subjective norms and perceived control regarding the behaviour. Although MCII and public commitment are not new, this dissertation further establishes them as effective methods for encouraging pro-environmental behaviour. Importantly, however, the secondary benefits of intention setting may only occur if the attitudes, subjective norms, and perceived behavioural control beliefs are not seen as directly related to the behaviour.

Application to previous research. Given that TPB base components can change in response to setting an intention, previous research on the effects of public commitment, goal setting, cognitive dissonance or policy-based behaviour change may be expanded. Studies in these areas suggested that intention setting or engaging in behaviour could result in attitudes or perceptions of control changing, but the studies presented here further explain that subjective norms may also change.

For example, in one study of public commitment (Cialdini, 1971), participants were asked to subtly make clear to others that they supported a given position on expansion of U.S. federal power (i.e., imply commitment to a given position). Subsequently, those who were asked to state their support for expansion were more likely to actually support it, and those who were asked to oppose expansion believed the opposite. With the results of the series of studies presented in the current dissertation, I can now further hypothesize with some confidence that, had the authors asked participants if they perceived that others agreed with their position, they would also find

that participants' perceptions of norms regarding the expansion would be in line with their position. One contribution of this research is that subjective norms, like attitudes, are likely to change in response to public commitment.

Similarly, this dissertation suggests that implemental mindsets may be associated with changes in subjective norms. In one study, individuals who were told to focus on a complex task that they had set an intention to accomplish within the next three months subsequently displayed positive illusions about their control over the goal behaviour (Taylor & Gollwitzer, 1995). Those told to focus on a complex task that they were currently deliberating ("Should I... or should I not...") did not experience this heightened sense of control. That is, individuals in an implemental mindset (who set an intention to act) experienced increased perceived behavioural control. Based on the results of this dissertation, I further hypothesize that these individuals likely also perceived that others supported their intentions (i.e., perceived norms became more supportive) and that their goal was more desirable to achieve (i.e., more positive attitudes toward the behaviour or the behaviour would feel better to achieve). Indeed, individuals in this study who were induced to experience an implemental mindset expressed generally more positive feelings. Perhaps this was indicative of an increase in their affective attitudes toward the behaviour. This was another contribution of the current dissertation – attitudes change as a result of setting an intention (and experiencing an implemental mindset).

In some cases, pro-environmental policy changes result in subsequent pro-environmental attitude change. This may be because policies directly force intention-setting and behaviour change. For example, before tolls were implemented for downtown driving during peak hours, residents of Stockholm showed little support for the proposal

(Brundell-Freij, & Jonsson, 2009). After a trial period, however, residents' attitudes became more positive toward the road tolls and, ultimately, a referendum decision was made to keep them permanently.⁴² In this study, the authors hypothesized that residents voted in favour of the tolls because cognitive dissonance caused attitudes to change; residents believed that congestion was reduced and, therefore, could not maintain unsupportive attitudes toward the tolls. I submit that, in addition to attitude change, residents perceived a change in subjective norms such that most others appeared to support the tolls as well. These two factors together may have been responsible for the referendum decision to keep the tolls. The results of my studies demonstrate that subjective norms may change in concert with attitudes as a result of policy change.

Application to diffusion of pro-environmental behaviour. Why should we care if base components that are irrelevant to behaviour are altered as a result of intention-setting? One compelling reason is the implication for interpersonal communication and social influence. Although a given TPB base component (Att, SN or PBC) may not matter for one particular individual who has set an intention to engage in a behaviour, it may be important for another individual considering the same behaviour. When the first individual discusses reasons for taking action with the second, he or she may cite Att, SN and PBC explanations (even if it was not important for him or her). This increases the persuasiveness of the message and makes behavioural adoption more likely by the second individual. In this way, a behavioural intention (and consequent behaviour) can spread through a social network. I shall explain further by means of a hypothetical example.

Erez sets an intention to use his bicycle to commute to work. Although his intention to ride a bicycle was initially based on his attitudes toward cycling (“Cycling

⁴² Public transportation options were also expanded as part of the toll program.

will make me healthier”), his perception of norms subsequently changed to fall in line with his intention (“Ever since setting my intention to ride to work, I feel like everyone else is also riding to work”); this is similar to the results of Study 1. Raphael is not planning to ride to work and is not particularly motivated by his attitudes toward cycling (“I know that cycling is good for my health but I already go to the gym”). However, Raphael is highly agreeable and cares a great deal about social norms and what others think. When Erez discusses cycling with Raphael, he will not only mention the “attitude” reasons for cycling (“it’s healthy), but also the “subjective norm” reasons as well (“everyone does it... and you should too, if you want to remain popular”). Raphael is convinced to try commuting by bicycle for subjective norm reasons but not “attitude” reasons. Had Erez not set an intention to cycle, he might not have perceived a favourable subjective norm and, therefore, he would have refrained from using it as an argument for cycling. Without this argument, Raphael would not have been convinced to take up cycling and the behaviour would cease to diffuse through the social network.

On a general level, the findings from this dissertation help to explain how people change their minds. As individuals set intentions to engage in a behaviour, they become convinced of its importance on several levels (Att, SN and PBC). This also facilitates diffusion of the behaviour because people who do the behaviour are more motivated to share it others.

The lessons for organizations implementing pro-environmental policies are that targeting behavioural intentions directly may be beneficial. As shown in this dissertation, pro-environmental intentions are likely to be followed by observable actual behaviour (not just self-reported behaviour). Additionally, this dissertation shows that encouraging

pro-environmental intentions may result in changes to base components. These base components may not be directly related to behaviour, but they could still be helpful in terms of communication with others or long term persistence of the behaviour. More generally, this dissertation shows that individuals “change their minds” about a pro-environmental behaviour once they’ve set an intention to do it. Hence, using public commitment or the MCII approach to directly influence intentions may be useful in the real world for addressing a wide variety of environmental problems (e.g., energy saving, pollution reduction, or waste diversion).

Immediate impact. In conducting the three studies of this dissertation, I worked closely with several on- and off-campus environmental organizations. During and after conducting each study, I met with the organizations involved and suggested ways to use my findings to increase their effectiveness. The Ancient Forest Alliance used the results of my pilot study to modify the way they present themselves to the public and how they discuss their dual goals of protecting forests and forestry jobs. The Office of Campus Sustainability at the University of Victoria invited me to write a report on my findings and present the research at one of their quarterly meetings. With my help, they also designed an intervention strategy to encourage ongoing use of setback mode by fume hood users.

Limitations and Future Directions

Despite some of the relative advantages of the three studies presented in this dissertation, the results remain limited in several ways. In general, the studies had a drawback common to many psychology studies of this nature: they were conducted on a

university campus. As such, participants were primarily mid- or high-socioeconomic level students with above average levels of education. Studies 1 and 2 included primarily first-year psychology students who participated in exchange for course credit. Therefore, these samples were also primarily females in their early 20s. Despite Study 3 having more external validity, results from all three studies may not translate perfectly to off-campus individuals as the settings and behaviours were controlled and specific.

One limitation that was more specific to the studies presented here was a lack of consistent measurement of perceived behavioural control in Study 1 and Study 3. In these two studies, the measurement of the construct was unreliable or showed a pronounced ceiling effect. Partially as a result of the nature of the construct (consisting of two quite different subparts – control and ease), and partially as a result of the nature of the behaviours being measured (objectively easy, or consisting of several different options), PBC was not a useful measure for these two studies. Although other researchers have also privately lamented the measurement of PBC,⁴³ this construct is a key aspect of the TPB. Study 1 and Study 3 were, therefore limited in what they could say about the relation between intentions and TPB base components. Study 2 of this dissertation, however, reformulated the PBC subscale and made use of specific behaviours that varied in difficulty, thus allowing a more reliable PBC measure. Future research could build on this strategy for measuring and testing PBC within the theory of planned behaviour.

⁴³ In private conversation, I have discussed this issue with several environmental psychology researchers who have admitted experiencing similar problems.

Overall Conclusions

Ajzen's original conception of the theory of planned behaviour was derived from Fishbein and Ajzen's theory of reasoned action which was, in turn, developed from Dulany's theory of propositional control. These researchers refined and redefined notions of attitudes and beliefs, and popularized the expectancy-value model of attitudes. They were the first to propose a causal sequence amongst beliefs, attitudes, subjective norms, perceived control, intentions and behaviour. Later, the theory of planned behaviour was expanded to include two aspects of attitudes (instrumental and affective), two aspects of subjective norms (injunctive and descriptive), and two aspects of perceived behavioural control (self-efficacy and controllability). Today, many additional constructs have been proposed and debated for inclusion in the theory of planned behaviour. The theory has grown and evolved over many years, through numerous iterations and alterations.

Nevertheless, since the inception of this now influential theory, support for its basic premise remains somewhat scarce. That the base components (attitudes, subjective norms and perceived behavioural control) influence intentions which, in turn, influence behaviour has generally been assumed, with relatively scarce experimental support. Early theorists questioned this basic premise and the few studies that have examined the causal sequence of events returned with equivocal support for the idea. Furthermore, no study had explicitly tested the notion that intentions might also influence a change in base components in a reverse-causal sequence.

This dissertation presents support for a reverse-causal influence of intentions on attitudes, subjective norms and perceived behavioural control. The support comes in the form of correlational, experimental and field-tested data. Thus, it is robust and

comprehensive evidence of a reverse-causal (or possibly reciprocal) relation between intentions and TPB base components. Perhaps, therefore, this could be the next evolution of the highly influential and useful theory of planned behaviour.

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Appendices

Appendix 1 – Qualitative TPB Questionnaire

Part 1: About You

Please provide us with the following information about yourself by typing in your responses to the questions below.

- 1 What is your gender (e.g., "m", "f" or "other")?
- 2 In which year were you born (e.g., 1983)?
- 3 How many years of post-secondary have you completed?
- 4 What is your major, or probable major?
- 5 Last four digits of your student number: V00XX-_____
- 6 Last four digits of your phone number: 250-XXX-_____

Part 2: The Ancient Forest Alliance

Please read the following paragraph and then click on the "Survey" tab below

“The Ancient Forest Alliance (AFA) is a British Columbian organization working to protect the endangered old-growth (never-before-logged) forests of BC and to ensure sustainable forestry jobs in the province. They are currently engaged in a campaign to lobby the government to stop logging old growth forests and, instead, transition into a second-growth, value-added forest industry. In this new industry, logging would occur at a slower and more sustainable rate, and wood products would be more often manufactured in BC. The AFA sees this as a way to protect jobs and preserve the forests that have never been logged.”

Please take a few minutes to tell us what you think about supporting the Ancient Forest Alliance (AFA). The organization has asked supporters to engage in one or more of the following actions (i.e., ANY of these actions would constitute support for the AFA):

1. reading a brochure about the Ancient Forest Alliance
2. signing a petition to show your support for the Ancient Forest Alliance
3. signing up for a mailing list in order to receive updates about the Ancient Forest Alliance’s campaign and activities (e.g., protests and rallies)
4. donating cash/change to the Ancient Forest Alliance to support their campaign (even less than a dollar is OK)
5. becoming a member of the Ancient Forest Alliance
6. signing and sending a letter to be sent to your MP supporting the Ancient Forest Alliance’s campaign (the letter is already written and we can send it on your behalf)

Part 3: Three Questions

Support for the AFA could include any of the following:

1. reading a brochure about the Ancient Forest Alliance
2. signing a petition to show your support for the Ancient Forest Alliance
3. signing up for a mailing list in order to receive updates about the Ancient Forest Alliance's campaign and activities (e.g., protests and rallies)
4. donating cash/change to the Ancient Forest Alliance to support their campaign (even less than a dollar is OK)
5. becoming a member of the Ancient Forest Alliance
6. signing and sending a letter to be sent to your MP supporting the Ancient Forest Alliance's campaign (the letter is already written and we can send it on your behalf)

In the following section, there are no right or wrong answers; we are merely interested in your personal opinions. In response to the questions below, please list the thoughts that come immediately to mind.

What (if any) are the advantages/benefits of supporting the Ancient Forest Alliance? These can be personal, societal, community-wide, among friends, etc. (remember, "support" constitutes doing one or more of the activities listed above). Please take your time and use full sentences.

What (if any) are the disadvantages/drawbacks of supporting the Ancient Forest Alliance? These can be personal, societal, community-wide, among friends, etc.

What else comes to mind when you think about supporting the Ancient Forest Alliance by doing any of the activities listed above?

Part 4: Four Questions

Support for the AFA could include any of the following:

1. reading a brochure about the Ancient Forest Alliance
2. signing a petition to show your support for the Ancient Forest Alliance
3. signing up for a mailing list in order to receive updates about the Ancient Forest Alliance's campaign and activities (e.g., protests and rallies)
4. donating cash/change to the Ancient Forest Alliance to support their campaign (even less than a dollar is OK)
5. becoming a member of the Ancient Forest Alliance
6. signing and sending a letter to be sent to your MP supporting the Ancient Forest Alliance's campaign (the letter is already written and we can send it on your behalf)

When it comes to supporting the Ancient Forest Alliance using one or more of the behaviours listed above, there might be individuals or groups who would think you should or should do it.

Please list any individuals or groups who would approve of you supporting the Ancient Forest Alliance. (remember, “support” constitutes doing one or more of the activities listed above)

Please list any individuals or groups who would disapprove of you supporting the Ancient Forest Alliance.

Sometimes, when we are not sure what to do, we look to see what others are doing. Please list the UVic students (or types of students) who you think are most likely to support the Ancient Forest Alliance? (please do not use names)

Please list the UVic students (or types of students) who you think are least likely to support the Ancient Forest Alliance? (please do not use names)

Part 5: Two Questions

Support for the AFA could include any of the following:

1. reading a brochure about the Ancient Forest Alliance
2. signing a petition to show your support for the Ancient Forest Alliance
3. signing up for a mailing list in order to receive updates about the Ancient Forest Alliance’s campaign and activities (e.g., protests and rallies)
4. donating cash/change to the Ancient Forest Alliance to support their campaign (even less than a dollar is OK)
5. becoming a member of the Ancient Forest Alliance
6. signing and sending a letter to be sent to your MP supporting the Ancient Forest Alliance’s campaign (the letter is already written and we can send it on your behalf)

The next questions pertain to actually performing any of the actions listed above

Please list any factors or circumstances that would make it likely or easy for you to engage in any or all of the 6 actions listed above.

Please list any factors or circumstances that would make it less likely or difficult for you to engage in any or all of the 6 actions listed above.

Thank you for completing this survey! Please inform the researcher that you are finished

Appendix 2 – Draft 2 of Quantitative TPB Questionnaire

Attitudes							
Support for the AFA could include <i>any</i> of the following:							
1. reading a brochure about the Ancient Forest Alliance							
2. signing an AFA petition to protect British Columbia's endangered old-growth forests and forestry jobs							
3. signing up for a mailing list in order to receive updates about the Ancient Forest Alliance's campaign and activities (e.g., protests and rallies)							
4. donating cash/change to the Ancient Forest Alliance to support their campaign (even less than a dollar is OK)							
5. becoming a member of the Ancient Forest Alliance							
6. signing a letter to be sent to your MP supporting the Ancient Forest Alliance's campaign (the letter is already written and we can send it on your behalf)							
Please answer each of the following questions by circling the number that best describes your opinion. Some of the questions may appear to be similar, but they do address somewhat different issues. Please read each question carefully.							
For me, supporting the AFA is...	1	2	3	4	5	6	7
Worthwhile							A waste of time
Socially responsible							Socially Irresponsible
Important							Unimportant
Foolish							Wise
Useful							Useless
Good							Bad
Satisfying							Unsatisfying
Necessary							Unnecessary
Pleasant							Unpleasant
Supporting the AFA would make me feel...	1	2	3	4	5	6	7
Good							Bad
Positive							Negative
Favourable							Unfavourable
Happy							Sad
Satisfied							Unsatisfied

Preserving forestry jobs (such as loggers and saw-mill workers) would make me feel...	1	2	3	4	5	6	7	
Good								Bad
Positive								Negative
Favourable								Unfavourable
Happy								Sad
Satisfied								Unsatisfied
Preserving ancient forests is...	1	2	3	4	5	6	7	
Worthwhile								A waste of time
Socially responsible								Socially Irresponsible
Important								Unimportant
Foolish								Wise
Useful								Useless
Good								Bad
Satisfying								Unsatisfying
Necessary								Unnecessary
Pleasant								Unpleasant
Preserving ancient forests would make me feel...	1	2	3	4	5	6	7	
Good								Bad
Positive								Negative
Favourable								Unfavourable
Happy								Sad
Satisfied								Unsatisfied
I believe the AFA...	1	2	3	4	5	6	7	
Will achieve its goals								Will not achieve its goals
Has realistic goals								Has unrealistic goals
Regarding forestry workers (loggers, saw-mill workers, etc)... WILL CREATE FORESTRY JOBS								WILL ELIMINATE FORESTRY JOBS

The people whose opinions I value most would support the AFA...	1	2	3	4	5	6	7	
Completely agree								Completely disagree
People who are important to me would support the AFA...	1	2	3	4	5	6	7	
Completely agree								Completely disagree
What proportion of your friends would support the AFA?	1	2	3	4	5	6	7	
All								None
Most of my close family members would approve of me supporting the AFA...	1	2	3	4	5	6	7	
Completely agree								Completely disagree
Most of my close friends would approve of me supporting the AFA...	1	2	3	4	5	6	7	
Completely agree								Completely disagree
Most of the students I know at UVic would approve of me supporting the AFA...	1	2	3	4	5	6	7	
Completely agree								Completely disagree
The people whose opinions I value most would approve of me supporting the AFA...	1	2	3	4	5	6	7	
Completely agree								Completely disagree
People who are important to me would approve of me supporting the AFA...	1	2	3	4	5	6	7	
Completely agree								Completely disagree

It is expected of me that I support organizations like the AFA...	1	2	3	4	5	6	7		
Completely agree									Completely disagree

Part 4: Control									
Support for the AFA could include <i>any</i> of the following:									
1. reading a brochure about the Ancient Forest Alliance									
2. signing an AFA petition to protect British Columbia's endangered old-growth forests and forestry jobs									
3. signing up for a mailing list in order to receive updates about the Ancient Forest Alliance's campaign and activities (e.g., protests and rallies)									
4. donating cash/change to the Ancient Forest Alliance to support their campaign (even less than a dollar is OK)									
5. becoming a member of the Ancient Forest Alliance									
6. signing a letter to be sent to your MP supporting the Ancient Forest Alliance's campaign (the letter is already written and we can send it on your behalf)									
<p><i>After completing this survey you will have the opportunity to engage in any of the actions listed above. You may choose to do any number of these actions (or none at all). Your choice to do so (or not) will be completely confidential. We will ask you to indicate your choice on a form, and the experimenter will then prepare an envelope with a debriefing explanation and any other materials you may need to carry out the actions (immediately in the lab). For example, if you wish, we have copies of the AFA petition to sign, letters for members of parliament to sign, donation envelopes for collecting money, information pamphlets to read, and mailing list sign-up forms for becoming a member of the AFA. We will put any of the materials you request into an envelope for you at the end of the session and you may complete the items privately before you leave.</i></p>									
<p>Please answer each of the following questions by circling the number that best describes your opinion. Some of the questions may appear to be similar, but they do address somewhat different issues. Please read each question carefully.</p>									
Supporting the AFA by engaging in any of the six behaviours listed above will be...	1	2	3	4	5	6	7		
Entirely my decision									Entirely decided by factors outside my control
Completely up to me									Completely outside my control

Easy								Difficult
Time Consuming								Quick
Challenging								Straight-forward
Expensive (\$\$\$)								Inexpensive (\$)
The amount of time it will take me to support the AFA (by engaging in any or all of the behaviours listed above) is...	1	2	3	4	5	6	7	
Large								Small
My choice to support the AFA today (by engaging in any or all of the behaviours listed above) is completely my own...	1	2	3	4	5	6	7	
Completely Agree								Completely Disagree

Part 5: Intentions								
<i>This is the final part of the pilot study. In the main version of this study you would be provided the materials to actually carry out actions to support the AFA (if you wanted to). However, because this is a pilot study we are only interested in the strength of your intentions to support the AFA. That is, we will not be providing the materials to carry out these actions (e.g., petitions or pamphlets), but we ask that you answer the following questions as if you were someone who was given the materials.</i>								
As a completely voluntary part of this study, <u>participants in the main study</u> would be given the opportunity to support the Ancient Forest Alliance. If you were a participant in the main study and you were given the following options, please indicate how likely you would be to take any of the following actions (<i>immediately in the lab after completing this questionnaire</i>):								
I will read a brochure about the Ancient Forest Alliance	1	2	3	4	5	6	7	
Unlikely								Likely
I will sign a petition to support the Ancient Forest Alliance's campaign	1	2	3	4	5	6	7	

	Unlikely								Likely
	I will sign up to the Ancient Forest Alliance mailing list in order to receive updates about their campaign and activities (e.g., protests and rallies)	1	2	3	4	5	6	7	
	Unlikely								Likely
	I will become a member of the Ancient Forest Alliance	1	2	3	4	5	6	7	
	Unlikely								Likely
	I will donate cash/change to the Ancient Forest Alliance to support their campaign. Even a dollar is OK	1	2	3	4	5	6	7	
	Unlikely								Likely
	I will sign and send a letter to be sent to my MP supporting the Ancient Forest Alliance's campaign (the letter is already written and we will send it on your behalf if you wish)	1	2	3	4	5	6	7	
	Unlikely								Likely
Do you any comments about this questionnaire or the experiment in general? Please share them in the box below...									

Appendix 3 – Study 2 Commitment to Take Action

Welcome!

This is a study about supporting local environmental organizations. Support could be something simple like signing a petition, signing an email, volunteering or donating a small amount of money (even \$1). These behaviours are small but meaningful.

We are interested in the thoughts and feelings of people who *actually* support environmental organizations, therefore **as part of this study we ask that participants choose an organization and make a REAL commitment to actually take some sort of action to support them at the end of the study**. Although not required, this would be greatly appreciated by the researchers and the organizations themselves. **If you would rather not support any organization in any way** that's completely fine. Although we may not be able to use your data, you will still earn your full participation credits and complete the questionnaires on a **"hypothetical"** basis. Please be honest about your intention to take action.

If you choose to take action, you will be asked to choose which organization you'd like to support. The organizations and actions include: making an **online donation** of any amount to the **Pacific Salmon Foundation**, **signing a petition** for the **Ancient Forest Alliance**, **signing an email** (part of a letter-writing campaign) for **Sierra Club BC**, or **volunteering** with the **Rocky Point Bird Observatory**. Again, support does not necessarily mean donating money - signing a petition, signing an email or volunteering are also options. The organizations will be described with short videos, then you will be asked a few questions regarding your thoughts/feelings about supporting each one.

You will be asked to complete the same questionnaires twice - once now and once again on your own (online). Following the second questionnaire, your participation will be complete and you will be expected to take action to support the organization **on your own**.

Thank you for your participation. Your help is invaluable!

Please indicate your willingness to support an environmental organization:

- I am willing to commit to supporting one of the environmental organizations.**
- I am not willing to commit to supporting one of the environmental organizations. [If you choose this option, you will still earn full course credit]

Appendix 4 – Study 2 Base Components Questionnaire

Ancient Forest Alliance Survey

For me, supporting the Ancient Forest Alliance by signing a petition would be...

Unimportant Somewhat important Extremely important

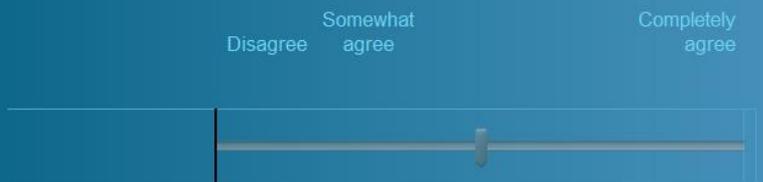


If you are paying attention, please put the slider all the way to the left, under "Attention"

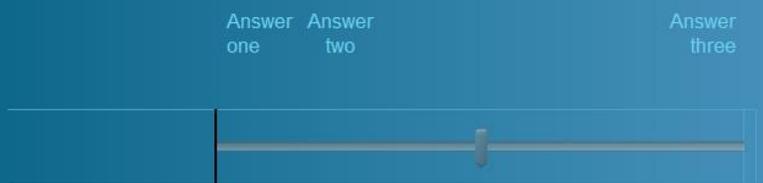
Attention Somewhat not paying Extremely not paying



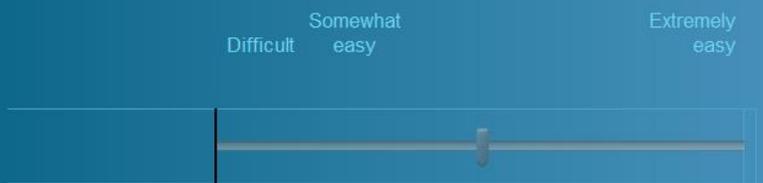
Most of my close family members would **approve of me** supporting the Ancient Forest Alliance by signing a petition...



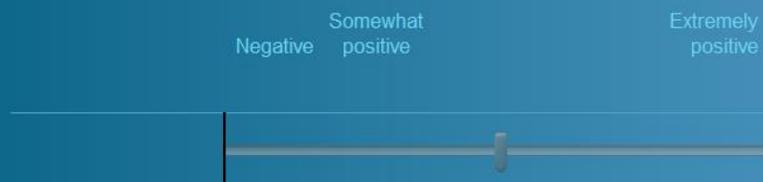
Please move the slider all the way to the right, under "Answer Three"



For me, supporting the Ancient Forest Alliance by signing a petition would be...



Overall, my attitudes toward signing a petition for the Ancient Forest Alliance are...



The people whose opinions I value most would support the Ancient Forest Alliance by signing a petition...



For me, the amount of effort required to support the Ancient Forest Alliance by signing a petition would be...

Large amount of effort Somewhat small amount of effort Extremely small amount of effort



For me, supporting the Ancient Forest Alliance by signing a petition would be...

Challenging Somewhat straight-forward Extremely straight-forward



For me, supporting the Ancient Forest Alliance by signing a petition would be...

Unmanageable Somewhat manageable Extremely manageable



For me, the burden of supporting the Ancient Forest Alliance by signing a petition would be...

Burdensome Somewhat unburdensome Extremely unburdensome



Of the people whose opinions you value most, how many would support the Ancient Forest Alliance by signing a petition?

None All



For me, Supporting the Ancient Forest Alliance by signing a petition would be...

Useless Somewhat useful Extremely useful



Supporting the Ancient Forest Alliance by signing a petition would make me feel...

Bad Somewhat good Extremely good



People who are important to me would support the Ancient Forest Alliance by signing a petition...

Disagree Somewhat agree Completely agree





Most of the students I know at UVic would support the Ancient Forest Alliance by signing a petition...

Disagree Somewhat agree Completely agree



For me, Supporting the Ancient Forest Alliance by signing a petition would be...

Foolish Somewhat wise Extremely wise



For me, supporting the Ancient Forest Alliance by signing a petition would be...

Onerous Somewhat easily done Extremely easily done



For me, supporting the Ancient Forest Alliance by signing a petition would be...

A waste of time Somewhat worthwhile Extremely worthwhile



Appendix 5 – Study 3 Qualitative Questionnaire

Efficient fume hood use involves: When **away from a fume hood for more than two minutes**, users should **(1) close the sash** and **(2) change the setting to setback mode**. For safety reasons, however, users should also **(3) change the setting back to normal mode** when they want to access the hood. Most Bob Wright users fail to follow these steps for safe and efficient fume hood use. Therefore, we are asking for your help to understand what motivates (or demotivates) this behaviour. Thanks for taking the time to complete this survey!

- 1) What (if any) are the advantages/benefits of **efficient fume hood use** (as defined above)? These can be personal, societal, community-wide, among friends, etc.
- 2) What (if any) are the disadvantages/drawbacks of **efficient fume hood use**? These can be personal, societal, community-wide, among friends, etc.
- 3) What else comes to mind when you think about **efficient fume hood use**?
- 4) Please list any factors or circumstances that would make it likely or easy for you to engage in **efficient fume hood use**.
- 5) Please list any factors or circumstances that would make it likely or difficult for you to engage in **efficient fume hood use**.
- 6) Sometimes, when we are not sure what to do, we look to see what others are doing. Who are the people you refer to when unsure of the proper procedure for using the fume hood (please do not use names)?

Appendix 6 – Standardized Quantitative Questionnaire

- 1) Using setback mode when I leave for the day is:

Unimportant	1 2 3 4 5 6 7	Important
-------------	---------------------------------	-----------

- 2) If I set my fume hood to setback mode when I leave the lab for the day then I will forget to set it back to Normal Mode when I return:

Disagree	1 2 3 4 5 6 7	Agree
----------	---------------------------------	-------

- 3) When the fume hood windows and sash are closed, using setback mode is:

Less safe than using normal mode	1 2 3 4 5 6 7	Equally safe as using normal mode
--	---------------------------------	---

- 4) Saving energy by using setback mode will make me feel:

Bad	1 2 3 4 5 6 7	Good
-----	---------------------------------	------

- 5) Using setback mode when I leave for the day is:

Useless	1 2 3 4 5 6 7	Useful
---------	---------------------------------	--------

- 6) Saving money for the university by using setback mode will make me feel:

Bad	1 2 3 4 5 6 7	Good
-----	---------------------------------	------

- 7) Most graduate students use setback mode when they leave for the lab for the day:

Disagree	1 2 3 4 5 6 7	Agree
----------	---------------------------------	-------

- 8) My direct supervisor in the lab would approve of me using setback mode when I leave the lab for the day:

Disagree	1 2 3 4 5 6 7	Agree
----------	---------------------------------	-------

- 9) UVic's occupational health staff would approve of me using setback mode when I leave the lab for the day:

Disagree	1 2 3 4 5 6 7	Agree
----------	---------------------------------	-------

10) Using setback mode when I leave the lab for the day would be:

Difficult	1	2	3	4	5	6	7	Easy
-----------	---	---	---	---	---	---	---	------

11) Using setback mode when I leave the lab for the day would make my work:

More difficult	1	2	3	4	5	6	7	No more difficult
----------------	---	---	---	---	---	---	---	-------------------

12) For me, the setback switch is:

Difficult for me to reach	1	2	3	4	5	6	7	Easy for me to reach
------------------------------	---	---	---	---	---	---	---	-------------------------

13) If I wanted to, I could use setback mode every time I leave the lab for the day:

Disagree	1	2	3	4	5	6	7	Agree
----------	---	---	---	---	---	---	---	-------

How many people share your fume hood (including you)?

What are the last 4 digits of your student ID? V00XX _ _ _ _

What are the last 4 digits of your phone number? 250 - XXX - _ _ _ _

What is your year of Birth? _____ What is your gender? _____

**What is your chemistry lab room number (circle one)? B211 B213A B215 B216 B214A
B210 B317**

THANK YOU!!

[Please circle your fume hood on the map attached]

Appendix 7 – Study 3 Intention-Focused Intervention Exercise

Mental Contrasting With Implementation Intentions - Using Setback Mode More Often

The following exercise is based on a well-researched method of achieving goals that has been used to help people to quit smoking, eat healthier, achieve better grades in school, etc. Feel free to use it for any task you are striving to complete! We'd like you to use it to achieve the goal of using setback mode more often.

Part 1 – Goal Setting

- 1) Thinking back over the past month, about what percent of the time did you put your fume hood in Setback Mode overnight?

Currently, I use setback mode overnight about ____ % of the days I am in the lab.

- 2) If possible, please set a goal for your increased use of setback mode.

Ideally, I think I can use setback mode ____ % of the days I am in the lab (goal).

- 3) In order to achieve this goal, take a moment to envision what it would look like to achieve your goal, and *contrast* this with your current use of Setback Mode (take 30 seconds to do this now).

Part 2 – Implementation Intentions

- 4) Write down how you intend to achieve this goal. Be as specific as possible.

- 5) What are some reasons that you *might not* achieve your goal? Write these down, *along with solutions* for overcoming these problems.

- 1.
- 2.
- 3.

Part 3 – Public Commitment

- 6) People who make a public commitment are more likely to follow through with their commitments. In order to signal your commitment to use setback mode, please **stick the attached (“I use setback mode”) sign to your fume hood**. Although very simple, this small behaviour can have a big effect. If you agree to do this, please put a check in this box:

Thank you!