ABSTRACT

Title of Dissertation: A META-ANALYTICAL TEST OF PERCEIVED BEHAVIORAL CONTROL INTERACTIONS IN THE THEORY OF PLANNED BEHAVIOR

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This study used meta-analytic procedures to test for interaction effects among the components of the theory of planned behavior (TPB). The central hypothesis examined was that attitudes and subjective norms should perform less well in explaining intentions when perceptions of behavioral control are low. A traditional meta-analysis of nine studies that directly examined perceived behavioral control (PBC) interactions was conducted. A second meta-analysis—the main focus of this dissertation—was conducted that tested for two- and three-way interactions in which the presence of PBC interactions was investigated in 121 studies, which provided 154 data sets with 44,424 participants. In addition to testing for two-way PBC interactions, this meta-analysis also examined whether the presence of PBC interactions depended on other variables. Specifically, three-way interactions with type of behavior classification (i.e., public versus private, familiar versus unfamiliar) and type of PBC operationalization (e.g., self-efficacy, perceived difficulty, perceived control, or some combination of the three) were explored.

Results indicated that attitude by PBC interactions exist but that the effects vary depending on the type of PBC operationalization and behavior context. In addition, meta-analytic structural equation modeling was used to examine whether the association between PBC and intention is mediated by attitude and subjective norms; however, no evidence for this relationship was found. Finally, results from an auxiliary analysis revealed that the attitude by PBC interaction on intention had statistically significant nonlinear effects in addition to a linear effect. In contrast, the norm by PBC interaction did not have statistically significant linear or nonlinear effects. The discussion highlights the effects of different meta-analytic techniques, the need for future investigation using experimental designs, the implications of these findings for further theory development, and practical implications for health communication researchers. In sum, through the use of a multi-faceted approach to quantitatively review attitude by perceived control and norm by perceived control interactions in the TPB, this study helped to address inconclusive results with regard to the existence and type of PBC interactions.

A META-ANALYTICAL TEST OF PERCEIVED BEHAVIORAL CONTROL INTERACTIONS IN THE THEORY OF PLANNED BEHAVIOR

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Chapter 1: Introduction

> Theory improvement is a cyclical process that involves the specification of relations between factors, the testing of those relations, the re-specification or rejection of initially hypothesized principles and the testing of the new relations. (Weinstein & Rothman, 2005, p. 296)

Having developed out of a stream of research concerned with explicating the cognitive basis of behavior, the theory of planned behavior (TPB; Ajzen, 1991) has important implications for the design and evaluation of behavior-change interventions (Fishbein & Ajzen, 2010; Fishbein & Cappella, 2006; Fishbein & Yzer, 2003). A primary implication of the reasoned action framework is that differences among people are ultimately derived from differences in their cognitive structures—not withstanding objective barriers that would prevent them from acting on their intentions. By explicating the cognitive processes that are hypothesized to determine behavior, the TPB enables campaign developers to make strategic decisions that leverage mechanisms known or assumed to activate campaign effects (Cappella, 2006; Rothman, 2004). Therefore, by applying the theory an investigator is able to anticipate whether an intervention will be effective or ineffective. Jemmott and Jemmott (2000) stated that "systematic understanding of the causes of behavior flows from a theoretical model of behavior and empirical tests of theory-based hypotheses" (p. 104). From the perspective of an interventionist, theories need to specify the relation between constructs and be able to discern which constructs are the most appropriate targets for interventions (Rothman, 2004). In this way, interventionists depend on the predictive validity of a theory.

Since its introduction 27 years ago (Ajzen, 1985), the TPB has become one of the most frequently cited and influential models for the prediction of human behavior.[1] For instance, Nosek et al. (2010) found that work on the reasoned action framework ranks as having the highest scientific impact score among U.S. and Canadian psychologists. Its influence is due, in part, because the theory helps narrow the scope of what drives behavior by providing a small set of causal factors that are proposed to explain and predict human behavior; moreover, Ajzen and Fishbein provided explicit and generalizable instructions for how to apply the theory in different domains, making the theory especially accessible (Ajzen, 1991, 2006a, 2006b; Fishbein & Ajzen, 2010, pp. 449-463). Many studies have tested the applicability of the theory in different behavioral domains, the operationalization of the theory's constructs, and the utility of additional variables (such as self-identity, anticipated affect, and past behavior). Yet some of the theory's assumptions have received scant attention and deserve further scrutiny. In particular, the role of perceived behavioral control (PBC) in determining intentions has not been definitively described.

To date, most applications of the theory have considered only additive effect of PBC on intention; however, rather than operating in parallel with attitudes and norms to predict intention, PBC may operate as a moderator. An alternative model of the TPB that treats PBC as moderator that interacts with attitudes and norms to affect intentions is not only conceivable, it is conceptually justified: The logic behind this position is that attitudes and norms are only likely to influence intention when individuals believe that they are capable of performing the behavior. In other words, why would people intend to

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[1] See the bibliography available from Icek Ajzen's Web page at http://people.umass.edu/aizen/tpbrefs.html for a list of some of the studies that have been published on the TPB. This list is updated frequently, and as of August 2nd, 2012, it has over one thousand references to scholarly work that uses the TPB in some fashion.

perform a behavior if at the same time they are quite sure that they will not be able to successfully do so? Consider, for example, the behavior of donating clothes to charity. According to the TPB, performing a behavior is based on a particular combination of attitudinal, normative, and PBC considerations. Thus, some people may donate clothes because they have a very positive attitude toward donating, whereas others may do so because of social pressure. However, even if people favorably evaluate this altruistic behavior and experience substantial social pressure to donate unwanted clothing, if they lack the time or doubt their ability to find a collection site to leave the clothes, they will perceive that they cannot donate clothes to charity and may thus not donate clothes. In sum, lacking the perceived capacity to enact a behavior is likely to render attitudes and social norms irrelevant because the behavior is not thought to be possible.

Although both Ajzen and Fishbein (Ajzen, 1988, 2002; Fishbein & Ajzen, 2010) have recognized the possibility that PBC moderates attitudinal and normative effects on intention, this effect is not a formal part of the TPB. Additionally, even though thousands of studies have provided empirical evidence for the main effects postulated in the TPB, there are only nine studies that the author knows of in which the interactions in question were tested (Bansal & Taylor, 2002; Boudewyns, Paquin, & Yzer, 2007; Conner & McMillan, 1999; Dillard, 2011; Kidwell & Jewell, 2003; Kim & Chung, 2011; McMillan & Conner, 2003; Park, Klein, Smith, & Martell, 2009; Umeh & Patel, 2004). Although these studies provide initial evidence for reconsidering the role of PBC in the TPB, they also highlight the relative infrequency with which the interactions of PBC and attitudes and PBC and norms have been tested in the past. Yzer (2007, 2012) argued that the limited attention given to PBC interactions is a missed opportunity for advancing our understanding of intention formation and suggested that the primary reason for this lack of empirical testing is methodological and not conceptual. Yzer went so far as to say that “the single most important explanation for the paucity of published research on PBC interactions is that these tests have inadequate statistical power” (2007, p. 117).

Although it is true that power affects results, a lack of power can only partially explain a lack of interactions between the main predictors of intention. What is unknown is whether previous studies have tested, failed to find support, and didn't report the null findings (i.e., the absence of an interaction), or if they didn’t test for the interactions. Assuming the latter, it is possible that the lack of testing can be attributed to two factors. First, the TPB model is an additive model devoid of any moderating relationships among the three predictors of intention (attitude, norm, PBC). Second, the key resources that provide step-by-step guidance on how to design, conduct, and analyze TPB research do not recommend that authors test for interactions between the predictor variables (Ajzen, 2006a, 2006b; Fishbein & Ajzen, 2010; Hankins, French, & Horne, 2000).

Explicating the role of PBC in determining intention is of great theoretical and practical importance. At the theoretical level, the evidence for a moderating influence of PBC on attitude and norms has important consequences for our understanding of how the variables associated with the reasoned action framework produce behavioral intention and change. Moreover, given the conceptual argument that the role of PBC needs to be conceptualized differently (i.e., as a moderator variable of attitudes and norms), the current TPB model without those interactions is theoretically incomplete. From an applied standpoint, the need for useful theory should not be overlooked. The TPB is frequently applied within health communication contexts to design campaigns that target specific health-related behaviors with the overarching goal of improving social well-being. The success or failure of these campaigns may depend on the appropriate application of theory in implementing a strategic health program.

Purpose of this Study

The overarching aim of this study is to explore the sufficiency of the proposed set of determinants (attitudes, norms, PBC) as an account of behavioral intention. Specifically, this dissertation will focus on the role of PBC in determining intention. The goal of this study is twofold. First, this study will advance what is currently known about the TPB by determining whether PBC substantially affects the magnitude of the association between attitudes and intention and norms and intention and whether the effect differs for attitude versus norms. Second, I will examine potential boundary conditions of the moderator hypothesis to provide a basis for specifying conditions under which PBC interactions are expected. For instance, I will explore whether the interaction depends on the type of behavior or operationalization of PBC.

To achieve these goals, this study quantitatively reviewed attitude by PBC and norm by PBC interactions in the TPB literature to address inconclusive results with regard to their existence and nature. This study used a multi-faceted approach to examine PBC interactions, using both study-generated and synthesis-generated evidence.[2] First, as a direct assessment of PBC interactions, a meta-analysis on the small number of previous

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[2] Study-generated evidence is present when a single study contains results that directly test the relation being considered, in this case, PBC by attitude or PBC by norm interactions. Synthesis-generated evidence is typically used to indirectly test for interaction effects. Such evidence is present when the results of studies using different procedures, different populations, or different contexts to test a hypothesis are compared to one another (Cooper, 2009). In the present study, the synthesis-generated evidence came from the various mean levels of PBC that were reported across the different behaviors and populations as well as the classification of those behaviors.

studies that directly examined these interactions was conducted (Bansal & Taylor, 2002; Boudewyns, Paquin, & Yzer, 2007; Conner & McMillan, 1999; Dillard, 2011; Kidwell & Jewell, 2003; Kim & Chung, 2011; McMillan & Conner, 2003; Park, Klein, Smith, & Martell, 2009; Umeh & Patel, 2004). Next, as in indirect test of PBC interactions, a meta-analytical approach was used to assess whether PBC interactions can be found in the larger body of work on the TPB, even though the primary studies never examined PBC interactions. In order to do this, the mean level of PBC was coded across studies that reported correlations between all TPB constructs. Therefore, unlike traditional meta-analyses on the TPB, the goal was not to provide a comprehensive overview of where the field is, but rather to obtain a sample of TPB research that provides sufficient power and a wide range of PBC (e.g., low, medium, high) to find the interaction if it is present. Moreover, testing for these interactions using meta-analysis helps provide stronger evidence for or against the empirical validity of the proposed interactions and encourages the next wave of primary research on the TPB to move beyond a simple additive modeling of the TPB. In sum, investigating such interactions as well as the conditions under which these interactions are likely to occur will advance our understanding of the mechanisms underlying intention formation and will help to delineate the theory's boundary conditions, resulting in the TPB being better articulated in its account of human behavior.

The second chapter of this dissertation provides an overview of the TPB, reviews the conceptual basis for including PBC in the TPB, provides a rationale for expecting PBC interactions, reviews previous research that has tested for these interactions and conducts a meta-analysis of these findings, and finally, discusses the methodological difficulty of detecting interactions. Chapter 3 outlines the hypotheses and research questions to be tested, and Chapter 4 describes the methods employed in this study and provides an overview of the proposed analyses.

Chapter 2: The Role of PBC in the TPB

The Roots of the Theory of Reasoned Action

The roots of the theory of reasoned action (TRA) can be traced to Dulany's (1961, 1968) theory of propositional control, which developed out of experimental work examining verbal operant conditioning. In a typical verbal conditioning experiment, subjects are reinforced by the experimenter for providing a specific class of verbal response, with the goal of increasing the frequency of that class of response. For instance, in Dulany's experiments participants were shown pairs of sentences and were asked to read one sentence aloud. Using a factorial design, sentences containing a predetermined set of words were followed by either a hot, cold, or room temperature stream of air across the face. Some participants were told that the stream of air indicated a correct response, some that it indicated neither a correct nor an incorrect response, and some that it indicated an incorrect response. According to the theory of propositional control, people form a conscious intention (i.e., a behavioral intention) to select a certain response, and this intention determines the actual response.

Intention, according to Dulany, is a function of two factors. The first factor is the participant's expectation that a specific response (on their part) will produce a result, paired with the participant's evaluation of that result. For example, over many trials, the participant becomes able to estimate the probability that a specific response will be positively or negatively reinforced (i.e., the participant develops outcome beliefs about the response). The second factor represents the participant's perception of the experimenter's demands. Because reinforcement is provided to the participant by the experimenter, the participant is able to infer which response the experimenter would prefer based on the perceived contingency between response and reinforcement. The influence of this demand characteristic on responses provided on subsequent trials is moderated by the participant’s motivation to comply with the perceived expectations of the experimenter. In effect, intentions to give a verbal response (i.e., a behavior) are determined as if by an expectancy-value computation directed toward that response and the normative influence of the experimenter.

Fishbein (1967) adapted Dulany’s theory to apply to all volitional social behaviors and not just verbal operant conditioning. Using the theory of propositional control as a prototype, the TRA was developed to provide a theoretical framework for explaining, predicting, and changing human social behavior. The first factor in the theory of propositional control was relabeled and reinterpreted as behavioral belief and defined as a person’s subjective probability that performing a certain behavior will produce particular outcomes, which is influenced by the person’s evaluation of that outcome. Because most behaviors are capable of producing a number of outcomes, in the TRA, people are assumed to hold multiple behavioral beliefs (Fishbein & Ajzen, 1975).

The second factor in Dulany’s theory is represented by the TRA’s normative belief construct. Fishbein (1967) recognized that the influence of the experimenter was a special case of social influence and expanded the theoretical mechanisms described in the theory of propositional control so that it could be applied to all volitional social behaviors. Through this theoretical evolution, the subjective norm component came to be conceptually defined in the TRA in a way that focused exclusively on a single process of social influence. A normative belief is the subjective probability that a particular normative referent thinks a person should perform a specific behavior, weighted by the person's motivation to comply with the referent's perceived expectations (Fishbein & Ajzen, 1975). *Normative referent* refers to groups, collectives, or persons that serve as a frame of reference for an individual. Specifically, people refer to the values and norms (sometimes called normative prescriptions) of salient groups or individuals (i.e., referents) when forming a subjective norm. As with behavioral beliefs, people are assumed to hold normative beliefs about a number of different referent individuals or groups. With the theory's theoretical lineage in place, I will now further elaborate on the constructs and theoretical assumptions in the TRA.

Components of the TRA

Intention. According to the TRA, behavioral intention is the direct determinant of behavior. Behavioral intentions are understood to capture the motivational factors that influence a behavior and are indications of a person's readiness to perform a behavior (Fishbein & Ajzen, 1975). People are expected to act in accordance with their intentions and, consistent with this idea, intentions are generally found to be good predictors of behavior. Instances in which the link between intention and behavior may be attenuated will be discussed in more detail in the section on the tenets of the TRA.

Attitude. An attitude is the degree to which a person holds a positive or negative evaluation of a given behavior (Ajzen 1988; Fishbein & Ajzen, 1975). Typically, in research that is based on the reasoned action framework, an individual's overall evaluation of an attitude object is assessed with a set of self-report, evaluative semantic differential items (Fishbein & Ajzen, 2010). Consequently, attitude measurement is concerned with locating a person's disposition toward a given object on an evaluative continuum. The specific anchor-terms used in this set of bipolar adjective scales are meant to be evaluative in relation to the attitude object of interest (e.g., athletic vs. unathletic in reference to "relay-race teammate") but will likely include generally evaluative terms (e.g., good vs. bad, favorable vs. unfavorable). Combined, these scales constitute a measure of *direct attitude* toward the specific object being evaluated.

Historically, it is relevant to note, the hypothesis that people behave in ways that are consistent with their attitudes has not always been operationalized with behavioral compatibility in mind. Instead, many early studies that examined the attitude–behavior association used *general attitudes* toward social groups (e.g., racial minorities, foreigners), institutions (e.g., labor unions), or other objects (e.g., sports, movies) to predict behaviors related to those objects (De Fleur & Westie, 1958; Wicker, 1969). The impact of such a lack of specificity was recognized as a possible source of the weak empirical evidence linking attitudes with behavior (Fishbein, 1966). In fact, Wicker (1969) reported results from a study designed to test the effects of specificity on attitude–behavior consistency and found that the association was strengthened when measures of attitudes and overt behaviors toward the same object were used.

In response to these criticisms, Fishbein and Ajzen (1975) made a distinction between general attitudes toward physical objects, institutions, groups, policies, and events, and attitudes toward performing a specific behavior. In the TRA, defining the attitude object as the behavior of interest is expressed by the *principle of correspondence* (Ajzen & Fishbein, 1977; Fishbein & Ajzen, 1974) or *compatability* (Ajzen, 1988; Fishbein & Ajzen, 2010). Briefly, general attitudes violate the principle of correspondence and thus tend to be inadequate predictors of actions and decisions regarding such issues (Ajzen & Fishbein, 1977; Kim & Hunter, 1993; Kraus, 1995).

Although the principle of correspondence or compatibility was originally explicated in order to clarify the relation between verbal attitudes and overt behavior in the TRA, it is applicable to other constructs in the framework. The principle of correspondence will be discussed in greater detail in the sections that follow.

Drawing from the expectancy-value model of attitude prediction and change (Fishbein, 1966), the attitude that one has toward performing a particular behavior is determined by salient (i.e., readily accessible) behavioral beliefs about the outcomes that will result from performing the behavior. In the aggregate, the subjective likelihood and value placed on these outcome beliefs lead to a favorable or unfavorable attitude toward the behavior. The multiplicative combination of these outcome expectancies, weighted by the evaluation of each outcome, (i.e., behavioral beliefs) is sometimes referred to as *indirect attitude measures*.

Subjective norm. Early scholars in the field of social psychology (e.g., Allport, 1935) considered attitude to be a central concept of the discipline. Nonetheless, the norms that prevail in a social environment have also been recognized as an important factor that, at least partially, influence intention and behavior (e.g., Asch, 1951; Deutsch & Gerard, 1955; French & Raven, 1959). With this in mind, according to the TRA, a second type of consideration that affects a person's intention has to do with perceived social pressure to engage or not engage in the behavior. Subjective norms refer to specific behavioral prescriptions or proscriptions attributed to a generalized social agent (Ajzen, 1991; Fishbein & Ajzen, 1975). Put simply, subjective norms are defined as a person's perception that important others think that he or she should or should not perform the behavior in question (Fishbein & Ajzen, 1975). Similar to attitudes and perceived behavioral control, subjective norms are ultimately based on the beliefs a person holds about the behavior. In particular, subjective norms are determined by a person's belief that salient referent groups or individuals would approve or disapprove of a given behavior combined with the respondent's motivation to comply with those referents. Depending on the behavior and population under investigation, the list of others may include anyone perceived to be important, such as friends, family members, classmates, and significant others.

Tenets of the TRA

Behavior specificity. According to the TRA, before setting out to predict and influence human social behavior the specific behavior of interest needs to be defined. The resulting definition of the behavior will guide both how the behavior is measured as well as the operationalization of all other constructs in the TRA. Fishbein and Ajzen (1975) argued that, with respect to any behavior of interest, four elements must be addressed: the *action* performed (e.g., purchasing), the *target* at which the action is directed (e.g., organic food), the *context* in which it is performed (e.g., at a chain grocery store), and the *time* at which it is performed (e.g., in the next 30 days). In other words, behavior, in general terms, should be described as an action directed toward a target within a given context and time. These elements may be thought of as the basic guidelines to which the definition of a behavior should conform; however, it is sometimes the case that one or more of the elements are left unspecified. For instance, the behavior "buying organic food" does not specify a context or time element.

In addition, each of a behavior's four elements can be defined at different levels of generality or specificity. However, it is important to note that theoretical and practical significance of the TPB can be undermined if a behavior is either too narrowly or broadly defined. To illustrate this point, consider the difference between the following two behaviors: “Getting tested for STDs at least once in my lifetime” and “Getting tested for STDs each time I have a new sexual partner in the next 12 months.” Although both behaviors express the same action and target (i.e., getting tested for STDs), they differ in the level of specificity given to context and time. Such differences may alter the relevance of findings derived from a TRA analysis by, for example, restricting the applicable audience to a specific geographical area (e.g., people living in a certain city or neighborhood) or making it difficult to assess whether or not an intervention has had the desired effect (e.g., when do you measure lifetime STD-testing?). The focal behavior should be defined at a level of specificity so that it is relevant to the population that will be the target of the intervention and sets a reasonable time-frame for campaign effects to be measured.

Principle of correspondence. Once a behavior is defined, maintaining consistency across all components in a TRA analysis is paramount to ensuring that the predictive power of the model is maintained. According to the principle of compatibility, the constructs in the TRA correlate with each other to the extent that they are compatible in terms of their action, target, context, and time element. Fishbein and Ajzen (2010) posited that a fundamental requirement for a strong relation between intentions and behavior (or attitudes and intentions, norms and intentions) is a high degree of compatibility in the constructs’ measures. With respect to attitudes, for example, differences in the way the behavioral criterion and the attitude object are defined on one or more of the elements (action, target, context, time) will lower compatibility and will likely attenuate the attitude–behavior association (Ajzen & Sexton, 1999). For instance, if a behavior is defined as "volunteering at a homeless shelter in the next six months," but the attitude-object focuses on the general attitude toward volunteering or, alternatively, toward helping the homeless, there will probably be a low relation between the general attitude and the specific behavior. So, although attitudes are conceptually defined in broad enough terms to refer to evaluations of any object whatsoever, in the reasoned action framework they are specifically related to evaluations of personally performing a particular behavior.

Intention–behavior association. Insofar as the measures used to assess intention and behavior comply with the principle of correspondence, intentions should reliably predict behavior. Fishbein and Ajzen (2010, pp. 43-48) provided a synthesis of previous research that examined the strength of the relationship between intentions and behavior. In line with the principle of correspondence, studies that exhibited a high degree of intention–behavior compatibility reported correlations ranging from .75 (blood donation, Giles & Cairns, 1995, as cited in Fishbein & Ajzen, 2010) to .84 (marijuana use, Conner & McMillan, 1999). Meta-analyses that have examined the intention-behavior relation have reported smaller correlations, ranging from .47 (Armitage & Conner, 2001a) to .53 (Sheeran, 2002).[3] However, these meta-analyses did not take into account intention–behavior compatibility, even though compatibility between intention and behavior measures probably varied considerably across studies (Fishbein & Ajzen, 2010).

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[3] These meta-analyses only corrected for sampling error. However, even after correcting for sampling and measurement error (a source of effect-size attenuation), more recent meta-analyses have reported similar effect sizes (Hagger & Chatzisarantis, 2009: .61; Hagger, Chatzisarantis, & Biddle, 2002: .51; Manning, 2009: .56; McEachan et al., 2011: .43).

Aside from correspondence factors, it has been noted that other factors may attenuate the intention–behavior association.[4] Additional factors are the temporal stability of intentions, volitional control, cognitive accessibility of the intention, and literal inconsistency (see Ajzen & Fishbein, 2005 for review). Temporal stability deals with decay of intention strength over time, and is often approximated by the amount of time that has lapsed between the measurement of intentions and the observed behavior. Lack of volitional control, on the other hand, deals with internal or external barriers that prevent a person from performing a behavior that he or she may have otherwise intended to perform. Moreover, a failure to remember one's intention to perform a behavior when the opportunity arises, which is linked to the cognitive accessibility of that intention in relevant contexts, may reduce the strength of the intention-behavior relation.

Finally, issues of literal inconsistency occur when subjects who indicate that they intend to perform a behavior fail to do so. A possible explanation for this phenomenon is that the hypothetical behavior described in a questionnaire from which subjects report their intention does not capture substantive features of the behavioral situation, allowing subjects to be unrealistic in their reported intentions. In sum, there is little evidence that these factors pose a conceptual threat to the internal validity of the theory; indeed, the most plausible explanations for their interference with the intention-behavior relation focus on methodological issues. In that sense, explication of these factors reinforces the general notion that the TRA is most effective when it is applied with careful consideration of methodological consistency.

Reasoned action. As the name of the theory implies, the TRA is based on the

[4] Because the relationship between intention and behavior is not a primary focus of this dissertation, I will only provide a cursory overview of these additional factors.

assumption that behavior "follows reasonably and often spontaneously from the information or beliefs that people possess about the behavior under consideration" (Fishbein & Ajzen, 2010, p. 20). Some have misinterpreted this statement to mean that the theory posits a dispassionate, rational actor who reviews all relevant information (i.e., beliefs) in an unbiased manner when deciding how to act. The TPB does not assume that beliefs are formed in a rational, unbiased fashion, nor does it assume that the underlying beliefs accurately represent reality. Instead, beliefs are said to represent the information that a person has in relation to a behavior. Ajzen (2011) elaborated, "this information is often inaccurate and incomplete; it may rest on faulty or irrational premises, be biased by self-serving motives, or otherwise fail to reflect reality" (p. 451). Regardless of how people form behavioral and normative beliefs, their attitudes and subjective norms follow consistently from these beliefs. It is in this sense that behavior is said to be reasoned.

External variables. Although the theory focuses on attitudes and norms, it does not deny the influence of other important kinds of variables such as demographics, personal characteristics, and environmental factors. Instead, these factors are considered background (or distal) variables that can influence intention and behavior indirectly through their impact on the theory's proposed determinants of behavior. Specifically, the influences of factors that are not formally integrated with the model are supposed to be mediated by the already defined predictor variables. That is, any influence on intention and subsequent behavior that can be traced back to a background variable should flow through the relevant attitude, subjective norm, or beliefs.

Relative contribution of predictor variables. One of the assumptions of the TRA is that the relative importance or weight of attitude and norms as predictors of intention may vary depending on the specific behavior under consideration, characteristics of the population, or temporary contextual factors (Fishbein, 2000). That is, the theory anticipates that the observed predictive value of attitudes and norms may be greater or smaller depending on contextual factors relating to specific behaviors and populations. Although the reasoned action framework anticipates the possibility of such moderating influences, as a general and parsimonious account of human behavior it does not attempt to explicitly model the various conditions under which such effects will occur. Nonetheless, recognizing that these extra-theoretical influences may be relevant in certain research contexts, it is recommended that formative research be conducted to anticipate, and empirically validate, the idiosyncrasies of the population and behavior of interest (Fishbein & Ajzen, 2010).

Volitional control. A very important limiting condition of the TRA is that it was designed as a model of volitional behavior. Volitional control is defined as the extent to which a person can decide at will to perform or not perform a behavior (Ajzen, 1991). Thus, the TRA is limited to explaining behaviors that only require motivation to enact the behavior. To the extent that a behavior is easily executed by almost everyone, the TRA should provide an adequate account of the volitional behavior. However, when a behavior is not volitional, intention should be a weaker predictor of behavior, and attitude and norms should be weaker predictors of intention. In other words, the TRA will be insufficient whenever control over the behavior is limited. Originally Fishbein and Ajzen (1975) thought that most behaviors of interest to social psychologists should meet the assumption of volitional control. Ajzen later commented that “closer scrutiny reveals, however, that even very mundane activities, which can usually be executed (or not executed) at will, are sometimes subject to the influence of factors beyond one's control" (Ajzen & Madden, 1986, p. 455). To address this criticism, Ajzen (1985) proposed an alternative theory to account for behaviors that are not under volitional control, the theory of planned behavior (TPB).

Theory of Planned Behavior

The TPB was designed to extend the TRA by including behaviors under which people do not have complete volitional control. The more that a person's behavior is contingent on having the appropriate opportunities or adequate resources (e.g., skills, cooperation of other people, time), the less the behavior is under volitional control (Ajzen, 1985). The TPB is identical to the TRA except that (a) perceived behavioral control is added as an antecedent to intentions and behavior, and (b) the assumption of volition control is no longer imposed in the model. In the TPB, the control that a person has over a behavior is treated as a continuum with easily executed behaviors on one end and behaviors requiring resources, special skills, and opportunities on the other end. In the TPB, control is taken into account by a variable labeled *perceived behavioral control* as well as a variable labeled *actual control*. Figure 1 depicts the TPB.

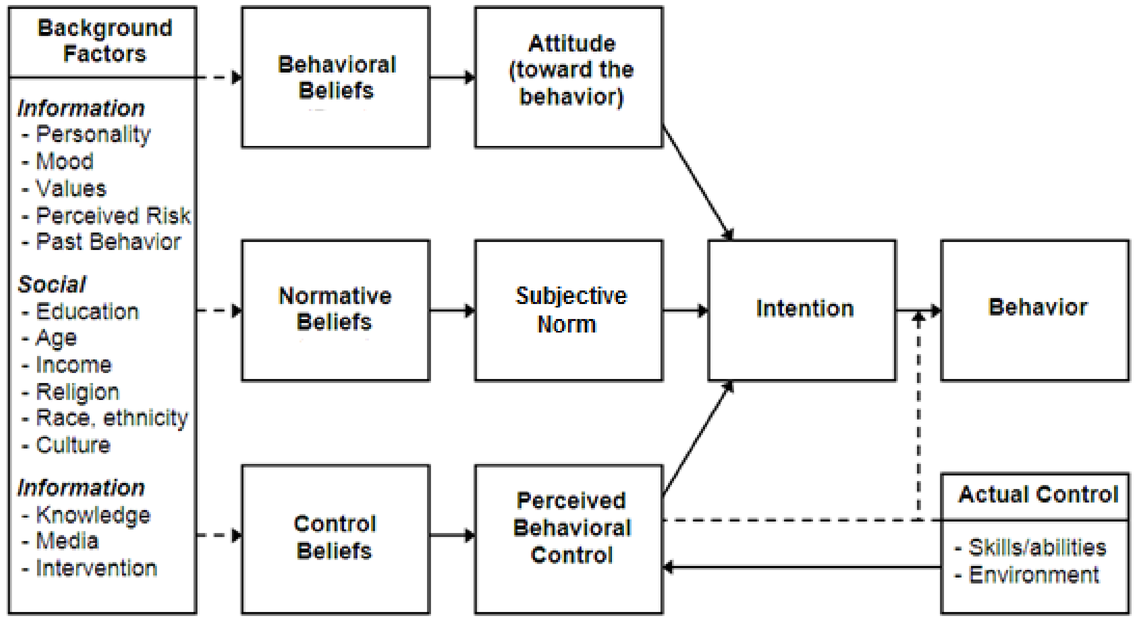

Figure 1. A model of the theory of planned behavior (Fishbein & Ajzen, 2010).

As in the original model, behavioral intention is the direct determinant of behavior (Ajzen, 1991; Fishbein & Ajzen, 2010). However, along with intention there must also be the ability to perform the behavior. Without this ability the behavior will not occur, regardless of intention strength (Ajzen, 1991). Therefore, in addition to a person's intention to perform a behavior, it is also important to take into account whether people have the requisite skills and abilities and whether there are any environmental constraints that might prevent them from carrying out their intentions (i.e., having *actual control* over performing the behavior). The stronger the intention, the more likely it is that the behavior will be carried out (assuming a person has the requisite skills and abilities and a constraint-free environment). What constitutes actual control, as well as how to best measure it, remains somewhat elusive (Fishbein & Ajzen, 2010). Therefore, to the extent that PBC is veridical, it can serve as a proxy for actual control and be used to improve the prediction of behavior by moderating the relationship between intentions and behavior (as shown by the dotted line in Figure 1; Ajzen, 1991). In other words, intentions and actual control interact in their effects on behavior, such that performance of a behavior should be more likely when a person is both motivated and able (see Ajzen, 1991; Fishbein & Ajzen, 2010).

According to the TPB, behavioral intentions are determined by three conceptually independent types of considerations: attitudes, subjective norms, and perceived behavioral control (PBC). Like its predecessor, the TPB is a model wherein attitudes, subjective norms, and PBC are variables that combine additively to form behavioral intention. The additive relationship suggests that the more favorable the attitude, the stronger the social norms, and the greater the PBC, the stronger the intention to perform the behavior. Formally, this portion of the model can be expressed by the following equation:

$$B \approx \hat{I} = b_1 Att + b_2 SN + b_3 PBC + b_0 \; ,$$

where *B* is the performance of some behavior and is usually assessed using dichotomous criteria (e.g., performed or not performed), although in some cases a continuous measure representing behavior frequency or magnitude serves as the behavioral criterion (Fishbein & Ajzen, 2010). *I* is intention to perform a specific behavior *B*, *Att* is the attitude toward performing behavior *B*, *SN* is the subjective norm with regard to *B*, *PBC* is the perceived behavioral control over performing *B*, b_0 is the intercept, and b_1, b_2, and b_3 are empirically determined weights (coefficients) for *Att*, *SN*, and *PBC*, respectively. The coefficients (b_1, b_2, b_3) are not theoretically bound to be constant but may vary by behavior, population, or situation (Fishbein, 2000). Because the conceptualization of attitude and norm remained the same in the TPB, I will focus my discussion on PBC.

Perceived behavioral control. The concept of PBC, as it is used in the TPB, owes much to Bandura's work on self-efficacy. As described by Bandura (1997), the concept of self-efficacy represents beliefs about the ability to perform a behavior; it is the extent to which people feel confident that they can perform the behavior, regardless of circumstance. Whereas the concept of self-efficacy focuses heavily on the idea that people need to feel confident that they can perform a behavior in a number of different situations, PBC extends this conceptualization to include perceptions of one's *perceived capability* to perform the behavior. According to Fishbein and Ajzen (2010), "conceptually, PBC is equivalent to Bandura's (1989) self-efficacy expectation although different operations are typically employed when these constructs are assessed in empirical research" (p. 177).[5]

PBC is usually assessed by various questions that tend to fall into two categories: capacity to perform a behavior (typically composed of questions related to one's confidence in the ability to perform the behavior, which is closely aligned with Bandura's notion of self-efficacy) and the judgment of autonomy over the decision to perform the behavior (typically composed of items that ask about one's control over performing the behavior). According to Fishbein and Ajzen (2010), "a comprehensive measure of PBC can be obtained by including items that represent both capacity and autonomy" (p. 167). In sum, PBC takes into account perceptions of being capable of and having control over performing a behavior. When people believe that they have the required resources and that they will encounter few (or manageable) obstacles, they should have confidence in their ability to perform the behavior and thus exhibit a high degree of PBC.

[5] These operations are discussed further in Chapter 3.

Like the other two direct predictors of intention, PBC is thought to be influenced by beliefs about the potential barriers, resources, and opportunities considered relevant to performing a given behavior (Ajzen, 1991). Following the standard expectancy-value formulation, these beliefs are weighted by the perceived power of the control factor to facilitate or impede the behavior. These salient control beliefs result in a sense of high or low perceived behavioral control. Thus, "the more resources and opportunities individuals believe they possess, and the fewer obstacles or impediments they anticipate, the greater should be their perceived control over the behavior" (Ajzen, 1991, p. 196).

The Role of PBC

Perhaps the most commonly researched role of PBC, and the role focused on in this dissertation, is the direct effect of PBC on intention. As with attitudes and norms, PBC represents a motivational factor that drives intention. As mentioned previously, in their formulation and discussion of the TPB, Ajzen and Fishbein stated that PBC is only one factor that determines intentions, and that PBC increases intention in conjunction with a positive attitude toward a behavior and supportive subjective norms. The additive model suggests that people with little or no PBC over a behavior will intend to engage in it if attitudes are sufficiently high. Likewise, people with very unfavorable attitudes could, on balance, have intentions that are driven by a strong sense of PBC. However, as mentioned in Chapter 1, favorable attitudes (or norms) may not yield strong intentions when PBC is low. If PBC is low it seems highly likely that even very positive attitudes or strong social pressure toward a behavior would not lead to behavioral intention. For example, many smokers may believe that quitting smoking would lead to positive health outcomes and that the people they love would like them to quit but, at the same time, they do not feel confident in their ability to quit. Here, it is likely that these smokers would not form strong intentions to quit smoking. When people base their intention disproportionately on PBC, attitude and norms should have less strong associations with intention. Based on this, one would expect that attitudes and norms would have a relatively strong effect on intention when PBC is high and that those effects are substantially attenuated when PBC is low (see Figure 2). In sum, the additive model does not sufficiently capture the underlying relationships described in the conceptual rationale behind the incorporation of PBC into the TPB.

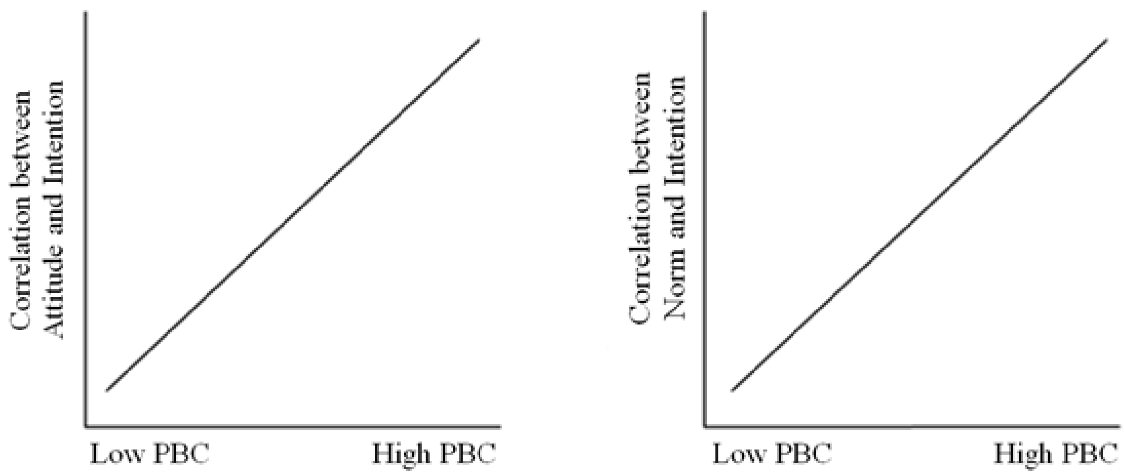

Figure 2. PBC by attitude interaction and PBC by norm interaction.

This interaction hypothesis seems particularly compelling given the history of the reasoned action framework. For example, the tenets of the TRA state that attitudes and norms are sufficient to explain intentions toward volitional behaviors. The TPB addresses a challenge against the sufficiency of the TRA when behaviors are under limited volitional control. Specifically, it is reasonable to expect that volitional behaviors would tend to occur with high PBC (i.e., people would tend to feel very capable of performing the behavior). As a result, one would expect to observe little or no variance in PBC over volitional behaviors. Importantly, the TRA models attitudinal and normative effects on intentions under the presumption that PBC is high. However, when the assumption that the target behavior is under volitional control is violated, attitudes and norms should perform less well in explaining intentions (Yzer, 2007).

As mentioned, the possibility of this moderating role for PBC has been acknowledged since the concept was introduced into the TPB model (Ajzen, 1988, 1991). Nevertheless, PBC interactions have not been discussed extensively in the literature and have not become central to the theory. In the initial series of tests of the TPB, Ajzen and colleagues explored the possibility of interactions among the determinants of intention, but typically failed to find support for such interactions (Ajzen, 1988, Ajzen & Driver, 1992; Ajzen & Madden, 1986). In fact, Ajzen and Driver (1992) pointed out that “the original formulation of the theory postulated interactions between perceived behavioral control and intention, and between perceived behavioral control and attitude” (p. 211).

Based on a lack of initial empirical support, Ajzen and others simply adopted the additive model, which omits any PBC interactions (Ajzen, 2002). In addition, Ajzen and Fishbein left out these moderating effects in subsequent depictions of the TPB (Figure 1 in Ajzen, 1988; Figure 1 in Fishbein & Ajzen, 2010). Nevertheless, Fishbein and Ajzen have continued to acknowledge the possibility that PBC moderates attitudinal and normative effects on intention and have recommended exploring it further. In fact, in their latest book on the reasoned action framework, contrary to the idea of PBC having an additive role in the TPB, Fishbein and Ajzen (2010) stated: “Perceived behavioral control is expected to *moderate* the effects of attitudes and social norms on intentions, just as it was expected to moderate the influence of intentions on behavior” (emphasis in original,

p. 181).

Additional evidence for PBC interactions. Certainly, research outside of the TRA and TPB provide support for the proposed moderating role of PBC. Research on the motivational power of self-efficacy or perceived behavioral control represents a major theme in psychological theories and research. For instance, the concept of control perceptions can be found in Bandura's social cognitive theory (1977, 1997), Weiner's theory of causal attributions (Weiner, 1985), Seligman's model of learned helplessness (Abramson, Seligman, & Teasdale, 1978), Rogers' (1983) protection motivation theory, and Witte's extended parallel process model (EPPM; 1994), just to name a few.

The conceptualization of PBC in the TPB draws heavily from Bandura's work on self-efficacy. Bandura introduced the concept of self-efficacy as a central factor in human motivation and personal agency (Bandura, 1977, 1997). According to Bandura, self-efficacy is among the most pervasive mechanisms of human agency and plays a central role in the self-regulation of motivation (Bandura, 1986, 1997, 2000). Self-efficacy is said to regulate human functioning through cognitive, motivational, affective, and decisional processes (Bandura, 1997, pp. 2-3). Other scholars agree with Bandura that self-perceptions of ability are a central determinant of how motivation translates into behavior (Weiner, 1992; Wulfert, 1996).

Motivation can be defined as a force that guides the direction, intensity, and persistence of behavior (Franken, 1994). Given that people motivate themselves anticipatorily through the exercise of forethought, it stands to reason that if people anticipate not being able to do something they are less likely to even try. What's more, they are also likely to experience anticipated discontent with deficient performance, which would tend to make a behavioral attempt less likely (Bandura, 1992). The effect of perceived inefficacy is particularly powerful when people don't feel capable of performing a behavior that is highly valued (perhaps due to social pressure or positive behavioral outcomes). For example, Bandura said that "people are saddened and depressed by their perceived inefficacy in gaining highly valued outcomes" (1997, p. 153). Thus, self-inefficacy can contribute to despondency and can lead to apprehension, apathy, or despair (Bandura, 1997). Despite positive attitudes and norms toward performing a given behavior, perceptions of efficacy likely dominate a person's motivational drive to act. In other words, when people feel a low sense of PBC, it is doubtful that favorable attitudes and norms are powerful enough to overcome the barriers imposed by self-inefficacy. When barriers are perceived to be insurmountable, they preclude the translation of attitude and norms into intention. In sum, self-inefficacious thinking creates discrepancies between cognitions and action (Bandura, 1986).

Following this line of reasoning, it is not surprising that Bandura also expected that perceptions of personal control (i.e., PBC or self-efficacy) would interact with outcome expectations (wherein attitude and norms represent different classes of outcome expectations) to predict behavior. Bandura (1997) stated:

> There are many activities that, if done well, guarantee valued outcomes, but they are not pursued by people who doubt they can do what it takes to succeed. A low sense of efficacy can thus nullify the motivating potential of alluring outcome expectations. (p. 126)

Bandura clearly suggests that low self-efficacy would prevent a person from intending to perform a task even if he or she were certain that doing so would lead to desired outcomes.

Research on human motivation and development elucidates why a low sense of self-efficacy can negate the motivating potential of an attractive potential outcome and prevent a person from forming an intention to act. In Skinner's (1992) synthesis of the impact of perceived control on motivation, coping, and development, she stated that "all individuals need to feel that they are capable of producing desired and avoiding undesired events. This need gives perceived control its power to regulate behavior, emotion, and motivation under conditions of challenge" (p. 91). Skinner went on to argue that motivational-needs theorists draw from evolutionary, empirical, and logical arguments to support the claim that, from birth, all people are motivated to produce desired events and to prevent undesired events (Connell & Wellborn, 1990; Deci & Ryan, 1985; White, 1959, as cited in Skinner, 1992). Following this, the reason helplessness (or perceived inefficacy) is so distressing is because it represents a state in which a basic psychological need is violated (White, 1959). Motivational theorists posit that when people's psychological need for control is violated, they will be disaffected, which affects behavior (e.g., avoidance, passivity, and resistance), emotion (e.g., anger, fear, and anxiety), and orientation (e.g., people would orient themselves *away* from the activity; Skinner, 1992). Note that this is consistent with Bandura's (1997) claim that low self-efficacy leads to depression, apathy, and despondency.

Individuals with low PBC are more likely to avoid a behavior because such disengagement serves as an adaptive reaction that protects them from exhaustion or loss of self-esteem in the face of impossible tasks (Skinner, 1992). For example, individuals with low self-efficacy tend to use emotion-focused coping strategies (i.e., focusing on one's own emotional reactions to a stressor), whereas the coping strategies of those with high self-efficacy tend to be more problem-focused (i.e., focusing on changing the stressor). Compared to emotion-focused strategies, problem-focused strategies have been shown to facilitate more adaptive responses to stressors (Lazarus & Folkman, 1984). In contrast, people with low self-efficacy use emotion-focused strategies that result in wanting to escape the situation, feeling pessimistic, feeling self-doubt, and discouragement, and having an avoidance orientation.

In line with this reasoning, research on fear appeals also provides support for the moderation hypothesis (Rogers, 1983; Strecher, Becker, Kirscht, Eraker, & Graham-Tomasi, 1985; Witte, 1992; Witte & Allen, 2000). According to the EPPM, the evaluation of a fear appeal initiates two appraisals of the messages—appraisal of the threat followed by an appraisal of the efficacy of the recommended response—which results in either danger control processes or fear control processes (Witte, 1992). The EPPM proposes that a perceived threat (a combination of perceived susceptibility and perceived severity) can serve as initial motivation to engage, or disengage, in a given behavior. However, this research also suggests that it is critical that, once motivated, a person needs to feel able to perform the recommended behaviors. So, although perceived threat determines the degree of the reaction to the message (e.g., motivation to accept the message and change behavior), perceived efficacy determines whether adaptive (i.e., engages in danger control by adopting the protective behavior, thus engaging in proper coping strategies) or maladaptive (i.e., engaging in fear control by tuning out the message and engaging in defensive or maladaptive behavior) reactions will result (Witte, 1992).

The theoretical explanation behind this process is that the majority of people have an innate need to feel good about themselves and avoid discomforting feelings such as fear (Witte & Allen, 2000).[6] When confronted by a threatening prospect that is perceived to be severe and likely (e.g., risks of harm expressed in a fear appeal), people become motivated to evaluate possible coping mechanisms. If perceived self-efficacy to remove or mitigate the threat is low, people are more likely to cope through maladaptive responses (Rippetoe & Rogers, 1987). Maladaptive responses include denial, fatalism, and hopelessness (Rippetoe & Rogers, 1987; Witte, 1992). For example, Strecher et al. (1985) found an interaction between outcome expectations (perceived susceptibility to health hazards of continued smoking) and self-efficacy (anticipated difficulty in refraining from smoking) with respect to smoking reduction. Subjects with high outcome expectancies but low self-efficacy exhibited the lowest overall smoking reduction. Strecher and colleagues argued that this group conforms to the characterization of personal "learned helplessness," wherein a person perceives a threat but feels unable to do anything about it (Seligman, 1975).

The view that self-efficacy is the foundation of human motivation and functioning implies that attitude and norm-related beliefs can affect behavior only after beliefs that the task can be successfully performed have been formed. Previous research has suggested that people with low PBC are unmotivated, discouraged, or apathetic toward a behavior over which they believe they have low control. In turn, an effective strategy for coping with these feelings is to ignore the perceived wishes of important others as well as the possible favorable outcomes of performing the behavior. In other words, attitudes and perceived norms affect behaviors only under conditions in which PBC is sufficiently

[6] Admittedly, this view assumes some level of mental health; not all people have this.

high. When PBC is low, associations of attitudes and norms on intention are expected to be attenuated. Although the aforementioned theories discuss PBC using various terms (e.g., self-efficacy, locus of control, autonomy and self-determination), they by and large address the same underlying phenomenon and reach a common conclusion: The motivating potential of beliefs about the likely effects of a given action (e.g., outcome expectancies) is regulated by beliefs pertaining to personal capabilities to perform that action.

Methodological Issues in TPB Research

Despite the conceptual support for the moderation argument, only a handful of studies out of the thousands that have been published on the TPB have specifically sought to detect PBC interactions. Indeed, Fishbein and Ajzen (2010) noted that the conceptually plausible interaction of PBC with attitude and PBC with norms has remained mostly ignored, and "the vast majority of studies that have been conducted within our reasoned action framework have used attitudes, perceived norms, and PBC as independent predictors of intentions" (p. 181). Reflecting on this paucity in the literature, Yzer (2007) suggested that the difficulty of detecting interaction effects in nonexperimental research have hindered efforts to empirically demonstrate the effect. Among the reasons that moderator effects are difficult to detect in nonexperimental research are that, relative to experimental studies, nonexperimental studies are often underpowered due to any number of factors, including range restriction, error variance heterogeneity, measurement error, scale coarseness, and small sample sizes (Aguinis, 1995; Aiken & West, 1991).

McClelland and Judd (1993) asserted that the major factor that threatens statistical power for detecting interactions concerns the distribution of the predictor and moderator variables. Briefly, in moderated multiple regression, the residual variance of the interaction (i.e., the unique variance in the interaction term that is not shared with either the predictor [*X*] or moderator [*Z*] variable) is determined by the joint distribution of the predictor and moderator variables. Importantly, the residual variance of the interaction determines the statistical power to detect an interaction effect. When the residual variance is low, the efficiency of the moderator parameter estimate and the statistical power will also be low (McClelland & Judd, 1993). When power is low, Type II error is high, which may result in erroneously rejecting theoretical models that include moderating effects (Aiken & West, 1991; Cohen, Cohen, West, & Aiken, 2003; McClelland & Judd, 1993).

Indeed, it is possible that neglecting to examine (or successfully find) moderating effects is due to methodological limitations. In fact, given the difficulty in detecting interaction effects in nonexperimental studies, it is not surprising that conventional approaches have failed to provide empirical support for PBC interactions. For instance, the standard practice for TPB research is to collect of observational data from nonexperimental studies and to conduct moderated multiple regression (von Haefton, Fishbein, Kasprzyk & Montano, 2001; Yzer, 2007); these nonexperimental studies are likely to have less residual variance than experimental studies because of the joint distributions of *X* and *Z*, which in turn makes the typical TPB study less likely to achieve the power needed to detect interactions. As mentioned, the statistical power for detecting a moderator effect, along with estimates of the size of that effect, depends on the joint distribution of the predictor and moderator variables.

Additionally, restricted range of observations and clustering of observations also reduce the residual variance of the interactions (McClelland & Judd, 1993). Consistent with this view, Yzer (2007) asserted that for most health behaviors that been subjected to TBP research, “the distributions of attitude, subjective norm, perceived control and intention are skewed and cluster around one of the scale end points” (p. 118). Based on his years of experience working with TPB data sets, Yzer has commented that the distributions of PBC, in particular, tend to cluster at the high end of the scale and exhibit limited variance. He argued that most people regard many of the behaviors that are examined in observational studies as performable with moderate to high levels of confidence, making it difficult to collect sufficient samples denoting low PBC (M. C. Yzer, personal communication, October 23, 2006). In line with this, Boudewyns and Paquin (2011) found that college student’s perceptions of behavioral control were clustered at the upper end of a 1-7 scale (where 7 = high PBC) and exhibited very little variance (*M* = 6.10, *SD* = 0.78). Not surprisingly, PBC was not a significant predictor of intentions to get tested for STDs when attitudes and norms were entered into the regression.

As an illustration, McClelland and Judd (1993) conducted a simulation of experimental and field studies in which the underlying model and model error were the same for both studies; there was no measurement error in either study, and the number of observations was held constant. The distributions of *X* and *Z* were the only way in which the simulated studies differed.[7] Results from the simulations indicated that the standard errors of estimates of the coefficient for the interaction in the field and experiment studies

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[7] In the field study simulations, the values of *X* and *Z* could vary between the values of -1 and +1 and were each sampled independently from a normal distribution with a mean of 0 (*SD* = 0.5), whereas for the experiment simulations (using a 2 x 2 factorial design with values of *X* and *Z* equal to -1 and +1), there were an equal number of observations at each of the four combinations of *X* and *Z* (-1, -1; -1, +1; +1, +1; +1, -1).

were very different (1.72 for field studies, 0.41 for experimental studies). The inflated standard errors for the interaction in the field study resulted in 91% of the simulated field studies making Type II errors by failing to reject the false null hypothesis (the null hypothesis was that there was not a moderating effect). In other words, 91% of the field studies failed to discover an interaction when one was known to be present. The results of these simulations demonstrated that the joint distributions of the predictor and moderator variables were solely responsible for the superiority of experiments over field studies.

Figure 3 shows the optimal joint distribution for a study that has seven levels of the predictor and moderator variable.[8] McClelland and Judd (1993) pointed out that the type of distribution in Figure 3 (with equal numbers of observations at each corner) is more likely to occur in experiments than in nonexperimental studies. The joint distribution illustrated in Figure 4 is more likely to occur for variables that have approximately normal population distributions. Unfortunately, most nonexperimental studies do not have enough observations at the extreme points of the predictor and moderator scales and thus fail to cover the full range of possible scores (Ajzen, 2002; McClelland & Judd, 1993).

[8] *Optimal* means that such joint distributions of the variables that make up the product term provide maximum statistical power and the smallest confidence intervals of the interaction parameter (McClelland & Judd, 1993).

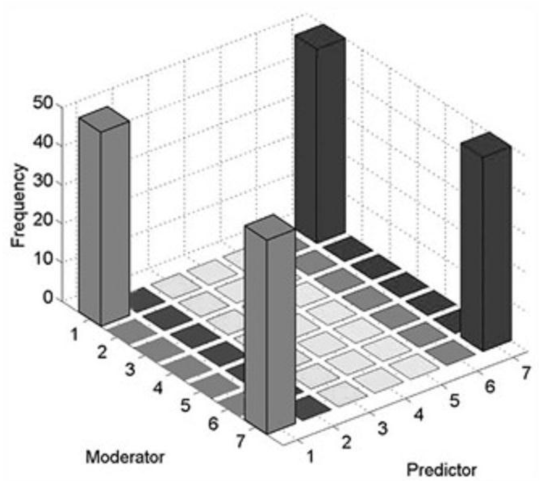

Figure 3. Optimal joint distribution for detecting interaction effects. From “Programs for problems created by continuous variable distributions in moderated multiple regression,” by B. P. O’Connor, 2006, *Organizational Research Methods, 9,* 554-567.Copyright 2006 by Sage Publications. Reprinted with permission.

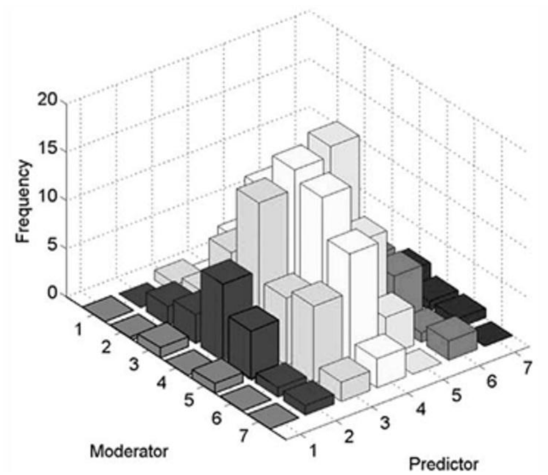

Figure 4. Typical joint distribution for a bivariate normally distributed data set. From “Programs for problems created by continuous variable distributions in moderated multiple regression,” by B. P. O’Connor, 2006, *Organizational Research Methods, 9,* 554-567. Copyright 2006 by Sage Publications. Reprinted with permission.

Previous Research on Perceived Behavioral Control Interactions

Roughly ten years after Ajzen first tested for a moderating effect of PBC on attitudes and norms, a second series of studies began testing for PBC interactions (see Bansal & Taylor, 2002; Boudewyns, Paquin, & Yzer, 2007; Conner & McMillan, 1999; Dillard, 2011; Kidwell & Jewell, 2003; Kim & Chung, 2011; McMillan & Conner, 2003;

Park, Klein, Smith, & Martell, 2009; Umeh & Patel, 2004).[9] Unlike those studies conducted by Ajzen, these more recent studies were the first to provide initial evidence that these specific interactions *may* exist. Table 1 summarizes a number of relevant features of the studies that looked for these interactions. Sixteen behaviors were examined across the 9 studies, of which 13 were health behaviors. With one exception (Boudewyns et al., 2007), all of the studies used nonexperimental data. Also, a greater number of studies tested only for the PBC by attitude interaction, with only four studies testing for both PBC by attitude and PBC by norm interactions in the same study.

[9] These studies represent studies that had a specific focus on the interactions of PBC and attitude or PBC and norms on intention. The initial tests of the interaction by Ajzen and colleagues (Ajzen, 1988, Ajzen & Driver, 1992; Ajzen & Madden, 1986) were not included in the meta-analysis reported below because the results of the tests of the interactions were not reported. The authors only stated that they found no evidence for an interaction between PBC and attitude.

Table 1

Review of Studies that Examined PBC Interactions Predicting Intention

Source	*N*	# Predictors	Intention to . . .	PBC Interactions on Intention: PBC x Att	PBC Interactions on Intention: PBC x SN
Bansal & Taylor, 2002	371	5	switch mortgage providers	Sign. +	--
Boudewyns et al., 2007	86	3	donate money in the next 30 days	Sign. +	--
Conner & McMillan, 1999	249	12	use cannabis over next 3 months	Sign. +	--
Dillard, 2011	174	6	get vaccinated against HPV during this year	Sign +	Sign. +
Kidwell & Jewel, 2003 (Study 1)	139	11	use sunscreen at least once per year	Sign. +	Sign. +
		11	drink & drive at least once per year	*ns*[a]	*ns*
		11	donate blood at least once per year	Sign. –	Sign. +
		11	east fast food at least once per year	*ns*[a]	*ns*
Kim & Chung, 2011	202	5	buy organic body lotion/shampoo	Sign. +	--
McMillan & Conner, 2003	461	8	use LSD over next 6 months	Sign. +	--
		8	use amphetamine over next 6 months	Sign. +	--
		8	use cannabis over next 6 months	Sign. +	--
		8	use ecstasy over next 6 months	Sign. +	--
Park et al., 2009	1,100	25	limit alcohol consumption the next time I party	--	Sign. +
Umeh & Patel, 2004	200	15	take ecstasy within next 2 months	Sign. +	*ns*
		15	obtain ecstasy within next 2 months	*ns*	*ns*

Note. PBC = perceived behavioral control, Att = attitude, SN = subjective norm. Sign. = two-tailed statistically significant at $p < .05$. *ns* = not statistically significant, "--" = not tested. "+" = positive effect, "–" = negative effect –.

[a] But note that PBC significantly interacted with positive emotional affect (in the context of drinking and driving) and negative emotional affect (in the context of fast food consumption), which are likely correlates with affective attitude.

Research Synthesis of the Interaction

To synthesize the results of these studies, a mixed methods approach was undertaken. First, a narrative review of the results was supplemented by a vote counting procedure. Next, a meta-analysis of the reported effect sizes was reported. Although vote counting is generally seen as bad practice when used to summarize evidence (Hedges & Olkin, 1985), it may be a useful descriptive tool.[10] Therefore, the vote count served as an informative complement to a meta-analysis of the interaction effect that was conducted using the semipartial correlation as the effect size.

In the studies that reported evidence of a significant, positive PBC by attitude or PBC by norms interaction, the effect of attitude on intention (or norm on intention) increased as PBC increased. However, these studies typically found that the interaction accounted for only a few additional percentage points of explained variance once the main effects were accounted for. It is difficult to draw conclusions from the studies in Table 1 because an incredibly small percentage of studies employing the TPB actually report tests of the interaction. So, although these studies represent instances in which PBC interactions were demonstrated, there has been limited published research examining this effect. Thus, the results across the nine studies are equivocal. Three studies found both significant and nonsignificant results (see Table 1: Kidwell & Jewel, 2003; Kim & Chung, 2011; Umeh & Patel, 2004). These three studies reveal a pattern wherein the PBC by attitude interaction was significant but the PBC by norms interaction

[10] Two common criticisms of vote counting is that the sample size is not included and a point estimate of the effect size is not provided; thus, larger studies are counted equal with smaller studies, and researchers are left unsure of the strength (i.e., magnitude) of the effect. For a more in-depth discussion on the potential pitfalls of the vote counting method, see Combs, Ketchen, Crook, and Roth (2011).

was not.

Formal vote counting. To do a vote count of directional results, studies reporting a statistically significant interaction were coded as *positive* and studies with a significant negative interaction were coded as *negative.* Where no significant interaction was found, the study was coded as *equivocal* (Light & Smith, 1971). If one article contained multiple studies, they were counted as independent votes (see Table 2). One article reported two similarly worded outcomes (take ecstasy and obtain ecstasy) in the same study; the outcome related to taking (instead of obtaining) ecstasy was coded because that measure was consistent with the wording used in the intention measure (e.g., the intention item asked about taking ecstasy). The three categories were then summed, and a sign test was conducted to see if the cumulative results suggest that one direction occurs more frequently than chance would suggest (Bushman & Wang, 2009).[11] The sign test is the binomial test with probability $\pi = .5$ (Conover, 1980, as cited in Busman & Wang, 2009). So, the test statistic for the sign test is the observed proportion of positive returns minus 0.5, divided by the standard deviation of the binomial distribution. The assumption is that under the null hypothesis, the probability of observing a positive interaction is equal to the probability of observing a negative interaction (this assumes that the true interaction effect is zero), or $\pi = .5$ (Hedges & Olkin, 1980).

For the attitude by PBC interaction, there were ten positive significant results in the fourteen studies (71%). The estimate of π is therefore 10/14 = .71. Using a two-tailed

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[11] Another approach to vote-counting is to sum the categories, and the category with the most votes (or more than some specific proportion of votes) is declared the winner (i.e., it is declared the category that is most representative of the literature as a whole).This approach was not used because although it allows the researcher to identify which model category is the winner, it does not allow one to determine the margin of victory (Bushman & Wang, 2009).

test, when $\pi = .5$, the test statistic for the sign test was .09. Thus, the null hypothesis that $\pi = .5$ at the .05 significance level was not rejected (because .09 is greater than .05). For the norm by PBC interaction, there were four positive results in the 7 studies (57%). The estimate of π is therefore 4/7 = .57. Using a two-tailed test, with $\pi = .5$, the test statistic for the sign test was .23. Once again the null hypothesis that $\pi = .5$ at the .05 significance level was not rejected. In sum, although 71% of the tests of the attitude by PBC interaction and 57% of the tests of the norm by PBC interaction found support for the presence of an interaction effect, the sign tests did not find evidence for the interaction.

Table 2

Vote Count of Interaction Effect of Attitude and PBC and Norm and PBC on Intention

	# of tests	Sign.+	Sign.–	Equivocal
PBC x Att	14	10 (71.43%)	1 (7.14%)	3 (21.43%)
PBC x SN	7	4 (57.14%)	0 (0%)	3 (42.86%)

Note. PBC = perceived behavioral control; Att = attitude; SN = subjective norm; Sign.+ = significant and positive interaction term; Sign. – = significant and negative interaction term; Equivocal = studies that found either positive or negative interaction effects that were not significant.

Meta-analysis. A meta-analysis of interaction effects was undertaken in order to estimate the size of the effect. Undertaking such a meta-analysis raises a number of questions regarding which parameters (e.g., correlation coefficients, regression coefficients, semipartial correlations) should be used in meta-analysis. Although the correlation coefficient, *r*, is a commonly used measure, it is an inappropriate statistic for interaction terms because of its scale dependence; therefore, one cannot be confident about the effect sizes for simple correlations involving multiplicative composites (Kanetkar et al., 1995). Using simulated data, Schmidt (1973) and Arnold and Evans (1979) demonstrated that the assumption that correlation coefficients are stable estimates on which to base meta-analyses does not hold for correlations between a multiplicative composite (i.e., interaction term) and a third variable. Specifically, this scale sensitivity occurs because both the covariance and variance of a product variable depend upon the means and variances of the component variables. Thus, aggegation of the correlations of multiplicative composites is not recommended (Kanetkar et al., 1995).

Across the nine studies, the most commonly reported statistic for the interaction term was the standardized regression coefficient. Unfortunately, aggregating this coefficient for meta-analysis is not recommended for two key reasons. First, the independent variables included in the original regressions are far from consistent across studies. In discussions of the utility of regression coefficients as effect sizes, it has been cautioned that the obtained beta coefficient should only be included into a meta-analysis if "all other included studies applied exactly the same set of predictors, which is rarely the case" (Hunter & Schmidt, 2004, p. 476). The second, and perhaps the more critical issue, is that the standardized coefficient for the association between the interaction term and intention is typically affected by an additive transformation of its component variables (i.e., mean-centering of the PBC and attitude or norm variables prior to multiplication) and is uninterpretable (Aiken & West, 1991). Because of this situation, when reporting tests of interactions, only unstandardized *b* coefficients should be reported (see Aiken & West, 1991, pp. 40-42).[12] Thus, it would not be wise to aggregate this statistic in a meta-analysis.

Kanetkar et al. (1995) used simulated data derived from hierarchical multiple regression models to identify which statistic should be aggregated in meta-analyses of

[12] Because β is uninterpretable, reporting the β for the interaction term would be irresponsible. In reporting the β in the output, even with strong caveats (which most authors fail to provide), there is an implicit understanding that the analysis can be interpreted in some meaningful way. Readers who don't grasp the limitations of the coefficient (i.e., that it is uninterpretable) may still try to find meaning in the output. In sum, reporting the β invites misinterpretation and is therefore misleading.

interactions. The goal of their study was to analyze alternative parameters (correlations, covariances, standardized and unstandardized regression coefficients, semipartial and partial correlation coefficients) derived from a hierarchical regression analysis and to make recommendations about the appropriate techniques to use for aggregating moderator effects in meta-analysis. Kanetkar et al. (1995) concluded that the only statistics that are appropriate when there are additive scale changes (as is the case with interaction terms that are the product of two mean-centered variables) are the unstandardized regression coefficient and the semipartial correlation coefficient. The authors noted that even though both the unstandardized slope and semipartial correlation coefficient are appropriate when there are additive scale changes, the semipartial correlation is more intuitively understandable.[13] Specifically, the squared semipartial correlation coefficient can be interpreted as the precentage of unique variance in the dependent variable explained by the interaction term. In sum, Kanetkar et al. (1995) stated, “Semipartial correlation coefficients provide the most nearly stable estimates for conducting meta-analyses involving interactions between predictor variables” (p. 223).

In this meta-analysis, the semipartial correlation represents the increment in the proportion of variance in intention explained by either the PBC by attitude or the PBC by norm interaction. The semipartial correlation r_{sp} was used as the effect-size index. The r_{sp} can be written as

$$r_{\text{sp}} = \frac{t_f\sqrt{(1 - R_Y^2)}}{\sqrt{(n - p - 1)}},$$

[13] An added benefit of using the semipartial correlation coefficient for this meta-analysis is that the majority of studies reported the necessary information to calculate the semipartial correlation coefficient. In contrast, only a couple of studies reported the unstandardized regression coefficient.

where t_f is the t statistic of the regression coefficient for the interaction in the multiple regression model, R_Y^2 is the squared multiple correlation for the full model, p is the number of predictors, and n is the sample size. The variance of each r_{sp} was computed using the following formula:

$$var(r_{\text{sp}}) = \frac{(R_Y^4) - 2R_Y^2 + R_{Y(f)}^2 + 1 - R_{Y(f)}^4}{n},$$

where $R_{Y(f)}^2$ is the squared multiple correlation for a model without the predictor of interest. Because $R_{Y(f)}^2$ is often not reported, the $R_{Y(f)}^2$ needed to be computed (see Aloe & Becker, 2012, for the complete proofs). $R_{Y(f)}^2 = R_Y^2 - r_{\text{sp}}^2$, where r_{sp}^2 the squared semipartial correlation (r_{sp}). Once the r_{sp} and the variance of the r_{sp} were computed, the meta-analytic procedure is the same as those that use correlation coefficients as effect sizes. Standard errors and confidence intervals were computed for the individual r_{sp} values from each study, and each study was weighted using inverse variance weights. The semipartial correlation for the interaction terms in the McMillan and Conner (2003) and Umeh and Patel (2004) studies could not be calculated because the necessary data was not reported.[14] In order to calculate the effect size one of the following pieces of information was needed: (1) the semi-partial coefficients for the PBC x Attitude or PBC x Norm interaction terms, (2) the t statistics for the interaction term's regression coefficients, (3) the unstandardized slope coefficients along with the standard errors of the slopes. Because the significance level was provided for the interaction terms in the McMillan and Conner study, a conservative approach was taken whereby the best

[14] These authors were contacted to request the necessary information. The t statistic for the Umeh and Patel (2004) study was not estimated because the interaction term was not significant and the necessary information to compute the effect size estimate was not reported.

estimate of the semipartial correlation was calculated using the upper-bound probability (i.e., $p < .05$ is $p = .05$). The minimum t statistic for the reported significance level was used (taking into account the df of the regression model). For the McMillan and Conner (2003) study, the t statistic used was 4.501. It is important to note that the semipartial correlations for the interaction terms from the McMillan and Conner study are lower-bound estimates of the actual effect size found in the study (Card, 2012). Figures 5 and 6 show the 13 effects that explored the PBC by attitude interaction and the six PBC by norm effects, respectively.

Effects were obtained from these studies. However, the regression models from which these effects were drawn were all markedly different. Eight articles presented regression results with the appropriate information needed to calculate semipartial correlations. Thirteen semipartial correlations for the PBC by attitude interaction and six semipartial correlations for PBC by norm interaction were calculated (see Figure 5 and Figure 6). Between five and 25 predictors were included in the models. For the interaction effect of attitude and PBC on intention, the weighted mean effect size under the fixed-effects model is $\bar{r}_{sp}= .10$ [$CI_{95\%}$ = .08, .12], with standard error = .01. The mean significantly differs from zero ($z = 10.93$, $p < .0001$). The study results are heterogeneous ($Q = 37.41$, $df = 12$, $p < .001$); therefore, the weighted mean effect size under the random-effects model was calculated. The mean effect size is $\bar{r}_{\text{sp}}= .09$, $SE = .02$ [$CI_{95\%}$ = .06, .13], ($z = 5.34$, $p < .001$). The squared semipartial correlation can be interpreted as the percentage of unique variance in intention that is explained by the interaction term. Therefore, this suggests that the attitude by PBC interaction uniquely explained 1% of the variance in intention. For the interaction effect of norm and PBC on intention, the weighted mean effect size under the fixed-effects model is $\bar{r}_{sp}$= .06 [$CI_{95\%}$ = .03, .10], with standard error = .02. The mean significantly differs from zero (*z* = 3.79, *p* < .0001). The study results are heterogeneous (*Q* = 15.31, *df* = 5, *p* <.01); therefore, the weighted mean effect size under the random-effects model was calculated. The mean effect size is $\bar{r}_{sp}$= .06, *SE* = .04 [$CI_{95\%}$ = -.02, .13], (*z* = 1.43, *ns*).

Study name	Statistics for each study				
	r_{sp}	Lower limit	Upper limit	*z*	*p*
Dillard, 2011	0.090	0.035	0.144	3.207	0.001
Bansal & Taylor, 2002	0.092	0.045	0.139	3.796	0.000
Conner & McMillan, 1999	0.090	0.036	0.143	3.284	0.001
Kidwell & Jewel, 2003 (donate blood)	-0.135	-0.243	-0.023	-2.358	0.018
Kidwell & Jewel, 2003 (drink)	-0.031	-0.149	0.087	-0.514	0.607
Kidwell & Jewel, 2003 (fast food)	-0.030	-0.133	0.074	-0.569	0.570
Kidwell & Jewel, 2003 (sunscreen)	0.163	0.052	0.270	2.869	0.004
Kim & Cheung, 2011	0.171	0.090	0.250	4.094	0.000
McMillan & Conner, 2003 (Amphet.)	0.140	0.081	0.198	4.616	0.000
McMillan & Conner, 2003 (Cannabis)	0.120	0.068	0.172	4.476	0.000
McMillan & Conner, 2003 (Ecstasy)	0.120	0.069	0.170	4.619	0.000
McMillan & Conner, 2003 (LSD)	0.150	0.084	0.214	4.446	0.000
Umeh & Patel, 2004 (take ecstasy)	0.111	0.033	0.188	2.781	0.005
Random effects model	0.092	0.058	0.126	5.338	0.000

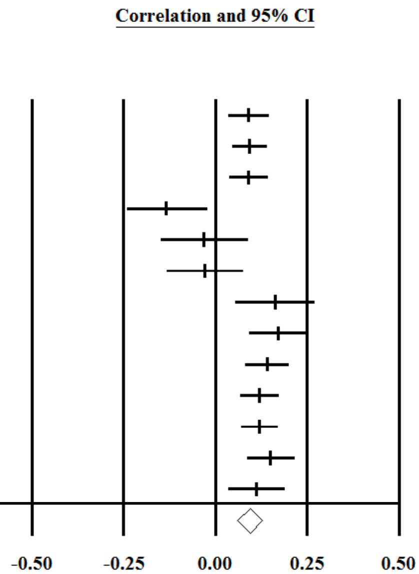

Figure 5. Forest plot of effect sizes for the attitude by PBC interaction under the random-effects model.

Study name	Statistics for each study				
	r_{sp}	Lower limit	Upper limit	*z*	*p*
Dillard, 2011	0.060	-0.398	0.494	0.244	0.807
Kidwell & Jewel, 2003 (donate blood)	0.170	0.058	0.278	2.954	0.003
Kidwell & Jewel, 2003 (drink)	-0.070	-0.187	0.049	-1.152	0.249
Kidwell & Jewel, 2003 (fast food)	-0.050	-0.153	0.054	-0.942	0.346
Kidwell & Jewel, 2003 (sunscreen)	0.150	0.039	0.257	2.648	0.008
Park et al., 2009	0.070	0.030	0.110	3.409	0.001
Random effects model	0.056	-0.021	0.132	1.433	0.152

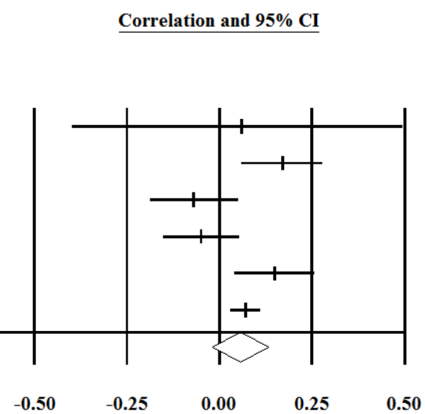

Figure 6. Forest plot of effect sizes for the norm by PBC interaction under the random-effects model.

Comparing the vote count and meta-analytic assessments, it appears that the two methods come to slightly different conclusions. Both fail to find evidence for a norm by PBC interaction, but whereas the attitude by PBC interaction reached, but did not achieve, significance in the vote count, it did reach significance in the meta-analysis. Specifically, the attitude by PBC interaction was found to have a small effect size (Cohen, 1992). Because vote counting takes into account the only the direction of effect and not the size of effect, the results of the meta-analyses are considered to be superior. Based on the meta-analysis, there appears to be a very small attitude by PBC interaction on intention, but there is not sufficient evidence for a norm by PBC interaction.

Case Study of Interaction

In addition to the aforementioned studies, Yzer (2007) empirically demonstrated that by increasing statistical power, PBC interactions could be found. He used three large datasets describing attitude, norms, PBC, and intention to use a condom with new sexual partners (N = 1,502), to use marijuana (N = 1,461) and to quit smoking (N = 3,456). Across the three studies, Yzer found that PBC moderates attitudinal and normative effects on intention. The strongest evidence for the interaction was found for the smoking cessation dataset, where attitude, norms, PBC, and intention were less skewed and not as clustered at one end of the scale, compared to the condom use and smoking datasets. For example, attitude, norms, PBC, and intention all had skewness coefficients within ± 1. Also, Yzer added, "potentially promising for the detection of interaction effects is the negative kurtosis for perceived control, which suggests that perceived control observations do not cluster very much and have short tails" (p. 115).[15] Specifically, attitude predicted intention more strongly (i.e., with a greater positive slope) when PBC

[15] The kurtosis coefficient for PBC was –0.54 (SE = 0.08).

was relatively high (*b* = 0.56) than when it was relatively low (*b* = 0.22). The same pattern was found for norms (*b* = 0.32 for high PBC vs. *b* = 0.10 for low PBC). Similar to the aforementioned discussion, Dillard (2011) demonstrated that a study with a smaller sample (*N* = 174) can also detect interactions when the distribution of the predictor variables are not overly skewed.[16]

Overcoming Methodological Issues

Noting both the difficulty and importance of examining PBC interactions, Yzer (2007) offered some suggestions for how to advance research on this topic. First, in the case of nonexperimental studies, conduct an *a priori* power analysis to determine the sample size needed for the interaction tests and make sure to check the distribution of the data before performing any analyses. Cohen et al. (2003) illustrated that in order to achieve .80 power to detect an interaction with a small effect size (assuming both predictor and moderator are measured with reliabilities over .80), a sample of over 1,000 cases is required. Such large samples are often beyond the resources of the researchers, and in fact, most TPB studies do not have such large sample sizes. As an illustration, in Hagger and Christiansen's (2009) meta-analysis of 36 TPB studies, only two studies had sample sizes equal to or greater than 1,000. Similarly, only one study (out of 27 studies) had a sample size greater than 1,000 in a TPB meta-analysis conducted by Rivas, Sheeran and Armitage (2009); the mean sample size for studies in this meta-analysis was only 272 (range = 24-3,428; *SD* = 389.31; median = 159).

Second, Yzer (2007) recommended future studies use experimental methods to

[16] For example, Dillard reported the following skewness values: attitude = -0.15, PBC = -0.29, norm = -0.64, intention = 0.33. The standard error for the skewness values was not reported.

manipulate subjects to be at the extremes (e.g., low attitude-low PBC, low attitude-high PBC, high attitude-low PBC, or high attitude-high PBC), thereby optimizing power to detect an interaction. Following up on this suggestion, Boudewyns and colleagues (2007) conducted a laboratory experiment that manipulated PBC and attitude to achieve extremes that are not typically observed in survey research. This study's design addressed the aforementioned issues (i.e., not having data points at the extreme ends of the PBC and attitude continua) and was the first study to experimentally test the attitude x PBC moderation effect. Boudewyns et al. used a 2 (PBC: low, high) x 2 (attitude: unfavorable, favorable) factorial design and randomly assigned each participant to one of the four conditions. All participants were presented with two fictitious newspaper articles, each dealing with the topic of donating money to a student organization on campus. One article was designed to manipulate attitude whereas the other manipulated PBC. As predicted, the results of the experiment provided evidence in favor of the hypothesis that the intention to perform a behavior increases in relation to an improvement in attitude only under conditions in which PBC is high.

Meta-analytic test for PBC interactions. Finally, to the extent that inadequate power accounts for the failure of many interaction tests, another possible solution would be to use meta-analytic methods to test for interaction effects across studies with different levels of PBC. This approach is the one that I adopted in this dissertation. Although this study will use a meta-analytic method, its goal and contribution is substantially different from that of previous meta-analyses that have been conducted on the TPB. Previous meta-analyses have sought to integrate past literature on the TPB in order to provide a comprehensive review of the state of the literature and to provide an assessment of the efficacy of the TPB as a predictor of intentions and behavior. These meta-analytic reviews include general overviews of the theory (Armitage & Conner 2001a; Notani, 1998) and examinations of specific behavioral domains (e.g., exercise: Downs, & Hausenblas, 2005; Hausenblas, Carron & Mack, 1997; physical activity: Hagger et al., 2002; condom use: Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Sheeran & Taylor, 1999; smoking: Topa & Moriano, 2010). Other meta-analyses focused on the utility of adding additional predictors to the theory by quantifying the relationship between any proposed additional variable and intention (Hagger & Chatzisarantis, 2009; Rivis & Sheeran, 2003a; Rivis et al., 2009; Rise, Sheeran, & Hukkelberg, 2010; Sandberg & Conner, 2008). Once again, the goal was to provide a statistical review of all the relevant literature in order to provide support for the inclusion of some new variable. In contrast, rather than provide a comprehensive overview of the utility of the TPB, this dissertation will strategically gather a large enough sample of TPB studies so as to assess whether PBC interactions can be detected, even when the primary studies did not test for such interactions.

Boundary Conditions of PBC Interaction

Certainly it is common practice to explore moderators when conducting a meta-analysis; previous TPB meta-analyses have examined things like the year of publication, the type of behavior, and the sample characteristics. But no previous study has explored ways to capture interaction effects that were not examined in the primary studies. Further, in addition to looking for specific interactions, potential boundary conditions of the interaction will be examined. One of the tenets of the TPB is that the relative importance of attitudes, norms, and PBC may vary depending the behavior being examined and the population being studied (Fishbein & Ajzen, 1975, 2010). That is, the theory anticipates that the predictive value of attitudes, norms, and PBC may be greater or smaller depending on contextual factors relating to specific behaviors and populations. It is also possible that the two-way interactions between PBC and attitude and PBC and norms on intention vary across certain behaviors.

Most TPB and TRA meta-analyses are behavior specific (e.g., Downs & Hausenblas, 2005) or are limited to health behaviors (e.g., Rivis & Sheeran, 2003). Because this dissertation was not limited by behavior type, the included studies represent a broad class of behavior types. However, given the focus of this dissertation, behaviors were classified into groups on the basis of their similarity along two different attributes that are particularly relevant for understanding the boundaries of PBC interactions. Specifically, based on existing research on the formation and importance of PBC evaluations (Bandura, 1997; Langer, 1975; Lent & Hacket, 1987), the attributes of familiarity versus novelty and public versus private are believed to influence people's perceived accuracy of their PBC appraisals. This classification will help elucidate thinking into why familiar or public behaviors are predicted differently by TPB constructs.[17]

Familiarity. According to Bandura (1997), self-efficacy is acquired or derived from four key sources: (1) enactive mastery experience (i.e., drawing from one's own experiences); (2) vicarious experiences (i.e., watching others of similar ability model certain behaviors or actions); (3) verbal persuasion (i.e., having important others persuade

[17] Certainly, there are others ways of classifying behaviors. M. Turner (personal communication, November 26, 2012) suggested that another meaningful way to classify behaviors is to code whether they are addictive or not.

one that he/she can perform a given behavior); and (4) emotional arousal (i.e., stress or excitement). Bandura (1997) stated, "enactive mastery experiences are the most influential source of self-efficacy because they provide the most authentic evidence of whether one can muster whatever it takes to succeed" (p. 80). Therefore, it is reasonable to expect that when people are faced with a familiar behavior (i.e., a behavior that they likely have performed in the past), they will think that they have formed accurate PBC evaluations. The perception of accurate PBC evaluations is important because, according to Lent and Hackett (1987), accurate and strong expectations of personal efficacy are crucial to the initiation of behavioral performance in human development (i.e., the formation of intentions). Bandura stated that "when the situations people are likely to encounter are not fully known, one would predict better from perceived efficacy for common situations than for unusual ones" (1997, p. 50).

From this argument, it follows that when people are familiar with a behavior, they will perceive to form more accurate assessments of their capabilities to perform the behavior. These assessments should also be held with more certainty. Take, for example, when people are asked how confident they are in their ability to only purchase organic food. If those people have consistently tried and failed at only buying organic food, they will likely think that they hold a fairly accurate perception of their confidence in their ability to only purchase organic foods. Insofar as perceptions of control that are also perceived to be accurate better predict intentions, the magnitude (or strength) of the association between PBC and intention should also be stronger for familiar behaviors. Indeed, some evidence exists to support this. In a meta-analysis on the predictive utility of PBC in the TPB, Notani (1998) classified behaviors as either familiar (e.g., a behavior that an individual would have plenty of experience with) or unfamiliar (e.g., a behavior that is relatively novel) and found that PBC was a stronger predictor of intention for familiar behaviors ($b = 0.17$, $p < .01$) than for unfamiliar behaviors ($b = 0.08$, *ns*).[18] Although these findings speak to the magnitude of the association between PBC and intention, they could also be interpreted as meaning that one's perceptions of control are perceived as more accurate. Notani argued that the degree of familiarity with a behavior can affect the motivation to translate behavioral control into intentions because PBC is more accurate for familiar behaviors. Taking this one step further, because attitude and intention are often highly correlated, moderators of the PBC–intention association should also moderate the PBC–attitude association.

Public versus private. Another source of PBC information is vicarious experience. Vicarious experience relies on social comparison, whereby people appraise their capabilities in relation to the attainments of others. More specifically, social comparison is the process by which individuals evaluate themselves by comparison with others to validate and define reality (Festinger, 1954). Bandura (2001) explained, "In vicarious verification, observing other people's transactions with the environment and the effects they produce provides a check on the correctness of one's own thinking" (p. 269). Here, the success or failure of similar others is seen as diagnostic of one's own capabilities (Bandura, 1997).

Bandura noted that there are certain contexts wherein vicarious information is particularly important to the formation of self-efficacy beliefs. Specifically, when people lack direct prior experience with a behavior they will turn to their vicarious experiences

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[18] *b* is the unstandardized regression coefficient.

to make PBC judgments (Bandura, 1997). One commonly cited source of vicarious influence is modeling. Importantly, the modes of modeling (often referred to as observational learning) include observing people directly in one's everyday life, or indirectly observing behaviors through the television and other media (Bandura, 1997). Rimal, Lapinski, Turner, and Smith (2011) summarized existing research on the effect that the public or private character of a behavior has on the strength of the relationship between attitude and intentions and norm and intentions. For example, the influence of perceptions of what others do and the pressure that one feels to conform to behaviors are argued to be attenuated for private behaviors (see Rimal et al., 2011, for review). The same relation is also expected with respect to PBC, wherein being able to watch others perform a behavior should heighten people's PBC to perform the same behavior (Rimal et al., 2005).

In their meta-analysis of the prospective prediction of health behaviors with the TPB, McEachan et al. (2011) used a functional approach to group behaviors.[19] Although they did not specifically code behaviors based on the extent to which behaviors are publically observable, some of their behavior categories reflect categories that are often generally performed in public or generally performed in private. For example, McEachan et al. (2011) used the following classifications of behaviors: risk (e.g., speeding, drinking alcohol, smoking, using drugs), detection, physical activity, dietary, safer sex, and abstinence from smoking. Arguably, physical activity behaviors are often enacted in the

[19] The functional approach to classifying behaviors is often utilized in the context of health behaviors, in which the overarching distinction is whether performance of a health behavior would benefit or harm health (McEachan, Lawton, & Conner, 2010). In this approach, behaviors are often further grouped as preventative health behaviors, detective health behaviors, or curative health behaviors (e.g., Rothman & Salovey, 1997).

presence of others (e.g., working out at a gym, running a marathon), whereas safe sex behaviors are often enacted in private, usually with one other person (e.g., condom use). Comparing the effect sizes for those two groups of behavior would determine if PBC is a stronger predictor of intention for public versus private behaviors. Their results showed that the correlations between PBC and intention for public behaviors were greater than that for private behaviors, but they were not significantly different: For example, the average correlation corrected for sampling error for physical activity was $r = .47$, and the average correlation corrected for sampling error for safe sex was $r = .44$. These differences may not be large, but they do show the expected pattern where the public behavior has a larger PBC–intention correlation than the private behavior. Physical activity and safe sex represent a public and a private behavior; expanding the group of public and private behaviors to extend beyond physical activity and safe sex may uncover greater differences.

In sum, this study will use a meta-analytic approach to provide an additional test to ascertain whether PBC is a moderator of the association between attitude and intention and norms and intention, thus providing a deeper understanding of the attitude–intention and norm–intention relations. This study will extend existing research in important ways. First, the previous studies that tested for PBC interactions did not do so in a consistent manner. For instance, of the two possible PBC interactions on intention, the PBC by norms effect has been examined less often than the PBC by attitude effect, and few studies have examined both. Second, none of the previous studies investigated the boundary conditions of the proposed moderation. Specifically, this study will examine whether the proposed moderation is affected by different types of PBC operationalizations and different categories of behaviors.

Chapter 3: Hypotheses

Moderation Hypothesis

Previous studies exploring PBC interactions provide some evidence against the appropriateness of the additive model. Although attitude and norms are positively related to intention, the strength of this relationship weakens as the level of PBC decreases (Dillard, 2011; Kidwell & Jewell, 2003; Yzer, 2007). Based on the argument presented in Chapter 2, for individuals with very low PBC, there should be little, if any, relationship between attitude and intention or social norms and intention. Being low on PBC depresses the relationship of attitude or norms to intention; being high enhances it. Previous research has explored these linear interaction effects, arguing low PBC detracts from the effect of attitude on intention (see Figure 2). The first possibility is that there is a positive monotonic relationship wherein the relation between attitude (or norm) and intention becomes more positive as the value of PBC increases:

> Hypothesis 1: The correlation between attitudes (independent variable) and intention (dependent variable) is increasingly more positive as the level of PBC increases from low to high.
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> Hypothesis 2: The correlation between and norms (independent variable) and intention (dependent variable) is increasingly more positive as the level of PBC increases from low to high.

Three-Way Interaction Hypotheses

A second objective of this study is to test whether different types of behaviors interact with PBC to affect the degree of the attitude–intention (or the norm–intention) relation. Two behavioral attributes that are predicted to affect the hypothesized PBC interactions will be examined: the familiarity of behavior and the public versus private character of the behavior.

Familiarity. If people think that they can't do something that they are familiar with, they may have more confidence in their assessment of PBC, which should strengthen the moderating effect of PBC on the attitude–intention effect size. Alternatively, if people are faced with a novel, or unfamiliar, situation they may feel uncertain about the accuracy of their PBC, which could lead them to discount, or downplay, PBC information. Thus, novel behavior categories may temper the moderating effect that PBC exerts on attitudes and norms.

> Hypothesis 3: The interaction effects proposed in H1 and H2 are more likely to occur for familiar behaviors than unfamiliar behaviors.

Public versus private. Because public behaviors provide the opportunity to watch similar others succeed or fail at a behavior, people should believe that they have more accurate perceptions of their PBC in this situation. In line with the familiarity argument, confidence in the accuracy of PBC evaluations should affect whether a PBC interaction is found.

> Hypothesis 4: The interaction effects proposed in H1 and H2 are more likely to occur among public behaviors than private behaviors.

Measuring PBC. PBC is conceptualized to reflect the perception of one's ability to perform a given behavior. Moreover, Fishbein and Ajzen (2010) suggested that researchers include a range of items that assess aspects of capacity and autonomy in order to capture the full range of the meaning of PBC. However, some have questioned the unitary conceptualization of PBC and instead have argued that items that are concerned with confidence in one's ability to perform a behavior measure perceived self-efficacy, whereas items that address control over a behavior (or the extent to which something is up to the actor) measure perceived behavioral control (Armitage & Conner, 1999; Manstead & van Eekelen 1998; Terry & O'Leary, 1995). These investigators have argued that there are fundamental differences between perceived controllability and self-efficacy; instead of representing self-efficacy and perceived controllability as two aspects of a single latent construct, these investigators have sought to empirically demonstrate that the two aspects represent two separate constructs (Armitage & Conner, 1999; Norman & Hoyle, 2004; Terry & O'Leary, 1995). Using principal components analysis, these studies have found evidence that the prototypical self-efficacy questions tend to load together and the prototypical perceived controllability items load together (e.g., Armitage & Conner, 1999; Terry & O'Leary, 1995).

Moreover, in a meta-analysis, Armitage and Conner (2001a) found that self-efficacy items correlated more strongly with intention (r = .44; 28 tests) than did perceived controllability items (r = .23; 7 tests).[20] However, the majority of studies in Armitage and Conner's (2001a) meta-analysis used measures that had a mix of self-efficacy and perceived controllability items; this comprehensive measure of PBC had the same correlation with intention (r = .44; 101 tests) as the self-efficacy items. Such studies suggest that items meant to assess PBC can not only be empirically separated into two aspects, but that there may be differences in the correlation of self-efficacy and perceived controllability in explaining intention. In contrast to this perspective, Hagger and Chatzisarantis (2005) used structural equation modeling and found that PBC is better

[20] The reported correlations were weighted by sample size.

represented as a second-order latent factor with two dimensions, as evidenced by equivalent goodness-of-fit and superior parsimony when compared to first-order discriminant and congeneric models. Unlike the previous studies, Hagger and Chatzisarantis explicitly modeled, tested, and found support in favor of the two dimensional factor structure advocated by Fishbein and Ajzen (2010). Hagger and Chatzisarantis' findings demonstrate that perceived self-efficacy and perceived behavioral control refer to the same latent construct, namely to perceived ability to perform a given behavior or carry out a certain course of action. On this view, it is important to note that the two constructs should not be seen as incompatible with each other. In short, both perceived behavioral control and self-efficacy should be assessed when examining the influence of perceived control.

Finally, it has also been suggested that there are differences between items that assess perceived difficulty over performing a behavior and control over a behavior. In fact, PBC was originally defined primarily in terms of the subjective difficulty attributed to performing a behavior in a specific context (Ajzen, 1991, 2002). Some evidence has suggested that difficulty items load well with self-efficacy items (e.g., Manstead & van Eekelen 1998), whereas other studies found that perceived difficulty was more closely related to attitudes (Yzer, Hennessy, & Fishbein 2004).[21] Fishbein and Ajzen (2010) suggested that perceived difficulty items should be used with caution given that the conceptual meaning of perceived difficulty is ambiguous.

Although different measures of PBC may differ in their contribution to intention, there is no theoretical basis for assuming that the moderating effect of PBC holds for

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[21] Notably, Bandura (1997) believed that perceptions of perceived difficulty have little to do with self-efficacy.

some measures but not others. Regardless of whether self-efficacy, perceived controllability, and perceived difficulty are understood to be independent constructs (e.g., Kraft, Rise, Sutton, & Røysamb, 2005; Norman & Hoyle, 2004; Terry & O'Leary, 1995) or separate aspects of one underlying latent construct (perceived behavioral control), it is unclear whether one would expect these conceptually distinguishable aspects of PBC to differentially moderate the attitude–intention (or norm–intention) relation.

Research Question 1: Is there a moderating effect of PBC for the different measures of PBC?

Mediation Hypothesis

According to Bandura, self-efficacy affects human function in a variety of ways. Thus far, it has been argued that PBC affects behavior by moderating the path from attitude to intention and norm to intention. On the other hand, it is also possible that PBC serves as a predictor of attitude and norms. This mediation model is depicted in Figure 7. Indeed, PBC as a determinant of attitude is also a role that Bandura has suggested. Specifically, Bandura stated that a person's thought patterns are also affected by self-efficacy. According to Bandura (1997), "In most social, intellectual, and physical pursuits, those who judge themselves highly efficacious will expect favorable outcomes, whereas those who expect poor performances of themselves will conjure up negative outcomes" (p. 24). Thus, the outcomes that people expect are largely dependent on their judgments of what they can accomplish (Bandura, 1997). In this way, low PBC might lead people to believe tasks are harder than they actually are or have more negative outcome expectancies. This relationship is depicted in Figure 7 where PBC is shown to have a direct effect on attitude. For example, using social cognitive theory, DiIorio and colleagues (2000) hypothesized that college students expressing high levels of self-efficacy would express more positive outcomes (related to condom use behaviors). Their findings supported their hypothesis: The effect of self-efficacy on condom use was transmitted through its effect on outcome expectancies (i.e., attitude). Additionally, if people don't think they can perform a given behavior, they might also believe that others don't think they should perform the behavior because, from a social comparison perspective, a person's intentions are governed by the desire to maintain or enhance self-esteem or self-consistency with normative reference groups (Wills, 1990; Wood, 1989). In line with this argument, the model in Figure 7 shows that PBC has a direct effect on norm. The mediation model suggests that attitudes and norms primarily derive from judgments of how well one can execute requisite behaviors (i.e., PBC).

> Hypothesis 5: PBC will influence intention indirectly through attitude and norm, such that the greater the PBC, the more positive the attitude and the greater the perceptions of social pressure.

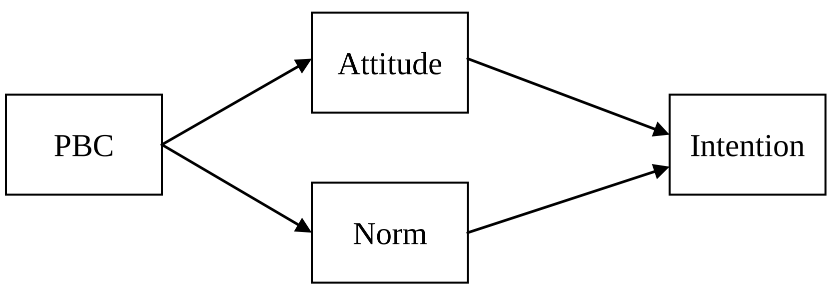

Figure 7. Mediation model.

Chapter 4: Method

Sample of Studies

References were retrieved from PsycInfo (1/1/1995-6/1/07) by using selected key words, “theory of planned behavior,” “theory of planned behavior,” and “TPB.” With those keywords, I retrieved 1,092 studies. The abstracts of these studies were then checked so that only empirical research studies would be included. Other reports were located by manually searching journals likely to carry relevant reports during the same time frame (*European Journal of Social Psychology, Journal of Applied Social Psychology*, *Journal of Personality and Social Psychology, Journal of Social Psychology*, *Personality and Social Psychology Bulletin,* and *Psychology and Health*). Reports published in English, Dutch, German, or Korean peer-reviewed journals in the selected years were considered for inclusion in the sample of studies. Based on the aforementioned criteria, the initial sample consisted of 712 reports. Additional inclusion criteria were applied during two rounds of cuts.

A decision was made to only include published research in this meta-analysis. This decision was made for the following reasons. First, Schulze and Whittmann (2003) provided a review of unpublished TPB research and found that the unpublished studies had a very similar mean effect size for the prediction of intention from attitude, norm, and PBC as the published meta-analyses did. Hagger and Chatzisarantis (2009) and Cooke and Sheeran (2004) also found that publication status did not constitute a significant source of bias in their review of TPB literature. Third, previous meta-analyses have indicated that the failsafe *N* was in the tens of thousands for relations among the model components (e.g., Armitage & Conner, 2001a). When the failsafe *N* is large enough, as has been consistently reported in previous meta-analyses, it is unlikely that there are enough unpublished studies to threaten the validity of the reported effect sizes.

Selection Criteria

The following criteria were used to select studies for inclusion in the meta-analysis.

1. The first round of cuts looked for the presence of appropriate statistics for all TPB variables. Due to the analytic strategy explained below, the report had to include complete correlation matrices as well as means and standard deviations for attitude, norms, PBC, and intention.

2. The second round of cuts checked that eligible studies used a direct measure of each variable. According to Fishbein and Ajzen (1975, 2010; Ajzen, 1992, 2002), attitude, norms, and PBC can be measured by asking direct questions about capability to perform a behavior, evaluations of the behavior, and assessments of social pressure (sometimes referred to as global measures). In addition, it is also possible to measure the beliefs that underlie each factor and use the aggregate of the beliefs as an indirect belief-based measure of the related variable.[22] Some scholars consider global (direct) and belief-

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[22] To obtain an indirect measure of attitude, norm, or PBC, the salient beliefs about the behavior for a given population need to be identified (Fishbein & Ajzen, 2010). The procedure for generating these accessible beliefs is described in detail by Middlestadt and colleagues (1996). Once people's salient beliefs have been identified, close-ended questionnaire item are used to measure belief strength and outcome evaluation. *Belief strength* (sometimes referred to as *outcome expectancy*) is measured by asking respondents how likely it is that a certain outcome will occur. For example, "My getting tested for STDs in the next 12 months will prevent me from spreading an STD to someone else." Belief outcome expectancies are typically assessed using a 7-point scale ranging, for example, from 1 (*slightly likely*) to 7 (*extremely likely*). To assess the *outcome evaluation*, participants evaluate each outcome (e.g., "For me to be prevented from spreading an STD to someone else is . . ."). Outcome evaluations are typically measured using a 7-point scale ranging from –3 (*extremely bad*) to +3 (*extremely good*).

based (indirect) measures as alternate ways of measuring the same construct. However, these belief composites should not be substituted for direct measures of attitude, norm, and PBC. This is because the summative indices of behavioral, normative, and control beliefs are conceptualized as *predictors* of attitude, norms, and PBC, but are not direct measures of the constructs. Theoretically, the indirect measure of each construct should exhibit a strong, positive correlation with its respective direct measure; however, those propositions are subject to empirical test. This implies that indirect measures of attitude, norm, and PBC tend to have a weaker correlation with intention than do the direct measures. This finding is consistent with the theory in that the model proposes that the influence of the belief-based measures on intention should be mediated by the direct measures (Hennessy, Bleakly, & Fishbein, 2012). Researchers who fail to recognize this mediation risk interpreting such attenuated correlations as implying that the association between attitude to intention is weaker than the theory would predict. In addition, the correlation of belief-based measures with the respective direct measures varies across behaviors and contexts. In addition, because indirect measures consist of a list of individual beliefs that are unique to each sample, treating indirect measures as if they were equivalent to the direct measures is not recommended (Fishbein & Ajzen, 2010). Therefore, the decision was made to only include direct measures.

3. Another inclusion criterion focused on the uniformity and quality of measures. In order to both argue that the collection of studies in the meta-analytic sample examined the same relationships and to increase the validity of the comparisons of effect sizes,

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This procedure is repeated for each salient belief. Then the belief strength and outcome evaluation for each salient belief is multiplied together and summed across all beliefs to produce composites of behavioral, normative, and control belief; these composites are indirect measures of their respective overarching construct (Fishbein & Ajzen, 2010).

eligible studies had to include or describe sample questions that were used to measure each variable. Since the theory's inception, Fishbein and Ajzen have outlined standardized measurement protocols to operationalize the theory's constructs, providing sample questionnaires that give the exact wording that Fishbein and Ajzen recommend for items assessing the variables in their model (see Fishbein & Ajzen 2010, pp. 449–463). The sample questions in the studies were reviewed and only those studies that used measures similar to those commonly used in TPB studies were included (see Appendix A for a list of the typical TPB measures).

For example, Wambach (1997) was excluded because the attitude measure was the Attitudes on Breastfeeding Scale (ABS; Cusson, 1985), which is designed to assess facets of adolescent girls' attitudes toward breastfeeding, including advantages of breastfeeding to baby and mother, convenience of breastfeeding, and whether breastfeeding is worthwhile despite possible reported inconveniences. Another study by Van Ryn, Lytle, and Kirscht (1996) was excluded because the attitude measure was the perceived benefits of exercise multiplied by perceived susceptibility to heart attack. This criterion—uniformity and quality of measures—served to make the sample of studies more homogeneous with regard to the measures used. The measures were also reviewed to ensure that the same behavioral object, with respect to each variable, was used (i.e., the principle of correspondence). For instance, if the behavior was "being healthy," a report was excluded if the attitudinal items asked how the person felt about "being healthy" but the PBC items asked how much PBC a person had over "working out."[23]

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[23] Cordano and Frieze (2000) are another example of both poor items and poor correspondence between items. In their study the intention item was labeled as a behavioral preference measure in which people were asked whether they would like to

Although the inclusion criteria were strict, it increased the confidence that can be placed in the meta-findings. After the second round of cuts, 125 articles were included in the meta-analysis, which provided 158 tests of the TPB (see Figure 8).[24]

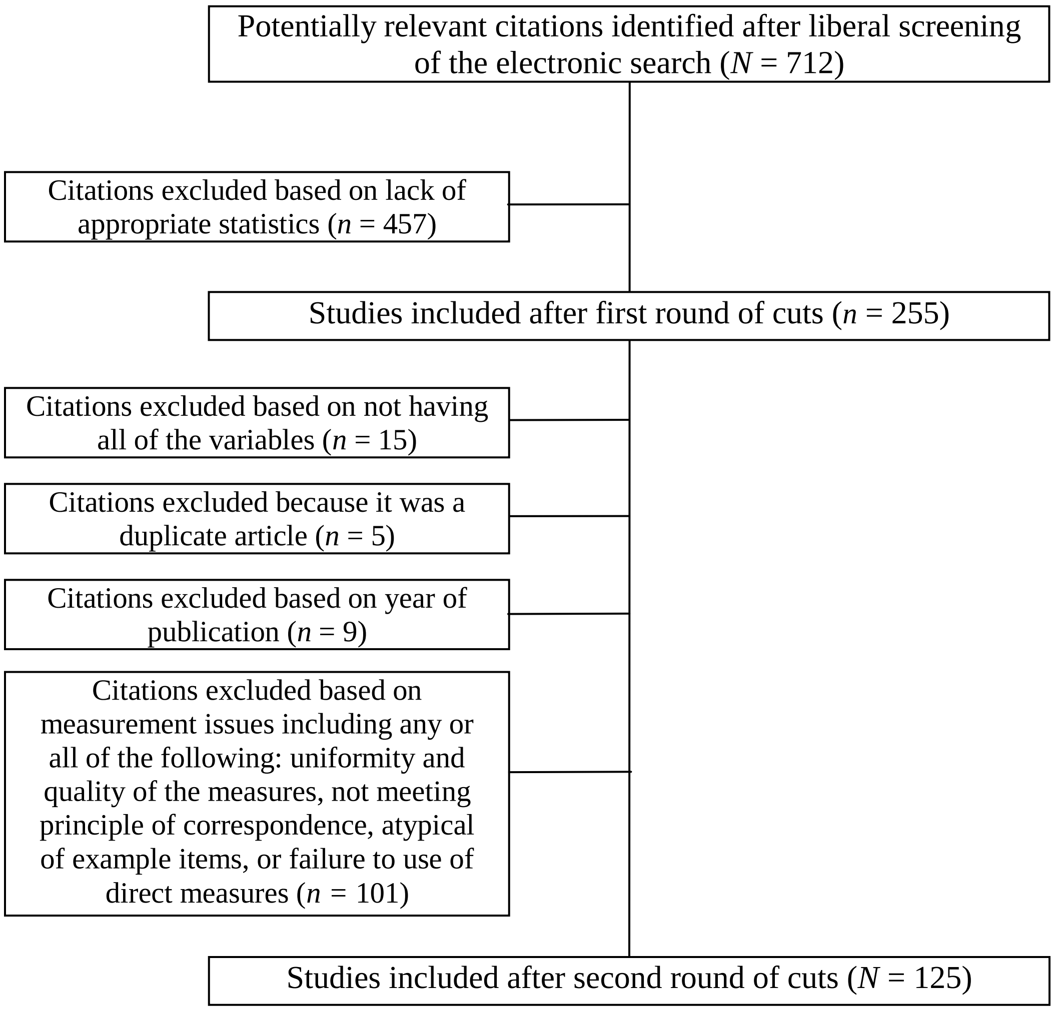

Figure 8. Flowchart showing the step-wise reduction in the # of studies based on inclusion/exclusion criteria.

Coding of Studies

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increase or decrease the number of source reduction activities in their facility. The attitude items, on the other hand, focused on pollution prevention (which encompasses more than just source reduction activities), the subjective norm items asked about whether people that are important to them think that pollution laws are strict, and that the natural environment is valuable. In all, the measures were not only atypical, but they lacked correspondence with each other.

[24] The unit of analysis for this meta-analysis was an individual study, not an article.

In order to extract information from the available research, a codebook was developed (see Appendix B). The following categories of information were coded: descriptive information, moderating variables, and effect size estimates. With respect to descriptive information, the following information was coded from each study:

- the complete citation;
- sample size;
- country of data collection;
- age of sample members;
- description of sample population (e.g., college students, cancer survivors);
- study design (i.e., experiment vs. nonexperiment);[25]
- study number (i.e., in the case of multiple studies);
- condition (if applicable);
- time point (if a study collected data at more than one occasion);
- the scale of the items (e.g., 1 to 7 scale, -2 to +2 scale);
- the direction of the scale (i.e., in case an item is in reverse order).

Studies were also coded for three potential moderators: operationalization of PBC, familiarity of behavior, and public versus private nature of the behavior.

Familiarity. To test Hypothesis 3, studies will be grouped into categories based on two behavioral attributes: familiar versus unfamiliar and public versus private. For familiarity, another coder (a Ph.D. student in communication at the University of Pennsylvania) and I grouped studies into one of two categories, either familiar or

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[25] An experiment was defined as any study that randomly assigned participants to different levels of an independent variable.

unfamiliar.[26] For judgments regarding familiarity, the coders were instructed to consider who the participants in the study were, consider the behavior being investigated, and then make a judgment as to the grouping of each behavior (e.g., familiar or unfamiliar) from the point of view of the participants. *Unfamiliar behaviors* should include behaviors for which people do not have a great deal of past experience and do not possess adequate knowledge of the specifics of engaging in that behavior (Notani, 1998). For example, the behavior of introducing a benchmarking program in the workplace was considered novel when the participants were described as “managers without experience in benchmarking” and was considered *familiar* when the participants were described as “managers with experience in benchmarking” (e.g., Hill, Mann, & Wearing, 1996). The protocol for coding for familiar versus unfamiliar behaviors followed the procedures used by Notani (1998).[27]

Interrater reliabilities for the coded variables are reported using the Cohen’s kappa statistic (κ). Cohen (1960) suggested the κ be interpreted as follows: values ≤ 0 as indicating no agreement and 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41–0.60 as moderate (fair agreement), 0.61–0.80 as substantial (good agreement), and 0.81–1.00 as almost perfect agreement (excellent agreement). The percent agreement rate was 95.8%

[26] The coding procedure was done separately and without prior discussion, other than to train the second coder on the coding procedure. The two coders had not done research on this type of behavior classification before, so it is unlikely that the high agreement rate is because of homogeneity of opinions in general.

[27] In Notani’s meta-analysis, familiar behaviors included participating in physical activity programs, smoking, voting in an upcoming election, drinking and driving, and alcohol consumption. Some examples of unfamiliar behaviors in Notani’s meta-analysis included: attending a new-technology training session, using oral rehydration treatment to prevent diarrhea in a baby, and using a new investigative teaching method.

and interrater reliability was excellent (κ = .87).[28] Discrepancies were resolved by consultation with a third coder (my advisor, Dr. Edward L. Fink) and further examination of the studies.[29]

Public character of behavior. For judgments regarding the public character of the behavior, the other coder and I were instructed to consider the behavior that was being investigated and then make a judgment as to whether the behavior under investigation was public or private. A behavior was considered *public* if it is typically enacted in the presence of others (e.g., exercising) or if its enactment or its consequences were likely to be known by others (either by observation or by communication about the behavior). A behavior was considered *private* if it is primarily enacted away from the presence of others and neither its enactment nor its consequences were likely to be known by others (either by observation or by communication about the behavior). Some examples were condom use, breast self-examination, and compliance with a therapeutic regimen. I and the other coder independently decided, for example, whether recycling was a public behavior and whether the participants would view recycling as familiar or unfamiliar. Any discrepancies were resolved by my advisor. The coding resulted in a 95.2% agreement with excellent interrater reliability (κ = .86).[30] As with the previous

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[28] Kappa is based on 168 decisions.

[29] When coders had difficulty coming to a consensus, the primary coder (Vanessa Boudewyns) went back to the article and examined if more information was provided by the authors that could clarify the proper classification. For the familiar/unfamiliar coding, the behaviors that needed the third coder to resolve a disagreement included: working for the NHS as a nurse, physiotherapist or radiographer; leaving a partner and to end the relationship within the next year; participating in the coming round of breast cancer screening; giving blood at a new blood transfusion service; lying on a selection test; taking an course online rather than in person; using marijuana even once in the next 12 months.

[30] Kappa is based on 168 decisions.

coding scheme, discrepancies were discussed and resolved.[31]

Measurement of PBC. The present meta-analysis distinguished between three types of PBC measures: self-efficacy, perceived control, and perceived difficulty. The measures of control were coded, making note of the types of questions that were asked. Items measuring *perceived capabilities* by assessing *confidence* were coded as self-efficacy (SE; e.g., “How confident are you that you could [behavior] if you really wanted to?”; “How sure are you that you could [behavior] if you really wanted to?”). Items assessing *difficulty* were coded as perceived difficulty (PD; e.g., “How difficult or easy would it be for you to [behavior]?”). Items assessing *perceived control* were coded as perceived behavioral control (PC; e.g., “To what extent is [behavior] up to you?”; “To what extent is [behavior] completely under your control?”). Studies that employed mixed measures (i.e., any combination of the above) were coded as CTRL.

Retrieval of correlations. In cases where an article reported multiple independent samples, the additional studies were treated as independent data sets. In order to minimize violations to the meta-analytic assumption of independence of observations, when a study looked at different behaviors within the same group of

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[31] For the public versus private coding, the behaviors that needed the third coder to resolve disagreement included: applying for a promotion when the next opportunity becomes available; giving blood at a new blood transfusion service; studying at least 3 hours in the next 2 weeks; taking an online course; using marijuana even once in the next 12 months. In addition, although another coder and I did not disagree on the coding of exercise, eating healthfully, and tobacco use, a decision was made to talk to experts in these topic domains to see is they would agree that these three behaviors are public. In particular, the majority of behaviors focused on exercise, so it was especially important to verify the classification with such experts. Therefore, two senior scientists at RTI International (an independent, nonprofit institute that provides research, development, and technical services to government and commercial clients worldwide) who specialize in obesity and tobacco research were consulted. In all instances, these experts agreed with the public classification of these behaviors.

participants, the behaviors were assessed as to whether or not they measured substantially different behaviors or not. If the behaviors were deemed to be similar and the correlation coefficients were sufficiently similar, the samples were averaged together (using the procedures outlined by Lipsey & Wilson, 2001). There were three cases where this occurred (Bogers, Brug, van Assema, & Dagnelie, 2004; Rapaport & Orbell, 2000; Smith & Biddle, 1999). If the same behavior was measured at different times, data from the first time was kept and the second was dropped from the analysis. This occurred twice (Blanchard, Courneya, Rodgers, Daub, & Knapik, 2002; Legare, Godin, Dodin, Turcot, & Lapierre, 2003). Lastly, if it wasn't clear whether or not the behaviors should be considered as different, but the difference between two correlation coefficients was greater than an absolute value of .10 (and therefore averaging the two correlations seemed less defensible), one of the studies was chosen at random for inclusion whereas the other was dropped from the analysis. This situation occurred five times (Armitage, Norman, & Conner, 2002; Parker, Lajunen, & Stradling, 1998; Payne, Jones, & Harris, 2004; Sparks & Shepherd, 2002; Yzer, Siero, & Buunk, 2001).

Another coder (my research assistant, who was a Ph.D. student in Communication at the University of Minnesota) and I retrieved zero-order correlations (*r*s) from the studies and included separate samples (because of additional behaviors, conditions in an experiment, multiple study papers, or multiple time points) when available. Coding and data entry were completed between June, 2007, and May, 2008. The entire data set was checked for any discrepancies between the two coder's data. Any discrepancies were noted and when it was not due to a typo, a third researcher was consulted to resolve any disagreements between the two coders.[32] For all items that did not involve any interpretation of the data (e.g., correlation values, age, year of study), the intercoder agreement was 100%. The intercoder reliabilities for the attitude and PBC measures (the only variables where some subjectivity was involved) are listed in Table 3. Because the obtained κ for each of the variables is greater than .70, the intercoder reliability was deemed satisfactory. After checking the intercoder reliabilities, disagreements between the raters were examined and were resolved by applying a majority rule wherein each case was coded in accord with the two raters who agreed with one another.

Table 3

Intercoder Reliabilities (κ)

Variable coded	Kappa	Number of cases
CTRL	.945	123
PC	.978	10
PD	.937	9
SE	.885	17

Note. PD = perceived difficulty, SE = self-efficacy, PC = perceived behavioral control, CTRL = a combination of any of the above items.

Transforming the PBC scale. Mean values of PBC measures were transformed to a common metric (low control = 1, high control = 7, with all integers in between being employed). A total of 50 PBC items needed to be rescaled to a 1– 7 scale. The following equation was used for rescaling:

$$Y = \frac{(B - A) \times (M - a)}{(b - a)} + A \quad ,$$

where *A* is the new minimum (in this case, *A* = 1), *B* is the new maximum (in this case, *B* = 7), *a* is the minimum of the original scale, *b* is the maximum of the original scale, and *M* is the original scale mean that is being transformed (i.e., becoming Y).

[32] The third researcher was Dr. Marco Yzer, an associate professor at the University of Minnesota, who has worked extensively with Martin Fishbein and specializes in TRA/TPB research.

Transforming reverse-coded items. After all PBC mean values were transformed to the common metric, any PBC scale that was reverse-coded (low control = 7, . . . , high control = 1) was further transformed using the equation $8 - M = Y$. *M* is the original scale mean that is being reverse-coded (i.e., becoming *Y*). A total of five scales needed to be reverse-coded from the following studies: Astrom (2004), Astrom and Mwangosi (2000), Bebetsos, Chroni, and Theodorakis (2002), Caperchione and Mummery (2007), and Parker, Lajunen, and Stradling (1998). Four other studies were flagged to be reverse coded (Conner, Sandberg, McMillan, & Higgins, 2006; Higgins & Conner, 2003; McMillan, Higgins, & Conner, 2005; Yzer, Cappella, Fishbein, Hornik, Sayeed, & Ahern, 2004), but when I went back to the articles to verify the need to reverse-code the PBC measure it came to my attention that these studies had intention, attitude and norm items formulated in terms of doing a behavior (e.g., smoking, using ecstasy, using drugs), whereas the PBC item was formulated in terms of *resisting* or *not doing* said behavior.

Rather than reverse code the PBC item, a decision was made to exclude these articles for two reasons.[33] First, measuring PBC in terms of *not* doing a behavior, whereas the other measures are directed at *doing* the behavior, on its face violates the principle of correspondence. Essentially, the attitude and norm items correspond with intention, but the PBC item does not meet the principle of correspondence. Consequently, the effects for PBC as a predictor of intention may be underestimated. More importantly, the studies should be excluded for not meeting one of the inclusion criteria. Second, simply reverse

[33] These studies would also needed to have the correlation coefficients reversed (i.e., multiply by -1) for all items correlated with PBC because the intention, attitude, and norm scales were not reverse-coded.

coding the mean was unjustified because the negation is ambiguous. If one were to reverse code the “not” item (e.g., “I have control over not smoking”), one would also assume that not having control over not doing the behavior is logically equivalent to having control over doing the behavior. Using smoking as an example, this would mean that not having control over “not smoking” is logically equivalent to having complete control over smoking. This assumption, though, is clearly invalid because it is possible that a person who has no control over *not* doing a behavior could also have no control over doing the behavior. Therefore, these four studies were excluded.

Computation of Effect Size Estimates

To compute a meta-analytic effect size, the results of all studies need to be converted into a common effect-size metric. The measure of effect size adopted for the current meta-analysis is the Pearson correlation (*r*). Each included study contributed six unique effect sizes (shown in the lower triangle of the matrix below).

$$\begin{bmatrix} 1 & & & \\ r_{\mathrm{ai}} & 1 & symm & \\ r_{\mathrm{si}} & r_{\mathrm{as}} & 1 & \\ r_{\mathrm{pi}} & r_{\mathrm{ap}} & r_{\mathrm{sp}} & 1 \end{bmatrix},$$

where *symm* is symmetric, *a* is attitude, *i* is intention, *s* is subjective norm, and *p* is PBC. A standard practice when using Pearson correlations for effects, whether using random or fixed-effects models, is to first transform the Pearson correlation using Fisher’s (1928) normalizing and variance stabilizing *r*-to-*Z* transformation, ES_{Zr_i}= 0.5 log [(1+ r_i)/(1- r_i)], where ES_{Zr_i} is the adjusted correlation coefficient from study *i*, and r_i is the unadjusted correlation coefficient from study *i* (Hedges & Olkin, 1985; Lipsey & Wilson, 2001; Rosenthal, 1994). The sampling variance of the *r*-to-*Z* transformed correlations $var(Z_r) = 1/(n_i - 3)$. One of the main arguments for conducting this transformation is that it removes the dependence of the estimate of the correlation variance on the sample estimate of the correlation (Becker, 2000; Hedges & Olkin, 1985). In other words, using the *r*-to-*Z* transformation tends to result in a more normal distribution of effect sizes. Importantly, when a sample size for a correlation is based on fewer than 100 participants and the population correlation is around an absolute value of .5 or larger in absolute terms (as is the case for studies in this meta-analysis), then the raw correlations (i.e., those that are not transformed) are based on the asymptotic distribution approximation that has been found to be negatively biased (Hedges, 1994). Therefore, in an effort to achieve more normal distributions of effect sizes, Fisher's *r*-to-*Z* transformation was applied to each correlation before combining the correlations. For ease of interpretation, the *r*-to-*Z* transformed correlations were then transformed back to the correlation metric. Of note, even though Hunter and Schmidt do not recommend transforming the correlations, one can (and many do: e.g., Lipsey & Wilson, 2001) use *r*-to-*Z* transformed correlations under a random-effects model.[34] The *r*-to-*Z* transformed correlations and mean correlation were transformed back into a standard correlation form by using the inverse of the *r*-to-*Z* transformation,

$$r = \frac{e^{2ES_{Zr}} - 1}{e^{2ES_{Zr}} + 1},$$

where r is the individual correlation, ES_{Zr} is the corresponding individual or mean *r*-to-*Z* transformed correlation, and e is the base of natural logarithms (Lipsey & Wilson, 2001).

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[34] Hunter and Schmidt (1990) argued that the use of the Fisher *r*-to-*Z* transformation can lead to positively biased results. However, in a simulation study conducted by Hafdahl (2001), the transformed and untransformed correlations were compared using univariate weighting approaches (like the ones used in this meta-analysis). According to Hafdahl (2001), univariate approaches (using both fixed-effects and random-effects) worked well whether or not the transformation was used, but that when differences did emerge, it was the *r*-to-*Z* transformed correlations that resulted in less bias.

Univariate method for averaging correlation matrices. Univariate approaches were used to combine the respective correlations from the included studies. This is the most common method for combining multiple correlations per study (Card, 2012; Lipsey & Wilson, 2000). Of note, univariate pooling approaches have been used exclusively in previous TPB studies as well as other meta-analyses. This approach assumes that the correlations that arise from the same study are independent; each correlation provided by the study is combined separately. Using a univariate approach, the following steps were taken. First, each of the six correlations from study *i* were transformed using the *r*-to-*Z* transformation (ES_{Zr_i}). Then, the six *r*-to-*Z* transformed correlations from study *i* were corrected for sampling error by weighting each effect size. The weight (w_i) that was used depended on whether a fixed-effects or random-effects model was used. (This idea will be elaborated on in the following section.) An average effect size for each of the six weighted, *r*-to-*Z* transformed correlations was computed using the following equation:

$$\overline{ES}_{Zr} = \frac{\Sigma\left(w_i ES_{Zr_i}\right)}{\Sigma w_i},$$

where w_i is the weight for study *i* , ES_{Zr_i} is the effect size estimate for study *i* (e.g., $ES_{Zr_{ai_i}}$would be the weighted, *r*-to-*Z* transformed attitude-intention correlation for study *i*) , and $\overline{ES}_{Zr}$ is the weighted mean effect size (e.g., $\overline{ES}_{Zr_{ai}}$is the average, weighted effect size for the attitude-intention correlation. Five other average weighed effect sizes were calculated for the remaining relationships). The resulting pooled correlation matrix is as follows:

$$\begin{bmatrix} 1 & & & \\ \overline{ES}_{Zr_{\mathrm{ai}}} & 1 & symm & \\ \overline{ES}_{Zr_{\mathrm{si}}} & \overline{ES}_{Zr_{\mathrm{as}}} & 1 & \\ \overline{ES}_{Zr_{\mathrm{pi}}} & \overline{ES}_{Zr_{\mathrm{ap}}} & \overline{ES}_{Zr_{\mathrm{sp}}} & 1 \end{bmatrix},$$

where *symm* is symmetric, *a* is attitude, *i* is intention, *s* is subjective norm, *p* is PBC, and $\overline{ES}_{Zr}$ is average, weighted *r*-to-*Z* transformed effect size corrected for sampling error.

Meta-Analytic Model

There are two models used in meta-analysis, the fixed-effects model and the random-effects model, and each has different assumptions about the studies. Field and Gillett (2010) said that the decision about whether to conceptualize a model as a fixed or random-effects model depends both on the assumptions that can be made about the populations from which the included studies are sampled and the types of inferences that a researcher wants to make from the results of the meta-analysis. With respect to the latter consideration, fixed-effects model are appropriate for conditional inferences (i.e., inferences that extend only to the studies included in the meta-analysis), whereas random-effects models are appropriate for unconditional inferences (i.e., inferences that generalize beyond the studies included in the meta-analysis).

Fixed-effects model. The fixed-effects model assumes that there is one true effect size that is shared by all the included studies (Hedges & Olkin, 1985). Because all studies are assumed to estimate the same effect size, a large study is given more weight than a small study. Therefore, the correlations based on larger samples will have more influence on the resulting pooled estimate of the correlations than the correlations from studies with smaller sample sizes; this is because the fixed-effects model assumes that the only source of error in the estimate is the random error within studies. As sample size increases, the error will tend toward zero. Hence, in a fixed-effects model the optimal weights are based on the standard error of the effect size (i.e., the standard deviation of the sampling distribution; Lipsey & Wilson, 2000). Specifically, the weights are computed as the inverse of the squared standard error value (also called the inverse variance weight). The inverse variance for the *r*-to-*Z* transformed effect sizes is roughly proportional to the sample size and is referred to as w_i (the weight assigned to study *i*). Under the fixed-effects model, w_i is calculated as follows:

$$w_i = \frac{1}{SE_i^2},$$

and the standard error of the effect size is

$$SE = \frac{1}{\sqrt{n-3}}.$$

Random-effects model. The random-effects model assumes that the true effect could vary from study to study (e.g., the effect size might be higher in older populations, or in different cultures, or with different reliabilities). The included studies are assumed to be a random sample of the relevant distribution of effects. In this way, the validity of the random-effects model is integrally tied to the procedures that are followed in selecting the included studies (Overton, 1998). Because the random-effects model estimates the mean of a distribution of true effects, large studies are not necessarily given more weight than small studies because, even though they may provide more precise estimates, each study estimates a *different* effect size that serves as a sample from the population whose mean we want to estimate. So, in contrast to the fixed-effects model, the assigned weights are more equal. The idea behind this weighting scheme is that although the estimate provided by a study with a small sample size is imprecise, the effect size still provides information about a population that no other study has captured.

In sum, the goal of random-effects models is to estimate an effect in a range of populations and not to let the overall estimate be overly influenced by any one population.

The random-effects model assumes that there are two sources of error: within-study variation and between-studies variation (reflecting random differences across studies). As with the fixed-effects model, each study is weighted by the inverse of its variance. However, in the random-effects model that variance now includes the original (within-study) variance *plus* the between-study variance (τ^2).

The equation for the computation of the weighted mean effect size is the same as the fixed-effects model except that the *w*s of the fixed-effects models are replaced with the random-effects weights w^*. For the random-effects model the effect sizes were weighted using the following equation:

$$w_i^* = \frac{1}{\tau_i^2 + SE_i^2},$$

where τ^2 is the estimated population variance of effect sizes. The population variance in effect sizes (τ^2) was calculated using the following equation:

$$\tau^2 = \frac{Q - (k - 1)}{(\sum w_i) - \frac{(\sum w_i^2)}{(\sum w_i)}},$$

where $w_i = \frac{1}{SE_i^2}$ and Q is the heterogeneity statistic derived from the following equation:

$$Q = \sum (w_i(ES_i - \overline{ES})^2) = \sum (w_i ES_i^2) - \frac{\left(\sum (w_i ES_i)\right)^2}{\sum w_i},$$

where ES_i is the individual effect size for $i = 1$ to k (the number of effect sizes), $\overline{ES}$ is the weighted mean effect size over the k effect sizes, and w_i is the individual weight for ES_i (Hedges & Olkin, 1985).

Mixed-effects model. The mixed-effects model is based on entering systematic sources of variance, random sources of variance, and variance associated with expected sampling error into the overall equation for the effect size estimate. This approach allows for the identification of potential moderator variables while also allowing for sources of random variance. Regression analyses and SEMs do not account for random sources of variance and are therefore based on the fixed-effects model. However, it is also possible to use a mixed-effect model that is based on the assumption that "the effects of between-study variables, such as treatment type, are systematic but that there is a remaining unmeasured (and possibly unmeasurable) random effect in the effect size distribution in addition to sampling error" (Lipsey & Wilson, 2001, p. 124). Mixed-effects models are useful when evaluating moderators in meta-analysis and when one wants to generalize the findings (and hence needs a random-effects model). Additionally, mixed-effects models are useful when fixed-effects moderator analyses indicate significant residual heterogeneity (as evidenced by a significant $Q_{residual}$; Card, 2012).

Correcting for Attenuation

The chosen effect size in a meta-analysis can be corrected for imperfections, referred to as artifacts. Such imperfections may alter the reported effect size in comparison to the true effect (i.e., the effect size that would have been reported if the study was conducted perfectly; Hunter & Schmidt, 2004, p. 33). The argument behind artifact correction is that primary studies report effect sizes among imperfect measures of constructs, and not the latent constructs themselves. The sources of imperfection can be due to things like range restriction, invalidity, unreliability, and artificial dichotomization (Hunter & Schmidt, 2004). Hunter and Schmidt (2004) are advocates of correcting for such study artifacts and have proposed a number of corrections (in the form of equations) to effect sizes.[35] These equations aim to correct for methodological features of primary studies that are known to bias or attenuate effect sizes. In this dissertation, I have corrected for sampling error (Hunter & Schmidt, 2004); however, another relevant correction is the correction for measurement error (or unreliability).

Correction for unreliability. Unreliability refers to nonsystematic error in the measurement process (Hunter & Schmidt, 2004). The rationale behind this correction is that the observed effect size estimate (in this case, the correlation) is based on the measurements of the two variables in the relationship. Measurement error has a systematic effect on the observed effect size and will always lead to an underestimation (i.e., absolutely close to zero), or attenuation, of the true effect (Hunter & Schmidt, 2004). In other words, the lower the reliability of either variable in the correlation, the greater the underestimation of the true correlation: The lower the reported reliabilities, the greater the difference between the corrected and uncorrected correlations. According to Hunter and Schmidt (2004), the effect of measurement error can be calculated, and corrected for, by taking into account the reliabilities of the measures. To do this, for each study the author would calculate both a raw effect size as well as an effect size corrected for attenuation.[36] After obtaining the adjusted effect size, the authors would then analyze

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[35] Using artifact corrections is not necessarily linked only to the Hunter and Schmidt framework. After effect sizes have been corrected, one can use any of the meta-analytic frameworks to analyze the effect sizes (Hedges & Olkin, 1985, pp. 131-145). However, the statistical methods for Hedges and Olkin's (1985) procedure for univariate weighting of correlations (which is frequently used in meta-analytic SEM studies and in other communication meta-analyses, and is the procedure adopted in this dissertation) does not require the individual corrections to correlations advocated by Hunter and Schmidt.

[36] The general equation for artifact correction is as follows: $ES_{adjusted} = ES_{observed}/a$, where $ES_{adjusted}$ is the new corrected effect size, $ES_{observed}$ is the uncorrected (raw) effect

the adjusted effect sizes in the same way one would analyze standard (uncorrected) effect sizes.

Reasons for artifact correction. One reason for artifact correction has already been mentioned: The corrections provide an estimate of the effect size between latent constructs (e.g., attitude and intention). Uncorrected effect sizes are thought to represent associations among measures (e.g., a particular self-report scale of attitude and a particular self-report scale of intention). Second, artifact corrections may reduce heterogeneity across studies that is due to differences in methodological imperfections, or "noise" (Hunter & Schmidt, 2004). In this way, the heterogeneity that is left would be largely due to substantively interesting differences (e.g., characteristics of the sample) rather than purely methodological differences (e.g., the use of a reliable versus unreliable measure of a variable).

Reasons against artifact correction. Although correcting for measurement error has benefits, it also has drawbacks. Despite the logic of the aforementioned arguments for artifact correction, modern meta-analysts, such as Rosenthal (1991) and Hedges and Olkin (1985), have continued to oppose artifact adjustment. Rosenthal (1991) argued that that the goal of meta-analysis "is to teach us better what *is,* not what might someday be in the best of all possible world" (p. 25, emphasis in original).

Other arguments against correcting for unreliability address more practical concerns. For example, the major drawback to correcting effect sizes for unreliability is that the reliability estimates necessary for estimating any disattentuation is only

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size, and a is the total correction for all study artifacts. The a is derived from the following equation for the correction for unreliability: $a_{\text{unreliability}} = \sqrt{r_{xx}r_{yy}}$, where r_{xx} and r_{yy} are the reliability estimates of variables X and Y (Hunter & Schmidt, 2004). Finally, the standard error also needs to be adjusted using $SE_{adjusted} = SE_{observed}/a$.

sometimes available in primary studies. When studies fail to report reliability information, the adjusted effect size correlation matrix has missing data. How to best handle missing data when pooling effect sizes (e.g., through listwise or pairwise deletion) is a major area of debate in the meta-analytic literature (Card, 2012; Cooper, Hedges & Valentine, 2009; Lipsey & Wilson, 2001). One of the strengths of the current meta-analysis is that the issue of missing data does not need to be addressed, because a condition of inclusion of studies in the meta-analysis was that all relevant correlations had to be reported.

A recent TPB meta-analysis (Manning, 2009) helps to illustrate just how many studies fail to report reliability statistics in TPB studies.[37] Of the 157 studies in Manning's (2009) meta-analysis, only 11 reported all necessary reliability coefficients for all TPB variables (intention, PBC, attitude, norm). Therefore, it seems likely that, for this dissertation, reliability information would not be available for very many studies. The median reliability for each variable in Manning's (2009) meta-analysis was as follows: attitude = .83, subjective norm = .80, PBC = .77, intention = .92. These reliabilities are in line with previous research that has found that TPB research tends to consistently use reliable measures (Fishbein & Ajzen, 2010). The greater the methodological limitations of the included studies (i.e., very low reliability), the greater the added value of artifact correction. Therefore, the benefits of artifact adjustment are likely to be small for the current meta-analysis. For instance, the uncorrected correlations in Manning's meta-analysis were attenuated by roughly 13%-16%.

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[37] This meta-analysis serves as a good example of what one might expect to find in this dissertation because Manning's meta-analysis is not restricted to a specific behavior, was conducted recently, and found a similar number of articles as the current meta-analysis.

One consideration in deciding whether to correct for unreliability is the expected magnitude of the effect that unreliability might have on the results (Card, 2012). Not correcting for measurement error will only serve to attenuate the reported effect sizes in this dissertation. Therefore, the cost of additional data-analytic complexity is not offset by the improved value of the results. So, the decision was made to not correct for unreliability.

Nevertheless, it is valuable to consider what the effect of unreliability may have on the reported effect sizes. Based on the aforementioned discussion, it is possible that any reported effect sizes will be larger if this correction had been employed. Beyond effect size attenuation, it is unclear whether correction for unreliability would substantively change the results. The pattern of results (which variables have a comparatively large and which have a small effect size) would not change due to the correction because the average reliabilities would likely be very similar for all TPB variables (as evidenced by Manning's meta-analysis). Further, finding a significant interaction effect despite the influence of measurement error should be taken as strong evidence that an interaction effect exists.

Homogeneity Statistics

Variability of effect sizes for both fixed- and random-effects models was tested by conducting homogeneity analyses using the Q statistic, which is distributed as a chi-square with $k - 1$ degrees of freedom (Hunter, Schmidt, & Jackson, 1982).[38] The Q value is an index of variability. If the Q statistic is significant, then the correlations are heterogeneous and the average weighted effect size cannot be said to represent the best

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[38] The tests of homogeneity are identical in both types of models (Hedges & Vevea, 1998; Raudenbush, 2009).

estimate of population effect size. In other words, the observed correlations may be coming from different populations (Lipson & Wilson, 2000). However, because of the *a priori* hypotheses concerning the effect of PBC on the relationship between attitude and intention and norm and intention, significant heterogeneity was not considered a necessary condition for conducting the moderator analysis. In fact, it was expected that the *Q* statistic would be significant given the hypotheses that PBC moderates the attitude-intention and norm-intention effect sizes. Such hypotheses assume that there is heterogeneity of variance in the attitude-intention and norm-intention effect sizes and propose that PBC is a source of the heterogeneity.

Moderator Analyses

Metaregression is a statistical technique that examines how characteristics of studies are related to variation in effect sizes across studies (Cooper & Hedges, 2009). In metaregression, the weighted effect size ($\overline{ES}_{Zr}$) serves as the dependent variable and information extracted from the studies serve as moderators or predictors of the effect size. In this study, separate metaregressions were conducted for attitude and norm. The dependent variable in the respective models was either the weighted effect size between attitude and intention or the weighted effect size between norm and intention. The mean level of PBC was the independent variable. The standardized regression coefficients from the analyses were provided to indicate the magnitude of the moderation. The moderator tests for PBC were done using the Wilson SPSS macro (2010).

Three-way interaction. In order to test Hypotheses 3 and 4 four additional metaregression analyses with three predictor variables in each model were conducted. To test Hypothesis 3, two metaregressions were conducted with either the attitude-intention effect size or the norm-intention effect size as the dependent variable. The three predictors in these two regressions were PBC, familiarity (0 = *familiar*, 1 = *unfamiliar*), and the interaction term for PBC and unfamiliarity. To form the interaction term, PBC was mean-centered and then the newly centered PBC variable and dummy coded familiarity variable was multiplied. To test Hypothesis 4, two metaregressions were conducted with either the attitude-intention effect size or the norm-intention effect size as the dependent variable. The three predictors in these two regressions were PBC, public nature of behavior (0 = *public*, 1 = *private*), and the interaction term for PBC and private. The interaction term was the product of the mean-centered PBC variable and the dummy coded public variable. Research Question 1 was assessed by conducting the same metaregression as was used for Hypothesis 1 and 2 across the four types of PBC measures and then looking for any differences in the regression coefficient for PBC across groups.

Mediation Model

To examine the mediation model, a model-driven meta-analysis using meta-analytic structural equation modeling (MASEM) was conducted. In general, MASEM involves two steps: calculating weighted mean correlations and checking them for homogeneity, and using the pooled correlation matrix as input for an SEM path analysis. Two pooled correlation matrices were computed; one used random-effects weights and the other fixed-effects weights. Then the *Q* test statistic was calculated for each weighted effect size in the matrix computed using a fixed-effects model. Following Cheung's (2000) recommendation, a Bonferroni-adjusted at-least-one approach for testing the homogeneity of the correlation matrices (derived from the individual studies) was used.

Under this approach, the homogeneity was rejected if at least one of the 6 correlations in the correlation matrix was heterogeneous across studies. For this study, the hypothesis of homogeneity of all the correlation matrices each with six correlations, was rejected if any one of the six observed *p* values from testing the homogeneity of individual correlations was smaller than $p = .0083$.[39] If the heterogeneity test was significant, the application of the fixed-effects model was deemed inappropriate and the correlation matrix from the random-effects model was used instead. The *r*-to-*Z* transformed effect sizes in each matrix were converted back to the *r* metric for ease of interpretation. Finally, a weighted path analysis was performed by inputting the pooled correlation matrix into LISREL 8.80 (Jöreskog & Sörbom, 1993).

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[39] The following equation was used: $\min(p_{ij}) < \frac{\propto}{p(p-1)/2}$, where p_{ij} is the *p* value for testing the individual $H_0 : p_{ij}^{(1)} = p_{ij}^{(2)} = \cdots = p_{ij}^{(k)}$ across *K* studies, α is the significance level , and *p* is the number of variables.

Chapter 5: Results

Preliminary Test of the Linearity Assumption

The central hypotheses in this dissertation predict linear-by-linear interactions; therefore, it is important to first assess the linearity of the relationship from attitude, norms, and PBC to intention. Therefore, I analyzed two TPB datasets that I had access to in order to examine whether the assumption of linearity is tenable. Using two different data sets, a TPB model with linear and quadratic effects was tested using the procedure outlined by Aiken and West (1991). The resulting analyses test the linear relationship between attitude, norms, PBC, and intention. Support for a linear relationship is found if the coefficients for the linear terms are significant and, at the same time, the coefficients for the quadratic terms are nonsignificant.[40]

Dataset 1 Details

Data from Dataset 1 were collected in the spring of 2008 from undergraduate students (*N* = 181) who were enrolled in introductory journalism classes at a large midwestern university (Boudewyns, 2008). All participants received course credit for their involvement in the study. Participants who signed up for the study completed an online survey; participants could only participate once and the questionnaire took approximately thirty minutes to complete. Participants were instructed that they could skip any questions that they did not wish to answer. The components of the TPB were measured with multi-item scales in relation to both getting tested for STDs in the next 12 months. Men represented a smaller proportion of the sample (*n* = 57, 32%) than women (*n* = 124, 68%), reflecting the ratio of men to women enrolled in the department at the

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[40] Importantly, the analyses do not test for nonlinearity in general; instead, they test for quadratic effects, which is a specific type of nonlinearity.

time the study was conducted. Participants received course credit for their participation. The respondents ranged in age from 18–28, with a mean of 20.24 years (*SD* = 1.46; *Median* = 20.00). Respondents identified themselves as Caucasian (86%), Asian (8%), other (3%), Hispanic (2%), and African American (1%).

Dataset 2 Details

Data from Dataset 2 were collected from undergraduate students (*N* = 310) who were enrolled in introductory communication classes at a large mid Atlantic university in the fall of 2010 (Boudewyns, 2010). Participants were recruited from the departmental participant pool and were offered class extra-credit for participating. Participants completed an online survey that took approximately thirty minutes to complete. Participants were instructed that they could skip any questions that they did not wish to answer. Similar to the Midwestern university sample, males represented a smaller proportion (*n* = 101, 33%) than women (*n* = 209, 67%), and the respondents ranged in age from 18–26, with a mean of 20.44 years (*SD* = 1.59; *Median* = 20.00). Respondents identified themselves as Caucasian (66%), Asian (14%), African American (9%), Hispanic (7%), and other (4%).

Dataset Measures

In Dataset 1, *intention* was measured with four items (e.g., "How likely is it that you will get tested for STDs in the next 12 months?"). The response scales for three of these items ranged from 1 (*extremely unlikely*) to 7 (*extremely likely*). The fourth item ("How willing are you to get tested for STDs in the next 12 months?") ranged from 1 (*extremely unwilling*) to 7 (*extremely willing*). An overall intention scale was constructed by taking the average of these four items

(Dataset 1: Cronbach's α= .92; *M* = 3.97, *SD* = 1.83). Dataset 2, used three items to measure intention ("How likely is it that you will get tested for STDs in the next 12 months?" "I intend to get tested for STDs in the next 12 months." and "I plan to get tested for STDs in the next 12 months."; Cronbach's α= .98; *M* = 3.39, *SD* = 2.02), with high scores reflecting stronger intentions to get tested for STDs in the next 12 months.

In Dataset 1, *attitudes* toward STD testing were measured using seven items that reflected both cognitive and affective dimensions of attitude. Responses to the statement, "Getting tested for STDs in the next 12 months would be:" (e.g., bad-good, harmful-beneficial, stressful-relaxing) were measured on 7-point evaluative semantic differential scales. The mean value of the seven items was used in the analysis (Cronbach's α = .80). Higher scores were assigned to the positive anchor (*M* = 4.28, *SD* = 0.97). Dataset 2 used four attitudinal items (bad-good, harmful-beneficial, unpleasant-pleasant, and stressful-relaxing). As with Dataset 1, the mean of the six items was used in the analysis (Cronbach's α =.78, *M* = 4.55, *SD* = 1.04).

In Dataset 1, *PBC* was measured using five items on 7-point scales that assessed both perceived confidence (e.g., "I am confident that if I wanted to I could get tested for STDs in the next 12 months") and capability (e.g., "My getting tested for STDs in the next 12 months is completely under my control."). The five items were combined to create a composite scale of perceived control with higher scores reflecting a greater sense of control over getting tested for STDs (Cronbach's α = .69, *M* = 6.10, *SD* = 0.78). In Dataset 2, PBC was measured using two items that asked about whether getting tested would be difficult or easy and how confident the participant feels about his or her ability to get tested (*r* = .70, *M* = 5.25, *SD* = 1.17).

In Dataset 1 and Dataset 2, *subjective norms* were assessed with three items on scales ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), (e.g., "Most people who are important to me think that I should get tested for STDs in the next 12 months."). The three items were averaged to create a subjective norms scale (Dataset 1: Cronbach's α = .72, *M* = 4.58, *SD* = 1.23; Dataset 2: Cronbach's α = .82, *M* = 4.32, *SD* = 1.56), with higher scores indicating greater perceptions of social approval and support.

Results

Separate, identical polynomial regression analyses for each dataset were conducted. The linear and quadratic (in this case, squared) terms for attitude, norms, and PBC were used as predictors of intention to get tested for STDs in the next 12 months. Prior to conducting the regression analyses, all predictor variables were mean centered. The mean-centered measures of attitude, norms, and PBC represented the linear trends. Then, each mean-centered measure was squared in order to create three new variables to represent the quadratic trends. The mean-centered attitude, norms, and PBC measures were entered into the first block of the regression model, and the squared mean-centered attitude, norms, and PBC measures were entered into the second block along with the variables entered in the first block.[41]

Dataset 1: results. The polynomial-regression analysis revealed that in the

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[41] For both datasets, additional hierarchical regressions were conducted that looked for linear by linear, linear by quadratic and quadratic by quadratic interaction effects between the predictor variables. The mean-centered attitude, norms, and PBC measures were entered into the first block of the regression model, and the squared mean-centered attitude, norms, and PBC measures were entered into the second block along with the variables entered in the first block, and finally the interaction terms were entered in the third block along with all variables from the previous blocks. None of the interaction terms were significant for either dataset and are not reported in the table.

second block the model significantly predicted intention to get tested for STDs in the next 12 months. The three predictor variables—attitude, norms and PBS—explained a significant proportion of the variability in intentions (R^2 = .72). The unstandardized beta coefficients representing the linear effects were statistically significant for attitude (b = 0.89, SE = 0.09, p < .001) and norms (b = 0.53, SE = 0.10, p < .001) but not for PBC (b = 0.04, SE = 0.13, *ns*). None of the quadratic trends for attitude, norms, and PBC were significant (see Table 4). According to these results, the assumption of linearity (as opposed to quadratic effects) was supported.

Dataset 2: results. The polynomial-regression analysis revealed that in the second block the model significantly predicted intention to get tested for STDs in the next 12 months. The three predictor variables—attitude, norms and PBS—explained a significant proportion of the variability in intentions (R^2 = .32). The unstandardized beta coefficients representing the linear trends were statistically significant for attitude (b = 0.40, SE = 0.10, p < .001), norms (b = 0.56, SE = .07, p < .001), and PBC (b = 0.20, SE = 0.10, p < .01). Once again, the quadratic trends for attitude, norms, and PBC did not reliably predict intention (see Table 4). According to these results, the assumption of linearity (as opposed to quadratic effects) was supported. These results are in line with results from Knussen, Yule, MacKenzie, and Wells (2004) and Lam (1999); both these studies included quadratic terms for each of the TPB variables in the analyses, but found evidence only for linear effects (i.e., the quadratic TPB terms were all nonsignificant).

Table 4

Polynomial Regression Of Intentions to Get Tested for STDs in the Next 12 Months

Data Set	Dataset 1 (Midwest)		Dataset 2 (Mid-Atlantic)	
Independent Variable				
	Step 1	*Step 2*	*Step 1*	*Step 2*
(Constant)	0.001	0.021	3.39	3.25
Attitude	0.90 (0.08)	0.89 (.09)***	0.40 (0.10)***	0.40 (0.10)***
Norms	0.52 (0.09)	0.53 (.10)***	0.52 (0.07)***	0.56 (0.07)***
PBC	0.06 (0.10)	0.04 (.13)	0.24 (0.09)**	0.20 (0.10)*
Att^2		0.02 (.05)		0.03 (0.05)
$Norms^2$		-0.03 (.06)		0.06 (0.03)
PBC^2		-0.03 (.09)		-0.03 (0.05)
R^2	.72 (.98)	.72 (.98)	.32 (1.68)	.33 (1.67)
F	142.21*** (df = 3)	73.50*** (df = 6)	46.91*** (df = 3)	24.17*** (df = 6)

Note. Unstandardized coefficients are reported. The ΔR^2 was not significant in either dataset. ΔR^2 = .001 for both datasets.
*** p < .001, **p < .01, *p < .05.

Meta-Analysis Results

The results are presented in two parts. The first part presents the average correlations between all constructs in the TPB and will describe the moderator analyses and outlier analysis that were conducted. The second part provides the results of the MASEM. The final set of included studies is listed in Appendix C.

Description of Studies

Collectively, 121 studies provided 154 data sets (*k*) and, in all, the studies involved 44,424 participants, which represent one of the largest TPB databases available. A description of the included studies is provided in Table 5. The overall sample consists of 924 primary effect sizes derived from 154 datasets. Of the total sample, the median year of publication was 2003, the mean sample size was 268, the majority (65.6%) of studies took place in Europe, and only one dataset used an experimental design. The mean age of participants was 33.0 (*SD* = 15.15), and the majority of participants were from the general population (54.5%), followed by undergraduate populations (30.5%).

With respect to the proposed moderators, the majority of studies had behaviors that were classified as being public (78.6%) and familiar (82.5%). Finally, on the whole, studies tended to use measures of PBC that were composed of a combination of items (i.e., CTRL, 77.3%).

Table 5

Descriptive Statistics for the Studies in the Meta-Analysis

Variable		Value	*k*
Median year of publication		2003	154
Mean year of publication (range = 1995–2007; SD = 2.97)		2003	154
Mean sample size (range = 24–3,428; SD = 399.12)		268	154
Median sample size		159	154
Location of study			
	Europe	65.6%	101
	US & Canada	30.5%	47
	Africa	2.6%	4
	Asia	1.3%	2
Population sampled			
	General Population	54.5%	84
	Undergraduates	30.5%	47
	Secondary School & High School Students	7.8%	12
	Employees	7.1%	11
Mean age of participants (range = 10–76; *SD* = 15.15)		33.0	130
Familiarity of behavior			
	Familiar	82.5%	127
	Unfamiliar	17.5%	27
Public nature of behavior			
	Public	78.6%	121
	Private	21.4%	33
Type of PBC Measure			
	CTRL	77.3%	119
	SE	10.4%	16
	PC	6.5%	10
	PD	5.8%	9

Note. PD = perceived difficulty, SE = self-efficacy, PC = perceived control, CTRL = a combination of any of the above items.

Outliers

Before synthesizing the effect size estimates, Lipson and Wilson (2001) recommended that the distribution of data points should be examined in order to identify whether outliers are present. The six effect size estimates were examined for univariate outliers (criterion $z = 3.0$, $p = .001$ two-tailed; Normal *Q-Q* plots, histograms, and boxplots were examined) and multivariate outliers (Mahalanobis distance using criterion $\chi 2\ (6) = 22.458$, $p < .001$), following the recommendations of Tabachnick and Fidell (2001; see Appendix D for figures). Because the correlations are also entered into a causal model rather than only examined independently, multivariate outliers were particularly of interest. Therefore, although univariate outliers were flagged, they were not removed unless they were also identified as multivariate outliers.

The z-scores for each of the six *r*-to-*Z* transformed correlations were examined first (see Table 6). One study was found to have an effect size more than three standard deviations from the mean for the intention-attitude *r*-to-*Z* transformed correlation (Courneya, Blanchard, & Laing, 2001, *z* score = -3.1). The box plots for each of the six correlations were examined next (see Appendix D). Five studies were identified as outliers (Burak & Vian, 2007; Courneya et al., 2001; Giles & Lamoure, 2000; Prapavessis et al., 2005; Verplanken, 2006).[42] Those studies had no typographical or coding errors that would account for the outliers. No errors were found; however, the Courneya et al. (2001) study had a very small sample size ($N = 24$). In fact, it was the smallest sample in the entire meta-analysis.

In order to identify multivariate outliers, the Mahalanobis distance values were used (Tabachnick & Fidell, 2001). One study out of the five previously identified with univariate outliers, had a Mahalanobis distance that exceeded 22.46 (Courneya et al., 2001; Mahalanobis distance = 30.97). Therefore, this data set (Courneya et al., 2001) was excluded because it reported a correlation ($r = -.05$) that was more than three standard

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[42] These 5 studies all had at least one correlation with a *z*-score approaching the 3.0 cutoff. See Appendix D for details.

deviations from the meta-analytic mean, and exceed the threshold of multivariate outliers.

Table 6

Results of Outlier Analyses for the Six r-to-Z transformed Effect Sizes

	Int_Att	Int_SN	Int_PBC	Att_SN	Att_PBC	SN_PBC
# studies with *z*-score > 3.0	1: ID_{45}	0	0	0	0	0
# outliers in box plot	1: ID_{45}	1: ID_{115}	2: ID_{65}, ID_{30}	0	1: ID_{136}	0
Skewness (*SE* = 0.20)	0.24 (ns)	0.26 (ns)	0.03 (ns)	0.11 (ns)	-0.19 (ns)	0.11 (ns)
Kurtosis (*SE* = 0.39)	0.28 (ns)	-0.11 (ns)	0.19 (ns)	-0.12 (ns)	0.19 (ns)	-0.57 (ns)

Note. ID_{45} = Courneya et al., 2001; ID_{115} = Prapavessis et al., 2005; ID_{30} = Burak & Vian, 2007; ID_{65} = Giles & Lamoure, 2000; ID_{136} = Verplanken, 2006. Int = intention; Att = attitude; SN = subjective norm; PBC = perceived behavioral control; ns = non-significant.

PBC Transformations

The descriptive statistics for the PBC indices are shown in Table 7.[43] The overall mean PBC was negatively skewed, so the variable was transformed prior to centering it and then entering it into the weighted metaregression.[44] The overall PBC and CTRL indices were transformed using the log10 transformation, PC was transformed using the square root transformation, and SE, and PD indices were not transformed. See Appendix E for more information.

[43] Dropping one study did not affect the reported statistics.
[44] I tried two transformations (log10 and square root) to correct for the skewness. The transformation used for the log10 function was LG10($K – X$). The transformation used was the square root function SQRT($K – X$), where K was equal to the largest score (in this case 6.55) + 1. Out of the two transformations employed for the overall PBC index, the logarithm with the base of 10 was selected as a transformation that better approximates normality than the original distribution and has the lowest skewness coefficient (0.13) as opposed to -1.11 for nontransformed PBC.

Table 7

PBC Indices Descriptive Information

Type of PBC Index	*n*	Min	Max	*M*	*SD*	*Median*	Skewness (*SE*)	Kurtosis (*SE*)
CTRL	118	1.53	6.41	4.94	0.92	5.14	-1.27 (0.22)	1.83 (0.44)
PC	10	4.15	6.37	5.31	0.59	5.45	-0.38 (0.69)	1.47 (1.33)
PD	9	3.12	6.43	4.63	0.98	4.38	0.50 (0.72)	0.34 (1.40)
SE	16	3.81	6.55	5.37	0.82	5.57	-0.63 (0.56)	-0.56 (1.09)
Overall PBC	153	1.53	6.55	4.99	0.91	5.20	-1.11 (0.20)	1.56 (0.39)

Note. PD = perceived difficulty, SE = self-efficacy, PC = perceived behavioral control, CTRL = a combination of any of the above items.

Weighted Mean Effect Size

The weighted correlation coefficients (i.e., weighted effect sizes) for both the fixed-effects and random-effects model are presented in Table 8.[45] A 95% confidence interval for the effect size was calculated using the standard error of the effect size.[46] The confidence intervals serve as an indication of the degree of precision of the estimate of the mean effect size (Lipsey & Wilson, 2001). Importantly, if the confidence interval does not include zero, the mean effect size is significant at $\alpha = .05$. The lower triangle of Table 8 reports the pooled correlations coefficients and the corresponding 95% confidence-intervals for the fixed-effects model. The corresponding Q-test statistic of homogeneity is provided for each matrix element in the fixed-effects model. Of the six

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[45] The correlations in the table have been back transformed using the Z-to-r transformation. $\bar{r}^{*} = \overline{ES}*$ = weighted back transformed mean correlation/effect size.

[46] To construct the confidence intervals, the standard error of the mean effect size was multiplied by a critical z-value (1.96 for $\alpha = .05$), and the product was added to the mean effect size for the upper limit, and the product was subtracted from the mean effect size for the lower limit of the critical value:

$$\overline{ES}_{lower} = \overline{ES} - 1.96(SE_{\overline{ES}}),$$
$$\overline{ES}_{upper} = \overline{ES} + 1.96(SE_{\overline{ES}}).$$

pooled correlations, the *Q*-statistic was below the critical value of $p = .0083$, which indicates that the variance in the sample of effect sizes are heterogeneous and seemingly could not be accounted for by sampling error alone. The assumptions underlying the fixed-effects model are therefore not met and the random-effects model was used for the remaining analyses (Hunter & Schmidt, 1990; Lipsey & Wilson, 2001). As a consequence, the six pooled correlations were recalculated under the random-effects assumption. The upper part of Table 8 presents these correlations and the 95% confidence intervals of these estimates.

Table 8

Fisher's Z-back-transformed Average Correlation Matrix Under the Fixed-Effects (Lower Triangle of Matrix) and Random-Effects (Upper Triangle of Matrix) Models

	Intention	Attitude	Norm	PBC
Intention	—	$\bar{r}^* = .56$ [.54, .58]	$\bar{r}^* = .39$ [.36, .42]	$\bar{r}^* = .52$ [.49, .55]
Attitude	$\bar{r}^* = .54$ [.53, .55] $Q = 1322.84$	—	$\bar{r}^* =$. 37 [.34, .40]	$\bar{r}^* = .41$ [.38, .44]
Norm	$\bar{r}^* = .36$ [.36, .37] $Q = 1541.56$	$\bar{r}^* = .35$ [.34, .36] $Q = 1782.40$	—	$\bar{r}^* = .27$ [.24, .29]
PBC	$\bar{r}^* = .50$ [.49, .51] $Q = 2210.62$	$\bar{r}^* = .39$ [.38, .40] $Q = 1797.62$	$\bar{r}^* = .25$ [.24, .26] $Q = 1487.55$	—

Note. $\bar{r}^*$ = weighted back transformed mean correlation; *Q* = homogeneity statistic with *k*-1 degrees of freedom. Each weighted mean correlation and *Q* is statistically significant, $p <$ .001. Confidence intervals (95%) appear in brackets.

According to Cohen (1992), $\bar{r}^* = .10$ is small, $\bar{r}^* = .30$ is medium, and $\bar{r}^* = .50$ is large. Overall, the average correlations were medium to large, with the strongest weighted correlations found for the attitude-intention relationship ($\bar{r}^* = .54$) and the PBC-intention relationship ($\bar{r}^* = .50$). None of the correlations were smaller than .10 (in absolute value), suggesting a less-than-small correlation by Cohen's (1992) guidelines.

Before proceeding with the hypothesis tests, for descriptive purposes, the effect of each of the proposed moderators on the correlation between attitude and intention, norm and intention, and PBC and intention was examined and reported in Table 9. Further, the correlation between the two behavior categories was examined and descriptive statistics for PBC in each category are presented in Table 10. The correlation between the two behavior categories was r (153) = .47, $p < .05$, two-tailed.

Results of the moderator analysis are shown in Table 9. The moderator analysis was conducted using a categorical mixed-effects model fitted by least-squares regression analyses using the SPSS macro provided by Wilson (2010). The average weighted correlation for each level of the moderator is reported, which permits an examination of the pattern of the effect. In separate models, the r-to-Z transformed correlations were regressed on the moderator values, using mixed-effects weights. The moderators were characteristics of behaviors that were coded and the operationalizations of PBC.

Table 9

Theoretical Association as a Function of Moderators

		Attitude and intention		Norm and intention		PBC and intention	
Moderators	k	$\bar{r}^*$	95% CI	$\bar{r}^*$	95% CI	$\bar{r}^*$	95% CI
Familiarity of Behavior							
Familiar	126	.56	[.53, .58]	.38*	[.35, .41]	.52	[.48, .55]
Unfamiliar	27	.56	[.51, .61]	.47*	[.41, .53]	.54	[.47, .60]
Public Nature of Behavior							
Public	120	.55	[.52, .57]	.37*	[.34, .40]	.58	[.53, .62]
Private	33	.59	[.55, .63]	.47*	[.42, .52]	.57	[.50, .66]
Operationalization of PBC							
CTRL	118	.55	[.53, .58]	.40	[.37, .43]	.53*	[.50, .56]
SE	16	.55	[.48, .61]	.36	[.28, .44]	.54*	[.46, .62]
PC	10	.60	[.52, .67]	.36	[.24, .46]	.33*	[.19, .45]
PD	9	.61	[.53, .68]	.39	[.27, .49]	.52*	[.39, .62]

Note. CI = confidence interval. $\bar{r}^*$ is the weighted back-transformed mean correlation.
*$p < .001$.

From these analyses, some significant findings emerged. The correlation between norm and intention was larger for unfamiliar behaviors (versus familiar behaviors), and for private behaviors (versus public behaviors). Both moderators sufficiently accounted for any excess variability among effect sizes. Further, type of PBC operationalization was a significant moderator of the PBC–intention correlation. The correlation between PBC and intention was larger when the study used measures that contained some combination of self-efficacy, perceived difficulty, and perceived control items (CTRL) or measures that only had self-efficacy items (SE), compared to studies that used only perceived control items (PC). This moderator did not sufficiently account for all of the heterogeneity in the PBC–intention correlation.

Table 10

PBC Descriptive Information Split by Behavior Type

	M	*SD*	Median	Min	Max
Unfamiliar	5.01	0.85	4.93	3.76	6.30
Familiar	4.99	0.92	5.20	1.53	6.55
Private	5.10	0.94	5.53	2.92	6.55
Public	4.96	0.90	5.16	1.53	6.43

Moderator Analyses

As described in Chapter 4, the mean level of PBC was coded for each study and was transformed to have a common metric. Mean PBC was hypothesized to moderate the association between attitude and intention and norm and intention. To test Hypotheses 1 and 2, separate weighted least squares regressions were conducted using appropriate adjustments for meta-analysis (see Lipsey & Wilson, 2001). That is, mean PBC was treated as the one predictor of the attitude-intention and norm-intention effect size. A mixed-effects model (Hedges, 1994; Raudenbush, 2009) was adopted and implemented using the SPSS macro provided by Wilson (2010).[47] Using the method of maximum

[47] Rather than opt for a single model of error (i.e., fixed- versus random-effects), both models were used. Therefore, all analyses were conducted twice, first employing fixed-error assumptions and then random-error assumptions. All fixed-effects models had significant residual *Q*-values, which indicates that the residual variance remained heterogeneous even after taking into account the moderator. Therefore, these findings

likelihood, the macro first estimated the random-effects residual variance component (τ_i^2) after accounting for PBC. The resulting residual variance component (.03 for attitude and .04 for norm) was then added to the variance of each study, and a weighted least squares regression was conducted.[48] The dependent variable was the *r*-to-*Z* transformed effect size of each study weighted by the inverse of its adjusted variance. The independent variable was each study's mean PBC. The results of the metaregressions can be interpreted analogous to a conventional multiple linear regression. Scatter plots were created using the Comprehensive Meta-Analysis statistical software package (Borenstein, Hedges, Higgins, & Rothstein, 2005).

Summaries of the moderator analyses appear in Tables 11-16. These tables include both the standardized (β) and unstandardized (*B*) regression coefficients along with the *Q* statistic for the overall model (Q_{Model}) and the *Q* statistic for the residuals ($Q_{Residual}$). The reported significance of the Q_{Model} is a test of the homogeneity of the regression model. A significant Q_{Model} indicates that the regression model explains a significant amount of variability across the effect sizes. The $Q_{Residual}$ represents the heterogeneity among effect sizes that is left unexplained by the model. A nonsignificant $Q_{Residual}$ indicates that the unexplained variability is no greater than would be expected from sampling error. In other words, a significant $Q_{Residual}$ suggests that there is still some heterogeneity left unexplained by the model (Lipsey & Wilson, 2001).

Hypothesis 1. Hypothesis 1 predicted that the slope between attitude and

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provided support for the use of a mixed-effects model. All results for the fixed-effects model are provided in Appendix F but will not be discussed herein.

[48] Remember that random-effects models weight each study by the inverse of the sampling variance (inverse of the squared standard error) plus a constant that represents the variability across the population effects (τ_i^2): $w_i^* = 1/\tau_i^2 + SE_i^2$.

intention would become increasingly more positive as the level of PBC increases. In the metaregression, the weighted effect size ($\overline{ES}_{Zr}$) for the transformed *r*-to-*Z* correlation between attitude and intention was the dependent variable and the mean level of PBC (that was log10 transformed) was the independent variable. The standardized regression coefficient indicates the magnitude of the moderation. The regression model was not statistically significant, *Q* (1) = 2.86, *p* = .09, with a random-effects variance component *v* = .03 and an explained variance of 2%. The standardized beta coefficients were in the predicted direction, with higher levels of PBC showing stronger effect sizes than lower levels of PBC, but they did not reach statistical significance (β = .13 *p* = .09; see Table 11). This finding indicates that there was no moderating relationship between PBC and the attitude-intention association. Therefore, Hypothesis 1 was not supported. Figure 9 shows the moderation with the attitude-intention *r*-to-*Z* transformed correlation on the *Y* axis and log10 transformed PBC on the *X* axis.

Table 11

Results from the Weighted Regression Analyses Under the Mixed-Effects Model

Dependent variable	Variable	*B*	*SE*	CI_{95}	*p*	β	*t*	Q_{Model}	$Q_{Residual}$	R^2
$\overline{ES}_{Zr}$ (Att, Int)								2.86	170.62	.02
	Intercept	0.56	0.04	[0.48, 0.65]						
	PBC	0.18	0.11	[-0.03, 0.39]	.091	.13	1.69			
$\overline{ES}_{Zr}$ (SN, Int)								0.40	175.22	.00
	Intercept	0.39	0.05	[0.30, 0.48]						
	PBC	0.07	0.11	[-0.15, 0.29]	.527	.05	0.63			

Note. . $\overline{ES}_{Zr}$(Att, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between attitude and intention. $\overline{ES}_{Zr}$(SN, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between norm and intention. PBC was log10 transformed. *B* = unstandardized regression coefficient; *SE* = standard error of *B*; β = standardized regression coefficient; Q_{Model} = heterogeneity explained by regression model; $Q_{Residual}$ = unexplained heterogeneity; R^2 = explained variance.

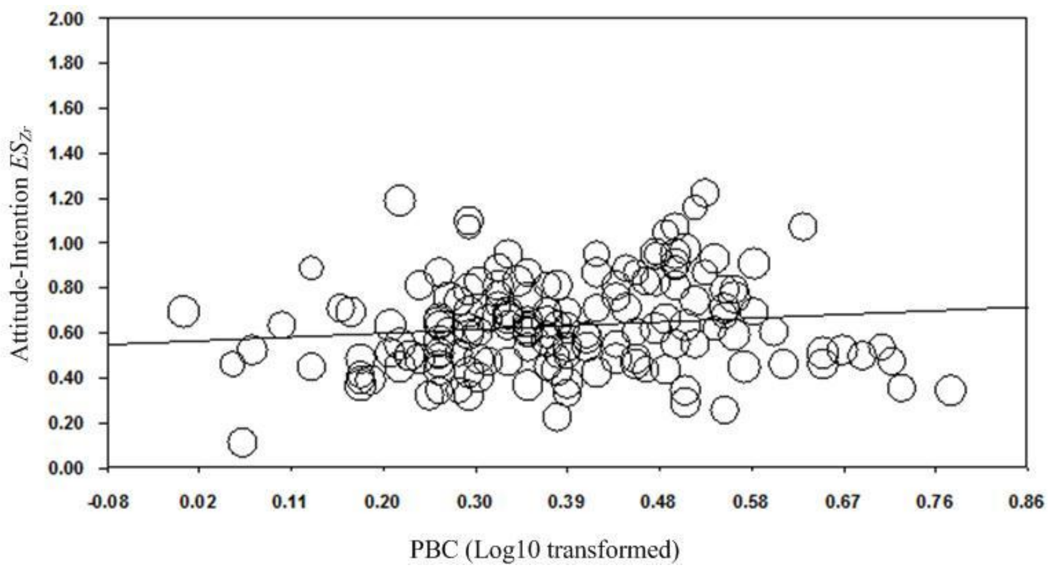

Figure 9. A scatterplot of the relationship between attitude and intention across different levels of PBC. Each study (*k*) is represented by a circle.

Hypothesis 2. Hypothesis 2 predicted that the slope between norms and intention becomes increasingly more positive as the level of PBC increases. The regression model was not statistically significant, Q (1) = 0.40, p = .53, with a random-effects variance component v = 0.04. Results from the weighted regression indicated that there was no linear association between PBC and the norm-intention effect size. Thus, according to this test, PBC was not a significant moderator of the norm-intention relation (β = .05, p = .53, see Table 11). Therefore, no support was found for Hypothesis 2. Figure 10 shows the results of the regression of PBC on the norm-intention *r*-to-*Z* transformed effect size.

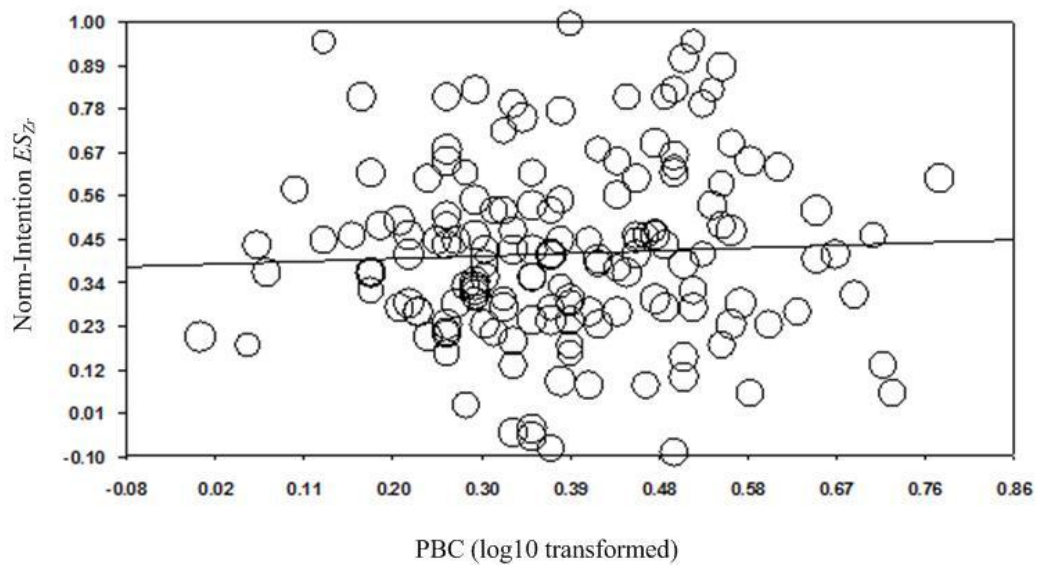

Figure 10. A scatterplot of the relationship between norm and intention across different levels of PBC. Each study (*k*) is represented by a circle.

Hypotheses 3. Hypothesis 3 predicted that PBC was more likely to moderate the attitude-intention and norm-intention relationship for familiar behaviors than unfamiliar behaviors. Two weighted mixed-effects regression models were used to test this hypothesis (for the first model the attitude-intention effect size was the dependent variable; in the second model the norm-intention effect size was the dependent variable). In both analyses, PBC, the dummy coded familiarity variables (0 = *familiar*, 1 = *unfamiliar*), and the interaction term were the three predictors.

As can be seen in the Table 12, for the attitude-intention effect size, the regression model was statistically significant, Q (3) = 8.23, $p < .05$, with a random-effects variance component v = 0.03 and the explained variance was 4.4%. According to the metaregression, there was a significant interaction between PBC and familiarity ($\beta = .18$, $z = 2.268$ $p < .05$). However, the positive beta coefficient indicated that the finding was in the opposite direction than that which was predicted. Specifically, the interaction between PBC and the attitude-intention effect size was significant for the unfamiliar behaviors but was not significant for the familiar behaviors. For unfamiliar behaviors, for every one unit increase in PBC there is a .59 unit increase in the attitude-intention untransformed correlation. The significant $Q_{Residual}$ for the attitude-intention model indicates that there is still some heterogeneity left unexplained.

To explore this three-way interaction further, a metaregression was conducted for unfamiliar behaviors (Table 13). The standardized regression coefficient ($\beta = .41$) indicates how the attitude-intention correlation changes with a one standard deviation increase in PBC: The correlation between attitude and intention increases as PBC increases. Also, the R^2, which can be thought of as a measure of the size of the interaction effect, was .17. In other words, PBC explained 17% of the variance in the attitude-intention correlation.

With respect to the norm-intention relationship, the regression model approached, but did not fully reach, significance, Q (3) = 7.66, $p = .054$, with a random-effects variance component $v = .03$ and an explained variance of 4.3% (see Table 12). The PBC by familiarity interaction was not significant ($\beta = .06$, $p = .44$). There was a significant effect of type of behavior ($\beta = .19$, $z = 2.58$ $p < .05$). These results indicate that the relationship between norm and intention got stronger for unfamiliar behaviors than for familiar behaviors. Therefore, Hypothesis 3 was not supported for either the norm-intention or attitude-intention effect sizes. Figure 11 shows the regression of the log10 transformed PBC on the norm-intention and attitude-intention *r*-to-*Z* transformed effect size across familiar and unfamiliar behaviors.

Table 12

Tests for 3-Way Interaction Using Mixed-Effects Weighted Regression

Dependent Variable	Predictor	Intercept	*B*	SE	CI_{95}	*p*	β	Q_{Model}	$Q_{Residual}$ (df = 149)	R^2
$\bar{r}^*$(Att, Int)		0.6298						8.23*	181.17*	.04
	PBC		0.07	0.11	[-0.16, 0.29]	.559	.05			
	Unfamiliar		0.00	0.04	[-0.07, 0.08]	.913	.01			
	PBC x Unfamiliar		0.59	0.26	[0.08, 1.09]	.023	.18			
$\bar{r}^*$(SN, Int)		0.3950						7.66†	172.26	.04
	PBC		0.29	0.12	[-0.22, 0.27]	.818	.02			
	Unfamiliar		0.11	0.04	[0.27, 0.20]	.010	.19			
	PBC x Unfamiliar		0.22	0.28	[-0.34, 0.78]	.435	.06			

Note. $\bar{r}^*$(Att, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between attitude and intention. $\bar{r}^*$(SN, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between norm and intention. *B* = unstandardized regression coefficient; *SE* = standard error of *B*; β = standardized regression coefficient; $Q_{Residual}$ = unexplained heterogeneity; R^2 = explained variance. Unfamiliar was coded as 1 and familiar was coded as 0.

* $p < .05$. † $p = .05$.

Table 13

Results from the Weighted Regression Analyses Under the Mixed-Effects Model for the Subset of Unfamiliar Behaviors

Dependent variable	Independent Variable	*B*	*SE*	CI_{95}	*p*	β	*t*	Q_{Model}	$Q_{Residual}$	R^2
$\overline{ES}_{Zr}$ (Att, Int)								6.77**	33.93	.17
	Intercept	0.39	0.10	[0.19, 0.59]						
	PBC	0.65	0.25	[0.16, 1.14]	.009	.41	2.60			

Note. . $\overline{ES}_{Zr}$(Att, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between attitude and intention. PBC was log10 transformed. *B* = unstandardized regression coefficient; *SE* = standard error of *B*; β = standardized regression coefficient; Q_{Model} = heterogeneity explained by regression model; $Q_{Residual}$ = unexplained heterogeneity.

** $p < .01$.

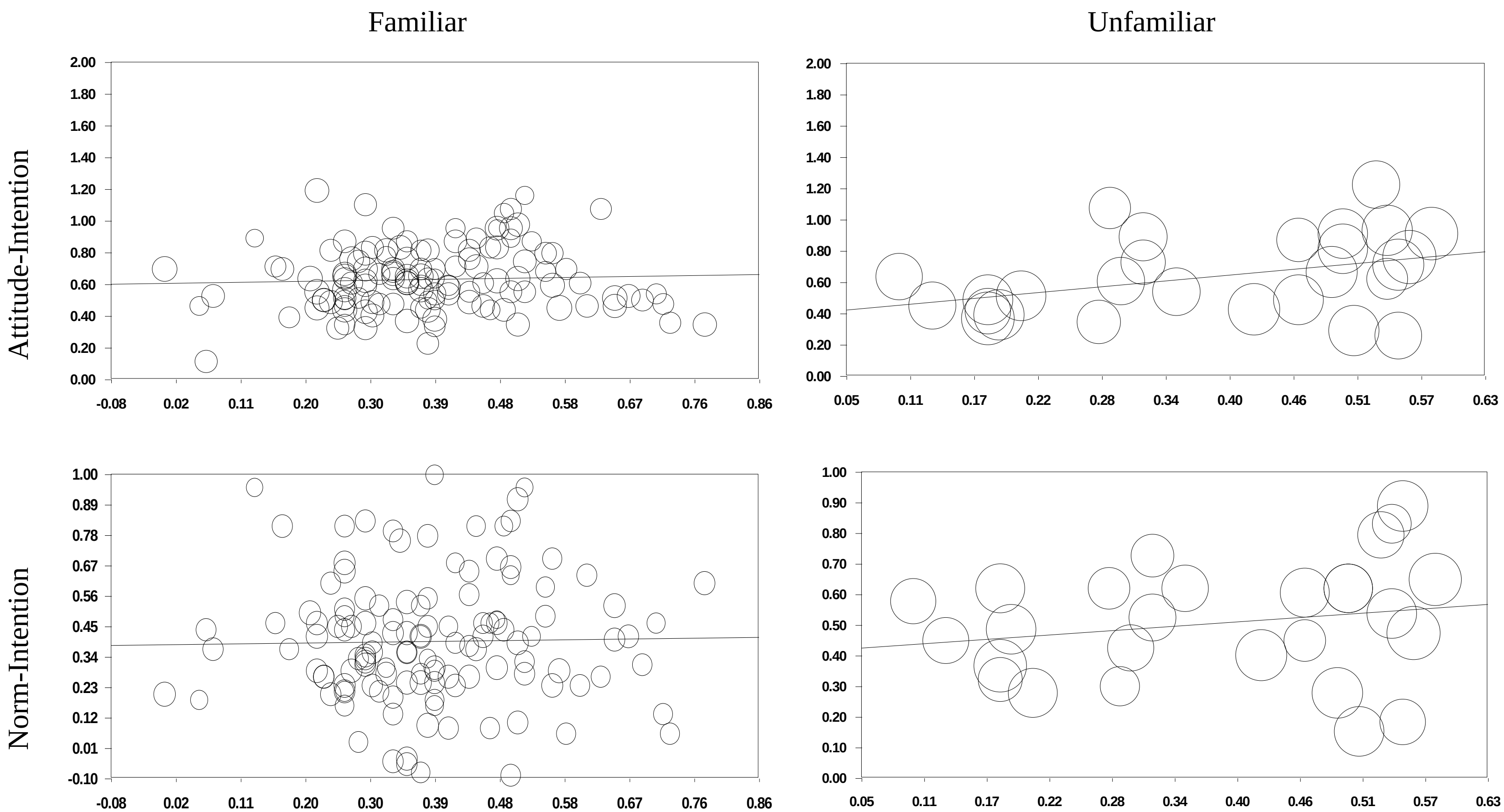

Figure 11. A scatterplot of the relationship between attitude and intention (top row) and norm and intention (bottom row) across levels of PBC for familiar (left column) and unfamiliar (right column) behaviors. Each study (*k*) is represented by a circle.

Hypotheses 4. Hypothesis 4 predicted that PBC was more likely to moderate the attitude-intention and norm-intention relationship for public behaviors than for private behaviors. Two weighted mixed-effects regression models were used to test this hypothesis (for the first model the attitude-intention effect size was the dependent variable, in the second model the norm-intention effect size was the dependent variable). In both analyses, PBC, the dummy coded public variable (0 = *public*, 1 = *private*), and the interaction term were the three predictors.

As can be seen in the Table 14, for the attitude-intention effect size, the regression model was not statistically significant, Q (3) = 6.68, p = .083, with a random-effects variance component v = .03. The regression model for the norm-intention relationship was significant, Q (3) = 11.19, $p < .05$, with a random-effects variance component v = .03 and an explained variance of 6.1%. However, the PBC by private behavior interaction term was not significant. Instead, there was a significant effect of type of behavior (β = .24, z = 3.25 $p < .01$). These results indicated that the relationship between norm and intention was stronger for private behaviors than for public behaviors. Hypothesis 4 was not supported for either the norm-intention or attitude-intention effect sizes. Figure 12 shows the regression of the log10 transformed PBC on the norm-intention and attitude-intention *r*-to-*Z* transformed effect size across private and public behaviors.

Table 14

Tests for 3-Way Interaction Using Mixed-Effects Weighted Regression

Dependent Variable	Predictor	Intercept	*B*	SE	CI_{95}	*p*	β	Q_{Model}	$Q_{Residual}$ (df = 149)	R^2
$\bar{r}^*$(Att, Int)		0.6150						6.68	169.82	.04
	PBC		0.19	0.13	[-0.05, 0.44]	.121	.14			
	Private		0.07	0.04	[-0.00, 0.15]	.053	.15			
	PBC x Private		0.01	0.23	[-0.45, 0.47]	.979	.00			
$\bar{r}^*$(SN, Int)		0.3870						11.19*	171.22	.06
	PBC		0.05	0.13	[-0.21, 0.31]	.707	.03			
	Private		0.13	0.04	[0.05, 0.21]	.001	.24			
	PBC x Private		0.18	0.25	[-0.31, 0.66]	.468	.06			

Note. . $\bar{r}^*$(Att, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between attitude and intention. $\bar{r}^*$(SN, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between norm and intention. *B* = unstandardized regression coefficient; *SE* = standard error of *B*; β = standardized regression coefficient; $Q_{Residual}$ = unexplained heterogeneity. Private was coded as 1 and public was coded as 0.

* $p < .05$.

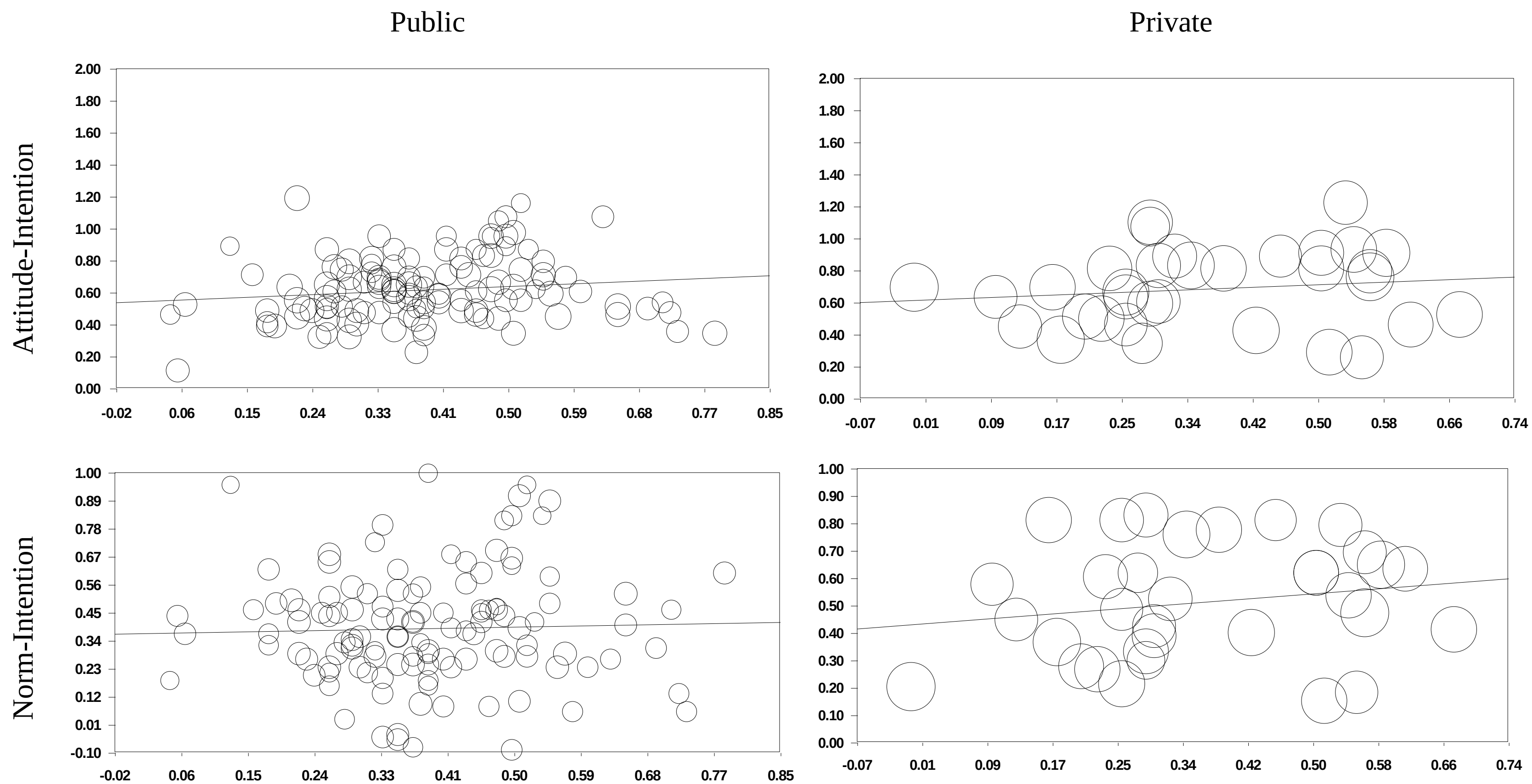

Figure 12. A scatterplot of the relationship between attitude and intention (top row) and norm and intention (bottom row) across levels of PBC for public (left column) and private (right column) behaviors. Each study (*k*) is represented by a circle.

Research question 1. Research question 1 asked whether the moderating effect of PBC holds across the different measures of PBC. Although a moderating effect of PBC was not found, it is possible that it may be found for certain operationalizations of PBC. In order to explore this research question, eight separate weighted regressions were conducted (four for the attitude-intention association and four for the norm-intention association). Table 15 reports the weighted regression with the attitude-intention effect size as the dependent variable for the separate PBC measures and Table 16 shows the weighted regression with the norm-intention effect size as the dependent variable.

PBC was a significant moderator of the attitude-intention relationship for the CTRL and SE indices (see Table 15). For CTRL, the model was statistically significant, Q (1) = 3.90, $p < .05$, with a random-effects variance component $v = .03$ and an explained variance of 3%. The standardized beta coefficient was in the predicted direction, with higher levels of PBC showing stronger effect sizes than lower levels of PBC ($\beta = .18$). This effect was even stronger when the PBC operationalization included only self-efficacy measures, Q (1) = 9.14, $p < .01$, with a random-effects variance component v = .01 and an explained variance of 31%. Consistent with expectations, higher levels of SE resulted in a stronger attitude-intention association ($\beta = .56$). In contrast, PBC did not moderate the norm-intention association across any of the different operationalizations (see Table 16). Figure 13 shows the regression of PBC on the attitude-intention r-to-Z transformed effect size across the four types of operationalizations. Figure 14 shows the regression of PBC on the norm-intention r-to-Z transformed effect size across the four types of operationalizations.

Table 15

Moderator Analysis of the Association Between Attitude and Intention Under the Mixed-Effects Model

PBC x Measure	*N*	*B*	*SE*	CI_{95}	*p*	β	*t*	Q_{Model}	$Q_{Residual}$ (*df*)	R^2
CTRL	118	0.26	0.13	[0.00, 0.52]	.048	.18	1.97	3.90*	116.61 (116)	.03
SE	16	0.10	0.03	[0.04, 0.17]	.003	.56	3.02	9.14**	19.98 (14)	.31
PC	10	0.86	.46	[-0.03, 1.76]	.059	.66	1.89	3.57	4.64 (8)	.43
PD	9	0.03	0.07	[-0.10, 0.16]	.675	.12	0.42	0.18	11.15 (7)	.02

Note. CTRL has been log10 transformed. PC has been square root transformed. *B* = unstandardized regression coefficient; *SE* = standard error of *B*; β = standardized regression coefficient; Q_{Model} = heterogeneity explained by regression model; $Q_{Residual}$ = unexplained heterogeneity.
* $p < .05$. ** $p < .01$.

Table 16

Moderator Analysis of the Association Between Norm and Intention Under the Mixed-Effects Model

PBC x Measure	*N*	*B*	*SE*	CI_{95}	*p*	β	*t*	Q_{Model}	$Q_{Residual}$ (*df*)	R^2
CTRL	118	0.10	0.14	[-0.17, 0.37]	.478	.06	0.71	0.51	129.37 (116)	.00
SE	16	0.10	0.05	[-0.01, 0.21]	.065	.41	1.85	3.42	17.40 (14)	.16
PC	10	0.33	0.47	[-0.60, 1.25]	.487	.25	0.70	0.48	7.08 (8)	.06
PD	9	-0.05	0.06	[-0.17, 0.07]	.393	-.30	-0.85	0.73	7.38 (7)	.09

Note. CTRL has been log10 transformed. PC has been square root transformed. *B* = unstandardized regression coefficient; *SE* = standard error of *B*; β = standardized regression coefficient; Q_{Model} = heterogeneity explained by regression model; $Q_{Residual}$ = unexplained heterogeneity.

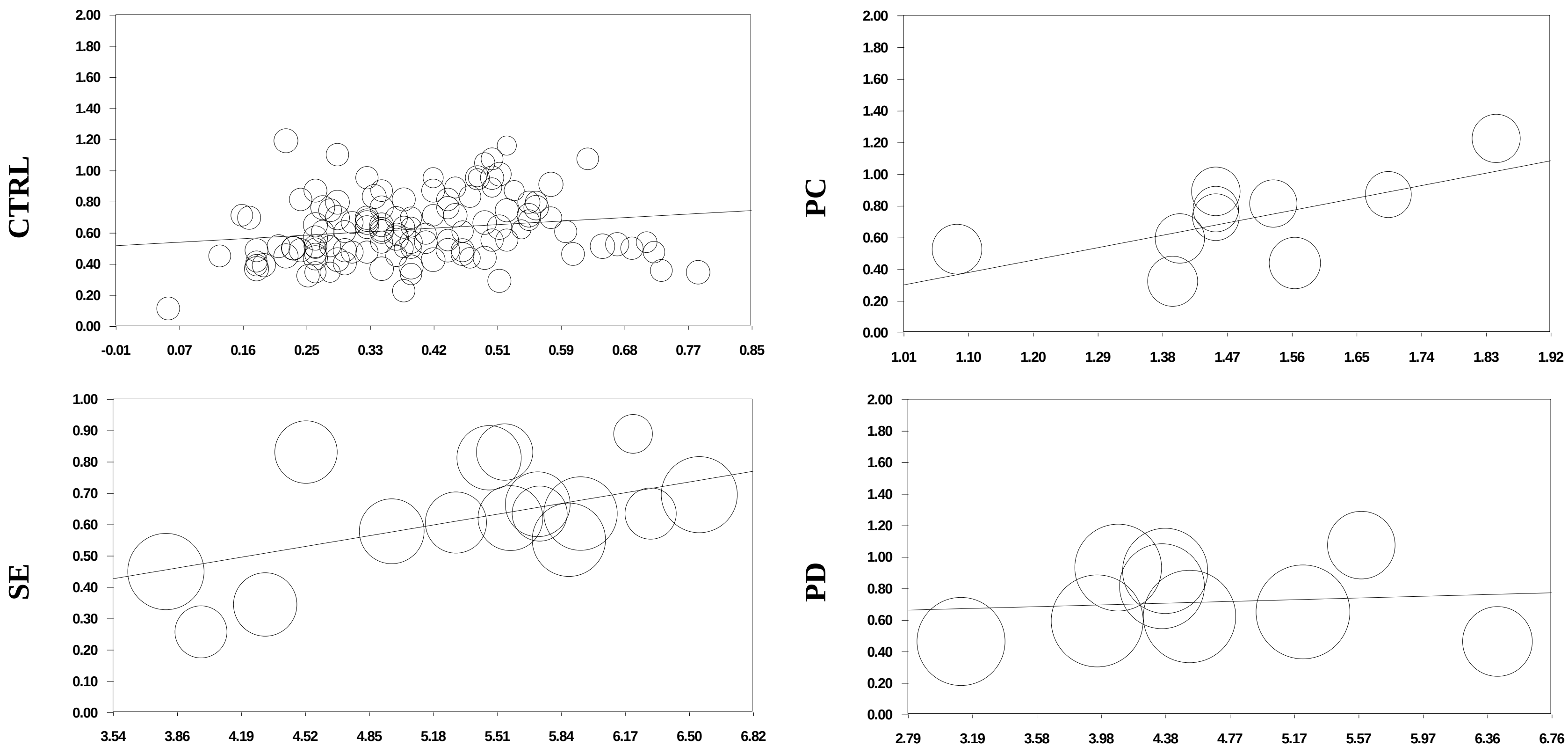

Figure 13. A scatter plot of the relationship between attitude and intention across levels of PBC for type of PBC operationalizations. Each study is represented by a circle. PD = perceived difficulty, SE = self-efficacy, PC = perceived behavioral control, CTRL = a combination of any of the above items. The sizes of the circles vary by operationalization because some operationalizations have more studies (*k*) than others; therefore, the circles are smaller to accommodate more circles.

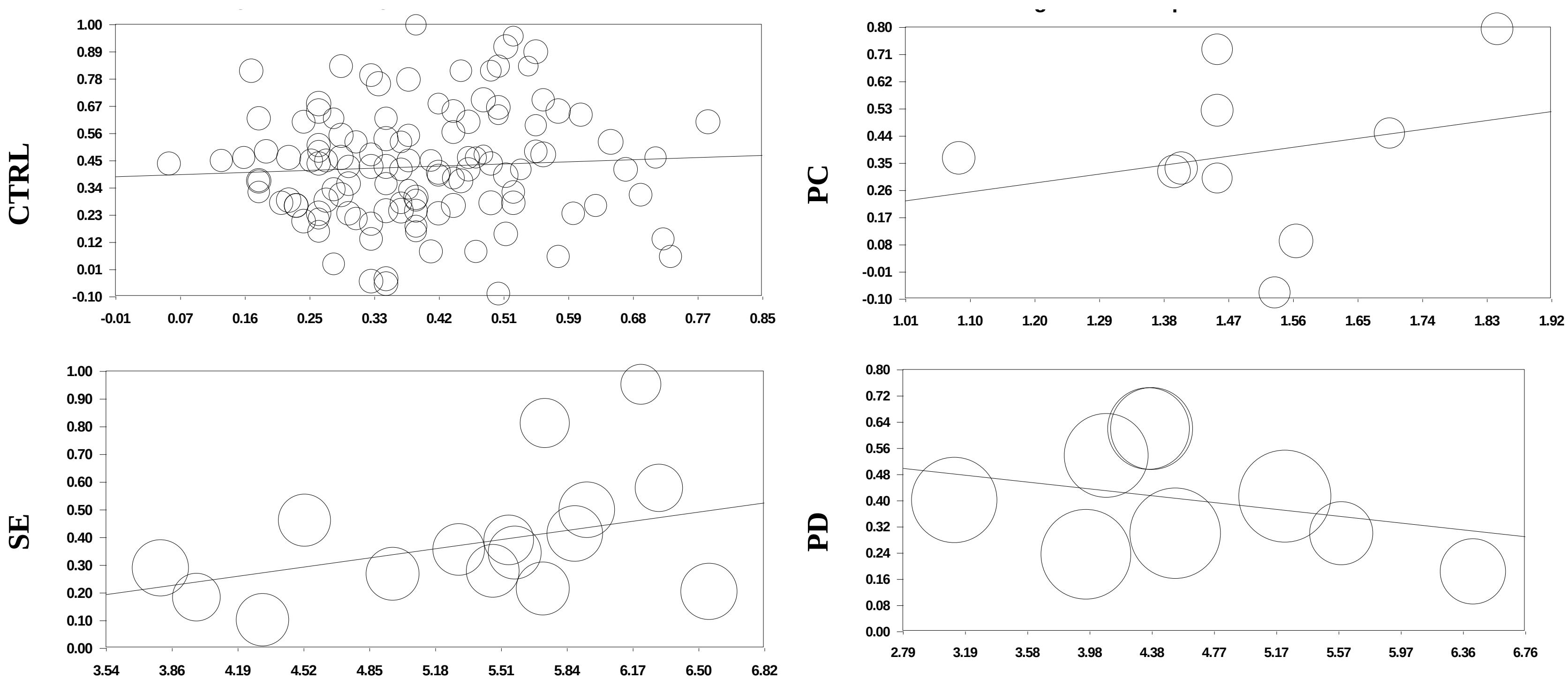

Figure 14. A scatterplot of the relationship between norm and intention across different levels of PBC for type of PBC operationalizations. Each study is represented by a circle. PD = perceived difficulty, SE = self-efficacy, PC = perceived behavioral control, CTRL = a combination of any of the above items. The sizes of the circles vary by operationalization because some operationalizations have more studies (*k*) than others; therefore, the circles are smaller to accommodate more circles.

Mediation Hypothesis

Meta-analytic structural equation modeling. As described in Chapter 4, the Hedges and Olkin (1985) approach was used to average the correlations so the first step was to convert the correlations into a standard metric by using Fisher's *r*-to-*Z* transformation. The *r*-to-*Z* transformed correlations were then weighted by the reciprocal of their estimated variances and these values were used to calculate an initial pooled mean effect size using a random-effects model. The weighted pooled correlations provided a 6 x 6 random-effects correlation matrix (see Table 8, upper triangle of matrix). The MASEM analysis was conducted using LISREL 8.8 (Jöreskog & Sörbom, 1993), and parameters were estimated with maximum-likelihood procedures. The maximum likelihood method was used to examine model parameters, as this method is preferred for samples < 500 (Hu, Bentler, & Kano, 1992). All studies included in this meta-analysis reported correlations for all model variables; therefore, the elements of the correlation matrix are based on the same sample size (N = 44,424). Thus, there were no problems associated with different sample sizes (see Viswesvaran & Ones, 1995 for review).

The fit of the overall model was assessed based on suggestions from several authors (Bollen, 1989; Hoyle & Panter, 1995; Hu & Bentler, 1999; Mueller, 1997). As a result, model fit indices are reported from several different index families. Common model-fit measures were used to assess the model's overall goodness-of-fit: the relative chi-square fit index (χ^2/df); the goodness-of-fit index and the adjusted goodness of fit index (GFI and AGFI, respectively); the standardized root mean-square residual (SRMR); Steiger and Lind's root mean-square error of approximation (RMSEA; Steiger, 1990); the normed fit index (NFI); and Bentler's comparative fit index (CFI; Bentler, 1990).[49] The goodness of fit index (GFI), adjusted goodness of fit index (AGFI), normative fit index (NFI), and root mean squared residual (RMR) were used as fit indices because those indices are not sample size dependent (Jöreskog & Sörbom, 1993). See Table 17 for the recommended value of each fit index.

Of note, the sample size used in the MASEM far exceeds that of the typical TPB study. Therefore, the resulting χ^2 statistic was anticipated to be large relative to other empirical studies of the TPB, and it was also possible that negligible (i.e., practically insignificant) relationships would be statistically significant (e.g., Bollen, 1989). To account for this potential problem, the same path model was specified using alternative sample sizes. Two alternative sample sizes were chosen: the harmonic mean of the sample sizes (N = 132) and the largest sample size of any of the studies included in the meta-analysis (N = 3,428).[50] Varying the sample sizes allowed investigation of whether a given relationship found to be significant with high sample sizes also held for smaller samples.

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[49] The relative chi-square fit index is the ratio of the chi-squared statistic to the associated degrees of freedom. The chi-square and χ^2/df ratio both look at the absolute size of the residuals. An acceptable chi-square fit index is usually set at a 3:1 ratio (Bollen, 1989). GFI is a sample-based fit index, analogous to the R^2 value that is reported with multiple regression models (Hoyle & Panter, 1995). The RMSEA is a parsimony-adjusted index with a built-in correction for model complexity: Given two models with similar overall explanatory power, the simpler model will be favored (Maruyama, 1998). The SRMR is a measure of the mean absolute correlation residual, the overall difference between the observed and predicted correlations (Maruyama, 1998). Finally, the CFI is an incremental fit index and does not assume a perfect population fit of the model (i.e., zero error of approximation; Maruyama, 1998).

[50] The harmonic mean takes the overall degree of the precision of the data into account and studies with larger sample sizes have no extra influence (Viswesvaran & Ones, 1995, p. 877). The harmonic mean is calculated by the formula $[k/(1/N_1 + 1/N_2 + \ldots + 1/N_k)]$, where N refers to sample size and k refers to the total number of samples. Here, less weight is given to large samples, so use of the harmonic mean results in more conservative effect size estimates.

According to the criteria for assessing data-model fit, the correspondence between the model implied and the actual pooled correlation matrix was judged as unacceptable, regardless of sample size (see Table 17). Therefore, the mediation model was not a good explanation to fit the data and Hypothesis 5 was not supported.

Table 17

Fit Indices for Structural Models

Fit Indices	Recommended Value	*N* = 44,424	*N* = 3,428	*N* = 132
χ^2/df	≤ 3.00	4.87	387.94	14.83
Goodness-of-fit index (GFI)	≥ 0.90	0.90	0.90	0.90
Adjusted goodness-of-fit index (AGFI)	≥ 0.90	0.49	0.49	0.49
Standardized root mean-square residual (SRMR)	≤ 0.08	0.13	0.13	0.13
Root mean-square error of approximation (RMSEA)	≤ 0.06	0.30	0.34	0.33
Normalized fit index (NFI)	≥ 0.90	0.79	0.79	0.79
Comparative fit index (CFI)	≥ 0.90	0.81	0.79	0.80

Auxiliary Analysis

Nonlinear moderation. Based on the scatterplots from the previous analyses, it was suspected that there would be a nonlinear relationship between PBC and the attitude-intention and norm-intention effect sizes. All computations were done with the SPSS syntax provided by Lipsey and Wilson (2001), using a polynomial weighted regression model with the method of moments (a mixed-effects model). The effect sizes representing the attitude-intention and norm-intention association served as the outcome variables in the separate regressions. The independent variables were the linear, quadratic and cubic trends for PBC. Table 18 shows the correlations between the independent variables.

Table 18

Zero-Order Correlations for Linear and Nonlinear PBC Variables

	PBC	PBC^2	PBC^3
PBC	–		
PBC^2	.19*	–	
PBC^3	.81**	.27**	–

Note. PBC = perceived behavioral control. PBC log10 transformed and then was mean-centered before creating quadratic (PBC^2) and cubic (PBC^2) terms.
*p < .05, **p < .001.

The norm by PBC interaction on intention did not have statistically significant linear or nonlinear effects. As can be seen in Table 19, the unstandardized regression coefficients representing the linear, quadratic, and cubic effects were not significant moderators of the norm–intention association. In contrast, the attitude by PBC interaction on intention had statistically significant nonlinear effects in addition to a linear effect. Results in Table 19 suggest that the linear, quadratic, and cubic PBC variables explained a statistically significant amount of variation in the attitude–intention association (e.g., 10% of the total variation). The unstandardized regression coefficients representing the linear, quadratic, and cubic effects, for the model with the weighted attitude-intention effect size as the dependent variable, were all statistically significant. The positive linear effect was as predicted. The negative regression coefficient for the quadratic effect indicates that the curve is an inverted *U*. In addition, it appears that the linear and cubic variables are highly correlated, even after mean-centering (see Table 18). The high correlation can be attributed to the fact that, in general, the cubic trend parallels the linear trend reasonably well (except when it dips down once). In other words, the high correlation between the cubic trend and linear trend suggests that the effects overlap.

Table 19

Tests for Curvilinear Moderation Effects (*N* = 153)

Dependent Variable	Independent Variable	R^2	Intercept	*B (SE)*	CI_{95}	β	*t*	Q_{Model}	$Q_{Residual}$
$\bar{r}^*$(Att, Int)		.10	0.66					17.46***	157.16
	PBC			0.58 (0.18)	[0.23, 0.93]	.41	3.22**		
	PBC^2			-1.40 (0.53)	[-2.43, -0.37]	-.20	-2.65**		
	PBC^3			-5.84 (2.30)	[-10.35, -1.33]	-.33	-2.54*		
$\bar{r}^*$(SN, Int)		.01	0.42					0.92	171.60
	PBC			0.19 (0.19)	[-0.19, 0.56]	.12	0.96		
	PBC^2			-0.03 (0.57)	[-1.14, 1.09]	-.00	-0.05		
	PBC^3			-1.80 (2.49)	[-6.68, 3.08]	-.09	-0.72		

Note. $\bar{r}^*$(Att, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between attitude and intention. $\bar{r}^*$(SN, Int) represents the weighted *r*-to-*Z* transformed correlation coefficient between norm and intention. PBC = log10 transformed PBC mean-centered linear trend; PBC^2 = log10 transformed PBC mean-centered linear trend squared; PBC^3 = log10 transformed PBC mean-centered linear trend cubed; *B* = unstandardized regression coefficient; *SE* = standard error of *B*; β = standardized regression coefficient; Q_{Model} = heterogeneity explained by regression model, *df* = 2; $Q_{Residual}$ = unexplained heterogeneity; R^2 = explained variance due to all three included independent variables.
* $p < .05$, ** $p < .01$, *** $p < .001$.

Sensitivity Analysis

Comparing results of fixed-effects and random-effects models. One strength of this meta-analysis is that both fixed- and random-effects models were applied to the data.[51] Because of this, a sensitivity analysis was able to be employed to examine the effects of the different assumptions on the results (Greenhouse & Iyengar, 2009). For example, finding that the moderation effect was significant under the fixed-effects model but not under the random-effects model suggests a limit on the generalizability of inferences about the moderating effect of PBC. Second, Cooper (1997) stated that, "In practice, most meta-analysts opt for the fixed-effects assumption because it is analytically easier to manage" (p. 179). Indeed, nine of the 16 previous TPB meta-analyses used fixed-effects model (see Appendix G). Therefore, the performance of the conditions with a fixed-effect model is important because it enables other researchers to compare the present results with previous TPB meta-analyses that used fixed- rather than random-effects models.

Table 20 provides a summary of the findings. Comparing the results from the fixed- and random-effects models revealed that the standard errors were larger and *z* values associated with the regression coefficients were smaller for the random-effects models (not shown in Table 20, but can be seen by comparing Tables 11-16 with the corresponding fixed-effects output in Appendix F). Similarly, confidence interval widths were smaller in the fixed-effects results as compared to the random-effects results. Thus, it is not surprising that more results were found to be significant under the fixed-effects

[51] In this dissertation, the random-effects model results were reported in the text and the fixed-effects results were reported in Appendix G.

model (see Table 20). The random-effects model is more conservative in protecting against Type I error than the fixed-effects model is. However, this also means that the random-effects model offers less protection against Type II error.

Table 20

Summary of Results

	Expected Direction of Relationship	Random-Effects Finding	Fixed-Effects Finding
Hypothesis 1			
Attitude-Intention	Positive β	Positive^	Negative*
Hypothesis 2			
Norm-intention	Positive β	Positive	Positive*
Hypothesis 3			
Attitude-intention:			
PBC x Unfamiliar	Negative β [a]	Positive*	Positive*
Norm-intention:			
PBC x Unfamiliar	Negative β [a]	Positive	Positive*
Hypothesis 4			
Attitude-intention:			
PBC x Private	Negative β [b]	Positive	Positive*
Norm-intention:			
PBC x Private	Negative β [b]	Positive	Positive*
Research Question 1 for attitude-intention association			
CTRL measures	Positive β	Positive*	Positive*
SE measures	Positive β	Positive*	Positive*
PC measures	Positive β	Positive†	Positive*
PD measures	Positive β	Positive	Positive
Research Question 1 for norm-intention association			
CTRL measures	Positive β	Positive	Positive*
SE measures	Positive β	Positive†	Positive
PC measures	Positive β	Positive	Positive
PD measures	Positive β	Positive	Positive

Note. The βs represent the standardized regression coefficients from the respective metaregression analyses.
[a] These βs are for the PBC x Unfamiliar interaction. Familiar = 0, unfamiliar = 1.
[b] These βs are for the PBC x Private interaction. Public = 0, private = 1
^ Approaching significance at $p = .09$, two-tailed.
† Approaching significance at $p = .06$, two-tailed.
* Significant at $p < .05$.

Notably, for Hypothesis 1 the fixed- and random-effects models not only differ in level of significance, but the direction of the coefficient: PBC was positive for the random-effects model and negative for fixed-effects model (see Table 20). This finding is most likely a result of a few studies with extremely large sample sizes (> 2,000) being given the lion's share of the weight in the analysis. Looking at Figure 15, it appears that a couple of studies dominated the analysis (as depicted by disproportionately large bubbles, which represent the weight assigned to a given study, based on sample size). There are two studies (one at the far left and far right of the figure) that have larger effects. As a result, the slope of the moderating effect of PBC is negative. Under the random-effects model, these weights are distributed more evenly: The impact of the two large studies is now less pronounced and, as a result, the slope is positive (see Figure 9).

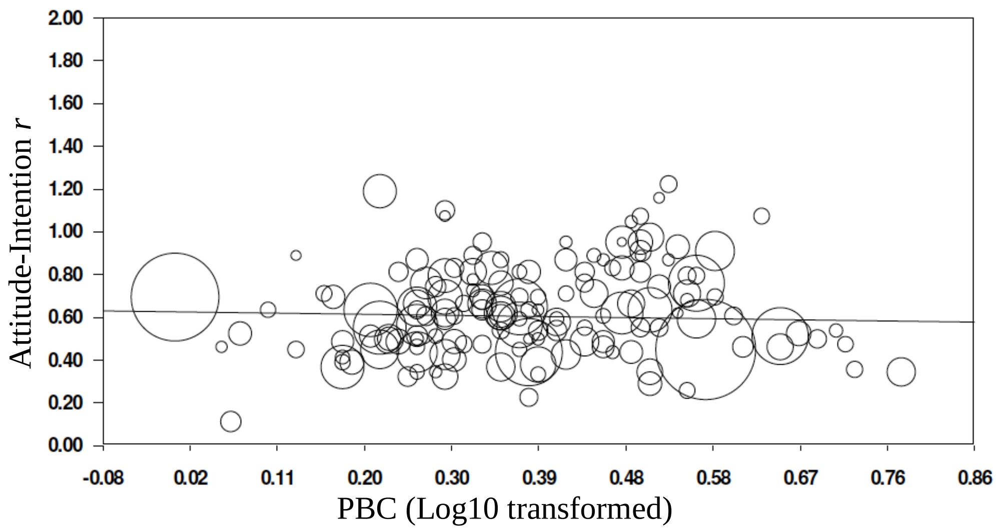

Figure 15. A scatterplot of the relationship between attitude and intention across levels of PBC. Each study (*k* is represented by a circle. The size of the circle is proportional to the study weight under the fixed-effects model assumptions, which is based on the sample size.

Publication bias. Finally, the tolerance of the present results for unpublished null results was estimated using the fail-safe *N* statistic (*FSN;* Rosenthal, 1984). Rosenthal's *FSN* addresses the possibility that studies are missing from the analysis and that these studies, if included in the analysis, would shift the effect size toward the null. Thus, Rosenthal's *FSN* provided an estimate of the number of unpublished studies comparable in size but containing null results that would be required to invalidate the conclusion that a given relationship is statistically significant. The recommended tolerance level used was 5*k* + 10 (Rosenthal, 1984), where *k* is the number of independent tests. Here, the tolerance level was 775. If the *FSN* is larger than the recommended tolerance, then the results are robust. A *FSN* was calculated for each of the three key relationships in the TPB (attitude to intention, PBC to intention, norm to intention) to indicate whether the relationship was robust (i.e., resistant to future null results).[52] For the attitude-intention effect size, the *FSN* was 490,573. This means that we would need to locate and include 490,573 null studies in order for the combined two-tailed *p*-value to exceed .05. Put another way, there would be need to be roughly 3,206 missing studies for every observed study for the effect to be nullified. For the norm-intention effect size, the *FSN* was 206,766. Finally, the *FSN* for the PBC-intention effect size was 405,266. These results suggest that the results are robust for the aforementioned effect sizes as it is quite unlikely that such a large number of unpublished studies with null effects exist.

As an additional step to rule out the possibility of publication bias, Orwin's (1983) *FSN* was calculated because it allows the mean correlation in the missing studies to be a value other than zero. Orwin's *FSN* is the theoretical number of unpublished or missing studies with effect sizes averaging zero (no effect) that would be necessary to reduce the medium effect sizes found in this meta-analysis to small effect sizes ($r = .10$, the value of "small" effect sizes according to Cohen, 1992). For the attitude to intention effect size, it was found that in order to reduce the medium effect sizes to small effect

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[52] It was not possible to calculate the FSN for the interaction, so the FSN for the direct effects between attitude, PBC and norm with intention was used to give the reader some sense of the robustness of the main effects.

sizes, 576 studies with nonsignificant results would have had to be included. For the norm to intention effect size, 429 studies with nonsignificant results would have had to be included. Finally, for the PBC to intention effect size, 682 studies would have to be included to reduce the effect size to $r = .10$. Thus, it seems improbable that the results of the present meta-analysis are the spurious result of sampling more published than unpublished studies. Thus, it is reasonable to conclude that publication bias did not adversely impact the results reported in this meta-analysis (cf. Scargle, 2000).

Chapter 6: Discussion

Despite the intuitive plausibility of perceived behavioral control interactions in the theory of planned behavior, there have been relatively few studies that have explored them, and some authors have argued that failures to find significant interactions might have been due to methodological problems. Rather than assume that limited empirical evidence for PBC interaction effects means that the conceptual logic behind the hypothesis is flawed or that the interaction isn't worth examining, the argument put forth in this study is that the role of PBC interactions has both theoretical and practical significance and has not been adequately investigated. The central premise of this study was that a meta-analytic approach would be useful to shed more light on the existence, magnitude, and boundary conditions of PBC interactions in the TPB.

Miller and Pollock (1994) divided meta-analyses into three categories based on their purpose and the type of information that they provide; these three categories contribute to theory in different ways. *Type A* meta-analyses aggregate study-level evidence with the main goal of establishing an empirical fact or association. *Type B* meta-analyses examine variables that moderate the strength of an overall effect. Importantly, the theoretical moderators examined are ones that have been invoked in prior, primary-level research. Finally, *Type C* meta-analyses (in addition to achieving *Type A* and *Type B* goals) test new theoretical hypotheses that have not been considered previously in primary-level studies. *Type A* analyses can be seen to make the smallest theoretical contribution, followed by *Type B* and then by *Type C* (Miller & Pollack, 1994). This study utilized all three types, thus making a strong theoretical contribution.

Both study-generated and synthesis-generated evidence was presented and tested for PBC interactions. For the study-generated evidence, a meta-analysis of studies that directly tested PBC interactions was conducted. This constituted a *direct approach* (i.e., Type B meta-analysis) to investigating the possible presence and magnitude of the interactions. Next, an *indirect approach* (i.e., Type C meta-analysis) was used to look for PBC interactions in the larger body of work on the TPB that did not examine PBC interactions in the original studies. Using the techniques of meta-analysis, the attitude–intention and norm–intention correlations were examined to see if they systematically varied as a function of the mean level of PBC. The use of synthesis-generated evidence made it possible to test relations that had not been examined by primary researchers (Cooper, 2009). These two approaches represent a convergent strategy to knowledge accrual.

Meta-Analytic Findings: Study-Generated Evidence

The results of the meta-analysis using a direct approach to examine PBC interactions served to highlight the direction and magnitude of PBC interactions. These studies were few in number and drew on samples that were heterogeneous in terms of persons, settings, behaviors, and times. Therefore, these studies, although limited, represented various conditions under which the PBC interactions are expected. Conducting a meta-analysis of PBC interactions necessitated a slightly altered approach to the traditional meta-analytic procedures. From information on a total of nine articles (providing 13 independent effect sizes), a statistically significant weighted semipartial correlation for the interaction of .09 was found. This finding suggests that there was a significant, albeit very small, attitude by PBC interaction. The results for the norm by PBC interaction tell a different story: In the six studies that examined norm by PBC interactions, the weighted semipartial correlation for the interaction did not reach significance. However, it is worth keeping in mind that far fewer studies allowed a test of the norm by PBC interaction than the attitude by PBC interaction (13 vs. 6).

Meta-Analytic Findings: Synthesis-Generated Evidence

The results of the meta-analysis of synthesis-generated evidence revealed the expected, positive direction of the PBC interactions. As PBC increased, the attitude–intention and norm–intention correlations increased. However, for the overall sample, although the results were in the expected direction, they were not statistically significant under the random-effects model. Assessment of possible nonlinearity of the PBC interaction yielded further supportive evidence for PBC interactions. The results of the auxiliary analysis suggested that, rather than a strictly linear-by-linear interaction, the interaction between PBC and attitude was both linear and nonlinear. Lower levels of PBC exert greater influence on the attitude-intention relation than higher levels of PBC (i.e., a diminishing returns effect). It appears that this was the case for the overall sample.

To the author's knowledge, this is the first study to explore *how* PBC affects the association between attitude (or norms) and intention. Of the previously cited studies that looked at PBC interactions, none explored nonlinear trends. Within the TPB there is a clear bias against nonlinear hypotheses; in fact, the TPB is formally stated as a linear model. This bias toward linear models is prevalent in communication and psychology. Although there is nothing wrong with linear hypotheses per se, tests of such hypotheses that neglect possible nonlinear trends can be misleading (Birnbaum, 1973; Busemeyer & Jones, 1983; Cohen, 1978; Cortina, 1993; Lubinski & Humphreys, 1990). Previous research on PBC interactions has assumed that the change is linear—as control goes up or down, the effect of attitude (or norms) on intention changes by a constant amount. In the present study, after statistically taking into account the potential for nonlinearity, there was support for a linear interaction effect. In addition to the statistically significant linear effect, there was statistically significant nonlinearity.

Although the meta-analysis provided evidence of a nonlinear interaction effect, how to explain the decreased association between attitude and intention at the highest levels of PBC still remains. Thus, specific levels of PBC and either attitude or norms may be multiplicatively related to intention in a nonlinear manner. Had the observed relationship been that the curve of the attitude–intention slope flattened out at higher levels of PBC, this would have been easier to explain. In this case, increments of PBC would add successively less to the magnitude of the attitude–intention relationship, finally reaching a ceiling where no further improvements would be able to be made. Instead, it was found that the attitude–intention association was lower at high levels of PBC than it was at moderate levels of PBC. Because this finding is counter to the theoretical thinking that has been presented, and because there is no explanation for this finding, caution needs to be exercised when interpreting these results.

Three-way interactions. As essential as is the task of exploring PBC interactions, it is also necessary to identify the conditions under which this relation is altered. Therefore, a second goal was to identify potential boundary conditions of the interaction. Specifically, this study examined whether PBC was associated with the magnitude of the attitude–intention and norm–intention correlations for different types of PBC measures or for different types of behaviors. This study uncovered new conditional relationships for attitude by PBC interactions that have heretofore been largely ignored in research. Attitude by PBC interactions were found for some PBC measures but not others, and for some behaviors but not others.

From these data, it appears there is mixed evidence regarding the moderators of the PBC interaction. The findings produced a pattern of results that was unexpected. That is, although the direction of the associations was always the same (i.e., as PBC increased, the magnitude of the dependent variables correlations increased), the subgroups analyses revealed some significant three-way interactions.

***Type of behavior*.** Hypotheses 3 and 4 explored the possibility that PBC interactions would be found for some behavioral contexts (public and familiar), but not others (private and unfamiliar). The underlying reasoning for both predictions was that familiar and public contexts provide the opportunity for people to form more accurate assessments of PBC. The more people feel confident in their assessments of PBC, the more likely it is that PBC will moderate other cognitions (like attitude and norm) that drive intention. However, whether a behavior was considered public or private did not moderate the PBC interactions.

There was, however, a statistically significant three-way interaction for familiarity. Counter to predictions, PBC did not moderate the attitude-intention effect size for familiar behaviors. Instead, a PBC interaction was found for unfamiliar behaviors. For unfamiliar behaviors, PBC accounted for 17% of the variance in the attitude-intention effect size, which was statistically significant. In sum, the attitude–intention correlation increased as PBC increased for unfamiliar behavior, but not for familiar behaviors.

One possible explanation for why the PBC interaction was found for unfamiliar behaviors and not familiar behaviors is that there may have been greater variance in PBC for the unfamiliar behaviors. If people were unsure of their capabilities, this could have resulted in a greater dispersion of scores within the samples (and therefore, more variance). As outlined in Chapter 2, interaction effects that involve variables with restricted ranges or reduced variances are difficult to observe because they often result in a loss of statistical power to detect such interactions (McClelland & Judd, 1993). Thus, if the variance of PBC were lower for familiar behaviors, the power to detect the moderating effect would also be reduced. To explore this further, the variances and range of PBC for unfamiliar and familiar behaviors was examined. Not only did PBC have less variance for unfamiliar behaviors, but the range for PBC was smaller in the unfamiliar group. For example, the minimum mean value of PBC was 3.76 for unfamiliar behaviors, and 1.53 for familiar behaviors. Therefore, this alternative explanation was rejected.

However, the restricted range found for the unfamiliar behaviors highlighted another possibility: What if the interaction effect was found in unfamiliar behaviors *because of* the restricted range? Upon initial consideration, this argument might seem counterintuitive given the previous discussion. At least one explanation helps to reconcile the present explanation with the previous discussion. Based on the minimum and maximum values of PBC for unfamiliar behaviors, it appears that unfamiliar behaviors only reflect upper levels of PBC. To the extent that attitude by PBC interactions are nonlinear, the interaction for unfamiliar behaviors only may have fit linearly because only part of the association was represented by those studies. For example, because the inverted *U* shape encompasses a positive linear model (the left side of the *U*) and a negative linear model (the right side of the *U*), the restricted range of PBC in unfamiliar behaviors may have focused on one subset of the relationship. Familiar behaviors, on the other hand, captured the full range of data. In this case, the linear test may have been not significant. However, to draw more certain conclusions about the above interpretation, future research is needed. Despite this peculiar finding, uncovering this conditional relationship is particularly interesting because, although PBC interactions have been found in the past, they have not been tested for boundary conditions.

Type of measure. Research question 1 explored whether there would be a moderating effect of PBC for different measures of PBC. Although different measures of PBC may differ in their contribution to intention (as evidenced by previous research: e.g., Armitage & Conner, 2001a), there was no theoretical basis for assuming that different operationalizations of PBC would affect whether or how PBC interacts with attitude (norms) in predicting intention. Interestingly, the interaction was found for some operationalizations, but not others. Specifically, a statistically significant positive PBC interaction was found for studies that used measures that contained some combination of self-efficacy, perceived difficulty, and perceived control items (CTRL) or measures that only had self-efficacy items (SE). These operationalizations were also found to affect the magnitude of the correlation between PBC and intention, with larger effect sizes found for CTRL and SE items than for PC items. These findings highlight why there may have been inconsistent results found in prior research with regard to the existence of PBC interactions. If observing PBC interaction effects is dependent upon the way PBC is measured, and a variety of different measures have been used in prior studies, then it is plausible that the inconsistent findings reflect these measurement differences.

One way that the type of measure could make a difference is that some measures are less sensitive to low PBC. The reported levels of PBC in the present study tended to cluster at the high end of the scale and exhibit limited variance. Yzer (2007) has noted that most people regard many of the behaviors that are examined in observational studies as performable with moderate to high levels of confidence; therefore, it is difficult to find studies that report samples with low PBC. Indeed, most of the behaviors in this meta-analysis seem to be regarded as performable with moderate to high levels of confidence. It is also interesting to note that the CTRL indices had the lowest minimum value for perceived behavioral control, whereas PC indices reported the highest minimum. As mentioned previously, Fishbein and Ajzen (2010) recommend using a combination of self-efficacy and perceived control items when measuring perceptions of control. In this meta-analysis, the majority of studies used items that measured PBC in this way (labeled CTRL). In addition to achieving greater content validity, the results of this study also suggest that being careful to measure the full range of PBC (i.e., some combination of SE, PD, and PC items) may produce a wider range of scores (i.e., greater variance) and, therefore, better reflects the actual population variance in PBC (which may be poorly estimated if items are used that only measure one aspect of the underlying construct).

Finding predominantly high levels of PBC across studies, samples, and contexts makes theoretical sense. People are driven by an innate need for control; they strongly value and are reluctant to relinquish perceptions of control (Skinner, 1995). According to Bandura (1997), people need and like to have personal control in their lives because not having control introduces unwanted uncertainty (i.e., being unsure whether one can perform a task) and anxiety. Further, people may be reluctant to admit that personal control over a situation is lacking (both to oneself and to others). As a result, people might be motivated to falsely attribute greater control over situations to themselves than they actually have, and report inflated perceptions of control (Carver, Scheier, & Weintraub, 1989).

None of the previous meta-analyses provided any information on issues related to the frequency distribution of any of the theory's variables. This level of descriptive information is often deemed less important than effect size estimates (usually correlation coefficients), but it can provide valuable information to researchers (Lipsey, 2009). First, it provides insight into the measures typically used. Second, it provides a basis for assessing problems related to ceiling or floor effects, something that has been mentioned in general discussion of TPB measures but which has never been systematically evaluated. Third, transforming PBC in the present study provides a clearer sense of the correct functional form relating the variables in the statistical model (Fink, 2009). In this way, the present study provided a richer understanding of the character and limitations of the primary research on which the meta-analysis is based.

Unexplored moderators. Even after taking into account the different moderators of the PBC interaction, there was still some heterogeneity. Therefore, there may be other moderating variables at play as well. Take, for example, age. Developmental theories tell us that children and young adolescents have relatively unstable attitudes, in part because they have not had a great deal of opportunities for experience with the attitudinal object. Drawing on such theories, one could explain why attitude-intention relationships tend to be weaker for adolescents than for adults. Another avenue of research might be to classify behaviors in a different way, perhaps by level of addiction, or presence of material costs or benefits. With respect to health behaviors, there are a number of different dimensions that could be used to classify behaviors (assuming some theoretical rationale for doing so). Some examples include frequent versus infrequent (Oullette & Wood, 1998); health promoting versus health risk (Conner & Norman, 2005); habits versus discrete behaviors (Borland, 2010); initiation versus maintenance (Van Stralen, De Vreis, Mudde, Bolman, & Lechner, 2009); and preventative versus detective (Rothman & Salovey, 1997). In sum, trying to find conditions and contexts in which the PBC interactions may be found can enrich the TPB and inform future research.

Meta-Analytic Findings: Size of the Interaction Effect

Combined, the results from the two meta-analyses in this study provide support for rethinking the role of PBC in the TPB. The results of the meta-analysis of studies that directly tested for interaction effects found support for PBC by attitude interactions: On average, the interaction explained an additional 1% of variance in intention. Similarly, the main meta-analysis that provided an indirect test of PBC interactions found a linear PBC by linear attitude interaction among studies that used a combination of self-efficacy, control, and difficulty items to measure PBC. These two interactions were similar in size—both explained between 1% and 3% additional variance in the dependent variable.

Because moderator effects are difficult to detect, Evans (1985) argued that even when an interaction explains as little as 1% of the total variance, it should still be considered important, especially when the theoretical implications are understood. In addition, it is often reported that moderator effects observed in social science studies are typically small in size, accounting for about 1%-3% of the variance in the dependent variable (Aguinis & Stone-Romero, 1997; Aiken & West, 1991; Champoux & Peters, 1987; Chaplin, 1991; Evans, 1985; McClelland & Judd, 1993). Putting this in the context of social science research in general, more recently, Richard, Bond, and Stokes-Zoota (2003) conducted a quantitative summary of 100 years of social psychological research. Richard et al. found that social psychology effects typically yield a value of R^2 of .04.

Notably, when the interaction effect was found in the tests of three-way interactions, the size of the effect was much larger. For unfamiliar behaviors, the size of the linear interaction effect was moderate in size ($R^2 = .17$; $f^2 = .20$), and when it was found for self-efficacy measures alone, the linear interaction effect was quite large in size ($R^2 = .31$; $f^2 = .45$).[53] Also, it is important to point out that these effects were found under the random-effects model which severely reduced the amount of power to detect an interaction (essentially making it so that the *N* for the statistical tests was *N* = 153 instead of *N* = 44,400). In sum, what these findings indicate is that although the size of the interaction varies from small to large, there is certainly evidence in support of the empirical validity of PBC by attitude interactions. This suggests that the role of PBC should be conceptualized differently (i.e., as a moderator variable of attitudes) in the theory.

Mediation versus Moderation

The possibility that PBC had another role in the TPB was examined by predicting a mediation model in which PBC was the direct antecedent of attitude and norm. Although some work by Bandura suggests that PBC might predict attitude, there is markedly less research that supports PBC as a predictor of norm. The results from the meta-analytic structural equation model indicated that PBC did not predict either attitude

[53] Cohen's f^2 (Cohen, 1988) is the effect size for between-subject designs, that is, the ratio of effect variance to the error variance within cells. According to Cohen (1988) effect sizes around f^2 =.02 are termed "small," around f^2 = .15 are termed "moderate," and f^2 = 0.35 are termed "large."

or norm. It is important to note that although the mediator and moderator approaches were examined separately and presented as independent strategies, it is certainly possible and desirable to examine them together. Indeed, both roles may be tenable. Ideally, this would be examined by manipulating PBC in an experiment and measuring the mediators (in this case, attitude and norm). Then a model that had both relationships could be examined. Unfortunately, given the data at hand, this type of model was not possible.

Strengths of the Study

Random-effects model. To benefit from the strengths of both models, both a fixed-effects model and a random-effects model were considered. However, in the final analyses, the random-effects model was used. This method provides more conservative estimates of population effect sizes, and therefore tends to "provide the most accurate estimates of the mean population effect size when effect sizes are heterogeneous" (Field, 2001, p. 179). There are two central reasons that the random-effects model was emphasized over the fixed-effect model. First, given that fixed-effects model assumes homogeneity *a priori*, the assumptions of the random-effects model seem more tenable. For example, it is harder to assume that true effect sizes are the same in all studies. Instead, it is more realistic to assume that effect sizes may vary across studies; this is especially true given that one assumption of the TPB is that the relative importance or weight of attitude and norms as predictors of intention may vary depending on the specific behavior under consideration, the characteristics of the population, and temporary contextual factors (Fishbein, 2000). In addition, it appeared that there was substantial variation among effect sizes (i.e., the assumptions underlying the fixed-effect model were not met).

Second, one goal of this dissertation is to make inferences that extend beyond the studies included in the meta-analysis. Random-effects models allow the researcher to add to a base of collective and generalizable knowledge and make inferences that extend beyond the studies included in the meta-analysis (Anker, Reinhart, & Feeley, 2010); however, generalizability is typically at the expense of statistical power (Hedges & Vevea, 1998). Power increases as the sample size (*N*) increases for a fixed-effects model, and it increases with the number of studies (*k*) for a random-effects model (Matt & Cook, 2009). Therefore, using the random-effects model resulted in a loss of power, but the advantages of the model outweighed the disadvantages.

Generalizability. This study tested for PBC interactions across a wide variety of studies. For example, the studies in the sample included a wide range of behaviors, populations, time frames, and measures. There were also strict inclusion criteria that were imposed. For one, the analysis included studies through 2007. However, that was not seen as a limitation to this study insofar as the theoretical relationship that was explored would not be expected to differ in the last five years. Additionally, according to the aforementioned assessment of potential publication bias, hundreds of studies would be needed to overturn the statistically significant findings of this study. In some ways, the inclusion criteria were quite broad, as they didn't restrict any study based on behavior or population. But in other ways, the inclusion criteria were narrow in that it ensured that only methodologically rigorous studies were included. In sum, the inclusion criteria combined with the random-effects model provides some confidence in the external validity of the study.

Preliminary test of linearity assumption. The hypotheses put forth in this study all assume that the basic relationships in the TPB are linear. For example, Hypothesis 1 assumes that, controlling for PBC, the relation between attitude and intention and norm and intention is linear. Because the linearity assumption was so central to this investigation, it would be important to look into that assumption if raw data were available. There were two options involved to evaluate this assumption: contacting other investigators to borrow their data or using my own data. Contacting other investigators to borrow their data for secondary analysis takes time and requires cooperation of the initial researchers. It is also fraught with challenges because each researcher has different coding schemes, different ways to document any initial analyses or transformations to the data, and, even worse, may have lost the information about the data or may simply refuse to cooperate. Fortunately, the author had access to raw data from previously conducted studies on the TPB. So, rather than assume linearity, it was possible to evaluate it as best one could with the data at hand. However, the results from this preliminary test should be interpreted with caution because the results are only from two data sets with small sample sizes and small variances. Although this approach had some limitations, it was an important way to set the stage for the hypothesis tests. In line with the assumptions, there was no evidence of any nonlinear main effects. Additionally, there was no evidence for any interactions or nonlinear interactions, which served to highlight both the difficulty in detecting moderating effects and the inconsistencies that can result in a body of literature.

Limitations

In the process of discussing the results of the analysis, a number of limitations have already been mentioned. Nonetheless, there are some general limitations that should be noted. Because I did not have access to raw data, or all the necessary statistics from prior studies, there were certain constraints that had to be worked around. The vast majority of the studies gathered for this meta-analysis did not aim to examine interaction effects; however, evidence to support or refute PBC interactions can nonetheless be derived from the results reported by these studies.

Univariate versus multivariate approach. This study used univariate averaging approaches; however, one drawback to the univariate pooling (or averaging) approach is that it ignores the dependence among the effect sizes. An alternative method would be to take a multivariate approach to combine the correlations matrices from each study. The multivariate approach takes into account within-study covariation and requires the researcher to incorporate information about the degree of covariation between correlations by combining the correlation matrices provided by each study simultaneously. Although there are strengths in the multivariate pooling approach, most statistical software is not capable of calculating the pooled correlation and covariance matrix using a multivariate approach.

To examine the added benefit of a multivariate approach, Furlow (2003) conducted a dissertation that compared multivariate weighting procedures with univariate weighting (both with and without Fisher's *r*–to-*Z* transformation) with simulated data. Furlow found that the multivariate procedures performed similarly to the univariate weighting method in averaging correlations and estimating the paths of a structural equation model, and she noted that previous research comparing these methods has found similar results (Becker & Fahrbach, 1994; Cheung, 2000; as cited by Furlow, 2003).

In Furlow's dissertation, differences emerged in the estimates of the standard errors and in the rejection rates for the chi-squared test of model fit. Specifically, the multivariate approach produced more accurate estimates of the standard errors. However, Furlow cautioned that even though the multivariate procedure outperformed the univariate weighting method, “it is still somewhat questionable whether the complexity involved in implementing this procedure outweighs its slightly superior performance” (2003, p. 117). Nonetheless, this analysis was explored, but it was not presented because it didn’t substantively affect the results that have been reported here.

High inference coding. The meta-analysis that coded the mean PBC, type of PBC operationalization, and type of behaviors for all studies used synthesis-generated evidence that required the use of low and high inference codes (Cooper, 2009). Low inference codes are data that are based on information that is directly reported in the study. Coding the reported mean level of PBC in each study is considered a low inference code. In contrast, high inference codes involve the coder evaluating or rating the study along some dimension(s). The coding of behaviors as public, private, familiar, or unfamiliar represents high inference codes. High inference codes introduce potential bias if the judgments are made inconsistently between or within the coders making the judgments (Cooper, 2009). Unreliable coding would have added additional error to the analysis, which would reduce power and weaken the stability of the results (Cooper, 2009). Therefore, careful attention was paid to the reliability of the behavior coding procedure. A number of steps were put in place to try to reduce any inconsistencies. This study employed two independent coders, consulted with experts in the topic area, created a clear code book, and assessed interrater reliability (which was considered excellent using Cohen’s, 1960, standards). Cooper noted, “Even though synthesis-generated evidence is equivocal, it is a major benefit of research synthesis and a source of potential hypotheses (and motivation) for future primary research" (2009, p. 33).

Future Directions

The arguments set forth in this study provide a compelling explanation for assuming that PBC should have a moderating effect. Although the present dissertation has answered many questions, there are a number of avenues for future research. First, because previous studies have found evidence for PBC by norm interactions, but the present study did not, more research is needed to determine when PBC might substantially affects the magnitude of the association norms and intention. The development of a theoretical account capable of explaining why PBC might interact with attitude but not norm would mitigate the need to empirically determine if PBC interactions are present for both variables, thus improving the efficiency of the model. As it stands, these data suggest that when testing for PBC interactions, attitude by PBC interactions are more likely to be found than norm by attitude interactions. It also underscores the need for future studies to empirically evaluate these relationships (along with potential boundary conditions of the moderator hypothesis) and suggests fruitful avenues for future research.

Call for experimental research. One key benefit of using a meta-analytic approach is that it provides more power than a single research study. In essence, it provides greater precision, objectivity, and replicability in the assessment of relationships than a single study can. Given that this meta-analysis drew on data from correlational studies, there is a need for a greater number of experimental studies designed specifically to test for PBC interactions. Evidence coming from experimental manipulation within a single study can provide support for inferences about causality (Cooper, 2009). For example, PBC and familiarity of behavior could be manipulated in an experimental design. This type of replication at the primary level would provide strong corroborating evidence if a three-way interaction were found.

After more experimental studies are conducted, meta-analysis of these experimental data would better establish the direction and magnitude of PBC interactions. As Hovland (1959) suggests, in experimental studies the researcher is typically interested in studying a precise set of factors that are expected, on the basis of theory, to have an effect on an outcome of interest. Compared to correlational methodologies (which are primarily utilized in TPB studies), experimental methods are better equipped to examine causal relationships. Other benefits of experiments have been discussed in Chapter 2. Although nonexperimental surveys, or correlational research, may capture a phenomenon in a more naturalistic situation, the controlled environment and manipulation of the factors of interest should result in an increased likelihood of observing the hypothesized effect in an experiment as compared with a survey study (Hovland, 1959). This is something that could be examined in experimental studies on this topic.

Practical Contribution

By explicating what motivates people to behave the way they do, the TPB helps facilitate a comprehensive understanding of the causes of any behavior. The theory also provides a framework to identify pathways and potential barriers to change. Effective interventions to address social problems cannot be designed without a thorough understanding of the factors that determine human behavior. The results of this meta-analysis provide some insights into the TPB and have practical and theoretical importance.

First, the results of meta-analyses are often used as a rationale when developing interventions. For example, if a meta-analysis reveals that the effect of some variable on behavior is negligible, it may be decided that spending valuable resources to target that variable in order to change the behavior would be inefficient. In the case of the present research, knowing the size of the interaction effect (as well as its limiting conditions) helps to clarify whether developing and implementing different interventions based on level of PBC is advantageous.

With reference to the variables of interest in this study (attitude, PBC, norms, and intention), a campaign based on a predictive model that ignores possible PBC interactions may be less effective at influencing intention. If interactions exist but are not factored into campaign decisions, the resulting campaign may inadvertently target a set of variables on the basis of poor or incomplete evidence relating those variables to campaign goals. For example, a campaign that relies on an additive, "main effect" form of the TPB may attempt to change attitudes or subjective norms on the basis of evidence showing that those variables are significantly and positively associated with intentions and behavior. Because the model used to generate that evidence does not take possible interactions into account, the campaign developer implicitly assumes that changes in attitudes or subjective norms will affect intentions in a similar way for all members of the target population.

Suppose, though, that PBC moderates the association between attitudes and intentions, such that attitude is only positively associated with intention at moderate and high levels of PBC, whereas at low levels of PBC there is no association between attitude and intention. In such a case, basing campaign decisions on evidence from a predictive model that ignores this interaction would lead the campaign to overestimate its impact among audience members with low PBC and to underestimate its impact among those with moderate to high PBC. In other words, by ignoring the interaction, the campaign would have adopted a strategy that would likely be less effective than it might have been for a subset of the target population. This situation is especially problematic if PBC were not found to be significantly associated with intentions in the model, making it unlikely that the interventionists would have tried to elevate levels of PBC as part of their strategy. Specifically, when PBC regarding the focal behavior is low, striving to alter attitudes alone as a means of promoting behavior change will have a limited impact. Given an awareness of an interaction, a different and more effective strategy might have been adopted. Such an approach would aim both to bolster PBC and to change the relevant attitude. Health communicators strive to know which combination of variables result in a desired behavior and acquiring that knowledge is at least partly dependent on well-specified theory.

Conclusion

This study was able to shed some light on the existence and boundary conditions of PBC interactions in the TPB literature. What's more, testing for these interactions using a meta-analytical framework provides stronger evidence for the empirical validity of the proposed interactions. The results supported the existence of an attitude by PBC interaction, but some strong caveats exist. First, the effect size of the PBC interaction ranged from small to moderate; because it is not yet clear when a moderate effect size would be expected, researchers should conduct *a priori* power analyses to determine the sample size needed to detect potentially small effect sizes with adequate statistical power.

Thus, even if the true interaction effect is small, there will still be ample power to detect it. Second, moderators exist that influence the interaction. Finding an interaction depends, in part, on the behavior examined as well as the measurement. Third, the shape of the attitude by PBC interaction was both linear and nonlinear. When researchers fail to look for the possibility of nonlinear interaction effects, they may fail to find the interaction. In sum, the complexity of the PBC interaction seems to provide an empirical basis that helps explain the inconsistent or nonsignificant tests of PBC interactions.

This study sought to provide a compelling argument for rethinking the role of perceived behavioral control in the theory of planned behavior. It is unlike any previous meta-analysis on the theory of planned behavior, it provides a novel statistical approach to test a conceptually strong idea, and it is focuses on a theoretical question of great importance. Despite being one of the most frequently cited theories of health behavior, few studies have examined in detail the relationship between the theory's central constructs (attitude, subjective norms, and perceived behavioral control). Therefore, the results of this study should encourage future studies to evaluate the relationships among the theory of planned behavior predictors rather than to always assume that the predictors have a simple additive relationship. In doing so, this study highlights new avenues and methods for meta-analytic research in theory testing.

Appendix A

Typical TPB Measures

Typical TPB Measures as Outlined in Fishbein and Ajzen, 2010
Behavioral Intention Measures
How likely is it that you will get tested for STDs in the next 12 months? unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely I intend to get tested for STDs in the next 12 months. unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely I plan to get tested for STDs in the next 12 months unlikely : 1 : 2 : 3 : 4 : 5 : 6 : 7 : likely
Attitude Measures
My getting tested for STDs in the next 12 months would be: bad : 1 : 2 : 3 : 4 : 5 : 6 : 7 : good foolish : 1 : 2 : 3 : 4 : 5 : 6 : 7 : wise unpleasant : 1 : 2 : 3 : 4 : 5 : 6 : 7 : pleasant harmful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : beneficial stressful : 1 : 2 : 3 : 4 : 5 : 6 : 7 : relaxing
Subjective Norm
Most people who are important to me think that I should get tested for STDs in the next 12 months. disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree Most people whose opinions I value would approve of my getting tested for STDs in the next 12 months. disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree Most people whom I respect would support my getting tested for STDs in the next 12 months: disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree
Perceived Behavioral Control Measures
I am confident that if I wanted to I could get tested for STDs in the next 12 months: false : 1 : 2 : 3 : 4 : 5 : 6 : 7 : true Suppose you wanted to get tested for STDs in the next 12 months. How sure are you that you could? sure I could not : 1 : 2 : 3 : 4 : 5 : 6 : 7 : sure I could My getting tested for STDs in the next 12 months is completely up to me. disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree My getting tested for STDs in the next 12 months is completely under my control. disagree : 1 : 2 : 3 : 4 : 5 : 6 : 7 : agree For me to get tested for STDs in the next 12 months is: difficult : 1 : 2 : 3 : 4 : 5 : 6 : 7 : easy

Appendix B

TRA/TPB Meta-Analysis: Coding Protocol

Commonly used abbreviations:

- B: Behavior
- BI: Behavioral intention
- SE: Self-efficacy
- PC: Perceived control
- PD: Perceived difficulty
- CTRL: Control variable
- ATT: Attitude
- SN: Subjective norm
- E: Evaluative attitude
- A: Affective attitude
- C: Cognitive attitude
- r: Correlation
- *n:* Sample size
- SD: Standard deviation
- *M:* Mean

Begin coding:

Step 1: Bibliographic information

Open pdf article and check that the author, year, title, journal, volume, and page numbers are correct.

Note: Sometimes you will need to use additional rows for the same paper, because, for example, the paper presents more than one study. Any time you create additional rows you do not need to re-enter the bibliography information. Under "Author" simply type "addt'l".

Step 2: Type of behavior

- Scan paper for the type of behavior being measured. Enter the type of behavior under the "Type of behavior" column.
- Many times you can find the behavior in the title or abstract.
- Most often, however, you will find the behavioral definition in the Method section. Particularly the part where the instrument (aka questionnaire, measures) is described. The example questions likely have the description of the behavior that study participants saw.

Step 3: Country of data collection

- Under "Country of data collection" enter the country where the data was collected—which may or may not be the country that the authors are from.

Step 4: Population

- Under "Population" enter a description of the population. Include all relevant descriptors.
- For example, if the article says that Scottish students aged 13-14 in non-denominational state schools in Tayside and Lothian regions were sampled, you would enter "Scottish students aged 13-14 in non-denominational state schools in Tayside and Lothian regions".
- We will subsidize these into smaller categories later, so it is best that you include all relevant information so we know how we should later group them. You will probably enter "college undergraduates" most often.

Step 5: <u>Mean Age</u>

- Under "mean age" give the mean age for the sample. For instance you might enter "23.45".

Step 6: <u>Age Range</u>

- Under "age range" give the range of ages for the sample. For instance you might enter "18-40".

Step 7: <u>Sample Size</u>

- Under "sample size" enter the sample size (denotes by *n or N*).
- When you make a new row for additional behaviors, control/experiments, multiple study papers, and time point studies make sure that the *n* is for the specific condition and not for the overall sample.
- For instance if a study has 500 subjects with 300 in the exercise behavior condition and 200 in the TV condition, you would enter 300 in the "sample size" column for the row that refers to the exercise condition and 200 in the "sample size" column for the TV condition—you don't have to enter 500.

Step 8: <u>Study Design</u>

- Under "study design" enter an "N" if the paper used a nonexperimental design.
- Enter an "E" if an experiment is used. An experiment (or a trial, or an intervention) is a study that gave some people a ‘treatment’ (e.g., persuasive messages, some type of counseling) and compared these people with other people who did not receive that treatment.

Step 9: <u>Study Number</u>

- The study number column refers to when a paper has multiple studies.
- If a paper has multiple studies where different samples of people are used and different results are scored, each study needs its own row.
- Create a new row for each study and in the "study number" column enter which study number the enter information applies to (i.e. enter 3 if you are entering the information that was gathered during Study 3).

Step 10: <u>Condition</u>

The "condition" column will be used if:

- The paper is an experiment if it has different conditions, such as a "control" and "treatment". The study will not necessarily label the conditions "control" or "treatment" so enter whatever labels the authors use or some other descriptive label.
- The paper uses a survey but asks different groups different things, or samples different people. For instance in the paper in Appendix A, the authors are studying the behavior of "adhering to malaria prophylaxis regimens on return from a malarious region" but then they split up their subjects into two groups: those who took mefloquine and those who took chloroquine. In this case you would create an additional row so that mefloquine is on its own row and chloroquine has its own row. Under "condition" on the mefloquine row you would enter "mefloquine"; under "condition" on the chloroquine row you would enter "chloroquine".

Step 11: <u>Time Point</u>

- If a study collected data at more than one occasion, we need to have information from all of these time points.
- If a study has multiple time points, create separate rows for each of these time points. Enter the time point number to indicate which time point the row refers to.

Step 12: <u>BI or B</u>

- BI stands for "behavioral intent".
- Enter BI if the study measures someone's intention to do a behavior.
- Enter B if the study measures whether someone actually performs the behavior. Enter BI, B if the study measures both the intention and the actual behavior.

Step 13: <u>1 CTRL; 2 CTRL; 3 CTRL</u>

- The CTRL columns refer to how 'control' (SE, PC, or PD) is measured.
- There will be studies that use a mix of PD, PC, and/or SE items.
- If you can identify the items as, for example, PD and PC, then you would enter 'PD, PC' under the 1 CTRL column if the items are combined into one overall measure of control.
- If multiple items are used to measure control but the authors measure control by looking at, for example, SE separately from PC you would use the 1 CTRL and 2 CTRL column to indicate what type of control questions were used. Under 1 CTRL you could enter SE and under 2 CTRL you could enter PC.
- In contrast, if the study only used one overall measure, but looked at both PC and SE, under 1 CTRL you would type PC, SE.
- **PD** = Assesses *difficulty*
    - Example: "How difficult or easy would it be for you to ______?" (very difficult→very easy)
- **SE** = Measures *perceived capabilities* by assessing *confidence.*
    - Examples:

"There can be a variety of obstacles to your _______. Even in the face of such obstacles how sure are you that if you really wanted to you can _______?" (Completely sure I cannot→ Completely sure I can).
"How confident are you that you could __________if you really wanted to?" (Not at all confident→ Very confident).
"How sure are you that you could __________if you really wanted to?"

- **PC** = Assesses perceived *control.*
  - Examples:
    "To what extent is ______ up to you?"
    "To what extent is ______ not up to you?"
    "To what extent is ______ completely under your control?"
    "To what extent is ______ completely not under your control?"
- **NOTE:** If the paper says that 3 items measured control but then only gave 2 examples enter a question mark '?'. For instance, "To what extent is ______ up to you?" and "How confident are you that you could _____ if you really wanted to?" you would enter 'PC, SE, ?' under the 1 CTRL column.
- **NOTE:** If the paper does not provide any example questions but refers to measures used and recommended by someone else, for example, "we used Ajzen's (1975) attitude measures" put the paper aside for Marco, Yoori and Vanessa to review it. Highlight the article in the excel file to denote that it needs to be reviewed.

Step 14: <u>Attitude</u>

- The 'Attitude' column is where you will enter what type of attitude was measured depending on the sample questions provided in the paper.
- In the section commonly labeled as 'Measures', find out what items (either evaluative, affective, or cognitive) were used to measure attitude and then enter either E, A, or C, depending on what items were used. See Appendix B for an example.
- **E** = Evaluative attitude = this is the most general, overall evaluation.
  - Examples: good—bad, positive—negative
- **A** = Affective attitude = indicates the affective part of an attitude.
  - Examples: pleasant—unpleasant, stressful—relaxing, enjoyable—unenjoyable, boring—fun, boring—interesting, dull—stimulating
- **C** = Cognitive attitude = indicates the non-affective part of an attitude, i.e., how much sense performing a certain behavior is.
  - Examples: foolish—wise, harmful—beneficial, useful—useless, valuable—worthless
- If the analysis looks at instrumental (cognitive) and affective measures separately, as many do, code it the same way you coded for additional control measures. You will have to keep track of which measure you put for 1Att or 2Att (for instance if you put C,E (instrumental) under 1Att, you will need to make sure that when you give the means, sd, etc that you are typing

in the information for the instrumental att). It is best to always use the same method (i.e. always code instrumental as 1Att and affective as 2Att). [I am using the term instrumental because the measures include both cognitive and evaluative measures]

Step 15: Mean B

- If behavior is measured, enter the mean of B.
- If behavior is NOT measured, leave this cell blank.
- The behavior might not be labeled as "behavior"; instead it might be labeled as the type of behavior that is being studied.

Step 16: SD B

- Only use this cell if behavior was measured.
- This is the standard deviation.
- See Appendix C for example.

Step 17: Time lag w/ BI

- Enter the amount of time after measuring BI that B was measured.
- See Appendix D for an example of when the information about behavior's time lag is in the 'Procedure' section of the paper.

Step 18: Scale

- In the "scale" column indicates the range of responses available.
- For example, you would enter 1-7 if there was a range of 7 responses.
- Other examples might include: 1-4, or -3-+ 3.
- The information about the range of the scale might be found either by the descriptions of the items used to measure the variable, or it might be included in the table reporting the means and standard deviations.

Step 19: Direction

- Enter "R" in this column if the scale measuring the variable is in reverse order.
- For instance: If 1 = Very strongly **agree** then the item is reverse coded.
- If the item is **not** reverse coded, leave the cell blank.

Step 20: Mean BI

- Enter the mean for BI. If BI was not measured, leave it blank.

Step 21: SD BI

- Enter the SD for BI. If BI was not measured, leave it blank.

Step 22: Scale

- See step 18.

Step 23: Direction

- See step 19.

Step 24: Mean Att

- Enter the mean for attitude. This cannot be left blank.

Step 25: SD Att

- Enter the SD for attitude. This cannot be left blank.

Step 26: Scale

- See step 18.

Step 27: Direction

- See step 19.

Step 28: Mean SN

- Enter the mean for subjective norm. This cannot be left blank.

Step 29: SD SN

- Enter the SD for subjective norm. This cannot be left blank.

Step 30: Mean CTRL

- Enter the mean for the control variable.

Step 31: SD CTRL

- Enter the SD for the control variable.

Step 32: Scale

- See step 18.

Step 33: Direction

- See step 19.

Step 34: Mean PD

- Enter the mean for PD.

Step 35: SD PD

- Enter the SD for PD.

Step 36: Scale

- See step 18.

Step 37: Direction

- See step 19

Step 38: Mean PD

- Enter the mean for PC.

Step 39: SD PC

- Enter the SD for PC.

Step 40: Scale

- See step 18.

Step 41: Direction

- See step 19.

Step 42: Mean PD

- Enter the mean for SE.

Step 43: SD SE

- Enter the SD for SE.

Step 44: Scale

- See step 18.

Step 45: Direction

- See step 19.

Step 47: r X, Y: Correlation matrix

- Using the correlation matrix in the article, enter the r for each pair of variables.
- Use CTRL if the overall measure of control includes more than one type of control measure. For instance, if control was measured using items that assessed PD and SE, report the CTRL correlations. However, if only perceived difficulty items were used report the PD correlations and leave the CTRL, SE, and PC correlations blank.
- **NOTE:** The author may refer to a variable as, for example, self-efficacy yet use items that assess perceived difficulty. In this case you would still report the "self-efficacy" correlations under the 'r X, PD' columns because, in actuality, it was perceived difficulty that was being measured rather than self-efficacy.

Appendix C

Coded Characteristics of Studies Included in Meta-Analysis

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Abraham et al. (1999) Study 1	106	adhere to Mefloquine prophylaxis regimes on return from a malarious region.	Gambia tourists	Unfamiliar	Private	CTRL	6.20
Study 2	61	adhere to Chloroquine prophylaxis regimes on return from a malarious region.	Gambia tourists	Unfamiliar	Private	CTRL	5.63
Alexandris et al. (2007)	119	engage in physical activity programs provided by the Centers for Rehab and Protection for the Older Individuals in Northern Greece (KAPI) center over the next month.	Middle-aged and old participants at KAPI	Familiar	Public	CTRL	5.20
Armitage (2005)	94	take part in regular physical activity.	Members of a private gym in the south of England	Familiar	Public	CTRL	6.02
Armitage & Conner (1999)	221	eat a low-fat diet over the next month.	Undergraduate students	Familiar	Public	SE	4.53
Armitage & Conner (2001)	172	donate blood in the future.	Prospective undergraduate students	Familiar	Private	PBC	5.59
Armitage et al. (2002) Study 1	124	use a condom every time I have sex.	undergraduates in the UK	Familiar	Private	SE	5.73
Study 2	201	attend a health check if offered the opportunity.	Patients who were serviced by a rural general practice in Norfolk, England	Familiar	Private	CTRL	5.85
Arnold et al. (2006)	978	work for the NHS as a nurse, physiotherapist or radiographer.	Callers to the NHS career helpline	Familiar	Public	SE	5.88
Astrom (2004)	372	take sugared snacks and drinks on a daily basis in the future.	Adolescents attending Public secondary schools in Uganda	Familiar	Public	CTRL	3.44

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Astrom & Mwangosi (2000) Study1	195	give dietary advice as part of primary school oral health education in the future.	Primary-school teacher-trainees in the district of Rungwe, Western Tanzania.	Unfamiliar	Public	CTRL	1.97
Study 2	232	give dietary advice as part of primary school oral health education in the future.	Primary-school teachers in the district of Rungwe, Western Tanzania.	Familiar	Public	CTRL	2.43
Astrom & Rise (2001)	735	eat healthy foods regularly in the future.	Random sample of residents around the age of 25 in Norway	Familiar	Public	CTRL	5.20
Bebetsos et al. (2002)	96	eat healthy next month.	University students in Greece who participated in physical activity at least 3 times a week for a minimum of 45 minutes	Familiar	Public	CTRL	5.70
Bish et al. (2000)	142	attend for a smear test in the next three months.	Women in London	Familiar	Private	CTRL	5.80
Blanchard, Courneya, Rodgers, Daub et al. (2002)	81	attend my scheduled exercise classes during my rehabilitation at the Glenrose rehabilition program.	Patients entering the Glenrose rehabilitation program	Unfamiliar	Public	CTRL	6.05
Blanchard, Courneya, Rodgers, & Murnaghan (2002) Study 1	83	exercise regularly.	Survivors of breast cancer	Familiar	Public	CTRL	5.18
Study 2	46	exercise regularly.	Survivors of prostate cancer	Familiar	Public	CTRL	5.17
Blanchard, Courneya et al. (2003)	215	adhere to exercise during phase II of cardiac rehabilitation.	Patients entering the Glenrose rehabilitation program	Unfamiliar	Public	CTRL	5.99
Blanchard, Rhodes et al. (2003) Study 1	90	accumulate 30 min of exercise at least 5 days per week over 3 months.	Undergraduate students in the USA	Familiar	Public	CTRL	5.11

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Study 2	94	accumulate 30 min of exercise at least 5 days per week over 3 months.	Undergraduate students in the USA	Familiar	Public	CTRL	4.91
Blue & Marrero (2006)	106	eat a healthful diet each day in the next 2 months.	People at risk for developing type 2 diabetes	Familiar	Public	CTRL	5.14
Bogers et al. (2004)	159	eat at least two pieces of fruit or vegetables a day.	Dutch mothers	Familiar	Public	CTRL	5.65
Bosnjak et al. (2005)	400	participate in the series of Web surveys.	Undergraduate business students in USA	Familiar	Private	CTRL	5.34
Bozionelos & Bennett (1999)	114	participate in regular exercise in the next 3 weeks.	Students at the University of Bristol	Familiar	Public	CTRL	5.52
Braithwaite et al. (2002)	168	participate in genetic testing for colon cancer.	Patients registered with participating physician in the UK	Unfamiliar	Private	PD	3.37
Brickell et al. (2006)	162	participate in moderate to vigorous exercise and sport for at least 30 minutes, 5 days per week during leisure time, over the next 5 weeks.	Canadian college students	Familiar	Public	CTRL	5.42
Broadhead-Fearn & White (2006)	70	obey the rules of the youth shelter as set out in its rule book for the duration of my stay. [2]	Youths staying at a homeless shelters in a large Australian city	Unfamiliar	Public	PBC	5.44
Brug et al. (2006)	627	eat at least two servings of fruit per day.	Random sample of adults from the Netherlands	Familiar	Public	PD	4.53
Byrne & Arias (2004)	48	leave my partner and to end the relationship within the next year.	Women in a shelter for battered women	Unfamiliar	Private	PD	5.59
Burak & Vian (2007)	222	give an under-the-table payment the next time I go to a government health facility.	Residents of Tirana, Albania, where the majority (76%) have given under-the-table payments in the past	Familiar	Private	CTRL	2.92

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Caperchione & Mummery (2007)	74	be physically active for 30 minutes on most days, if not all days of the week, for the next 3 months.	People that lived in Central Queensland Australia	Familiar	Public	CTRL	5.53
Chatzisarantis & Hagger (2005)	83	do active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week, during my leisure time, over the next 5 weeks.	Middle school students in UK	Familiar	Public	PBC	5.20
Chatzisarantis & Hagger (2007) Study 1	226	engage in active sports and/or vigorous physical activities for at least 40 min, 4 days per week, throughout the following 5 weeks, during my leisure time.	University students in the UK	Familiar	Public	CTRL	5.82
Study 2	292	drink five or more standard alcoholic beverages in a single session throughout the next 5 weeks.	University students in the UK	Familiar	Public	CTRL	5.32
Chatzisarantis et al. (2004) Study 1	222	do active sports and/or vigorous physical activities, for at least 30 minutes, three days per week, over the next five weeks, during my leisure time.	Secondary school kids in the UK	Familiar	Public	CTRL	5.39
Study 2	200	do active sports and/or vigorous physical activities, for at least 30 minutes, three days per week, over the next five weeks, during my leisure time.	Secondary school kids in the UK	Familiar	Public	CTRL	4.23
Study 3	93	do active sports and/or vigorous physical activities, for at least 30 minutes, three days per week, over the next five weeks, during my leisure time.	University students in the UK	Familiar	Public	CTRL	4.80
Christian & Abrams (2003)	126	use an outreach reach program this month.	Homeless people in London	Familiar	Public	CTRL	5.13
Christian & Armitage (2002)	104	use an outreach reach program this month.	Homeless people in South Wales	Familiar	Public	CTRL	2.20
Christian & Abrams (2004) Study 1	100	use a homeless outreach program.	Homeless people in London	Familiar	Public	CTRL	3.28

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Study 2	103	use of a homeless outreach program.	Homeless people in NY	Familiar	Public	CTRL	3.73
Conner & Abraham (2001) Study 1	181	look after my health in the next 2 weeks.	University students at two UK universities	Familiar	Public	CTRL	4.69
Study 2	123	engage in vigorous exercise twice per week in the next 2 weeks.	University students at two UK universities	Familiar	Public	CTRL	3.55
Study 3	123	look after my health in the next 2 weeks.	University students at two UK universities	Familiar	Public	CTRL	4.25
Conner et al. (2002)	144	eat a healthy diet in the future.	Patients attending health promotion clinics at their physicians general practice	Familiar	Public	CTRL	5.11
Conner et al. (2006) Study 1	347	initiate smoking.	Non-smoking adolescents	Unfamiliar	Public	CTRL	6.42
Study 2	675	initiate smoking.	Non-smoking adolescents	Unfamiliar	Public	CTRL	6.43
Conner et al. (2000) Study 1	201	attend a health check if offered the opportunity.	Patients from a single general practice in the UK	Familiar	Private	CTRL	6.08
Study 2	407	eat a low-fat diet in the future.	Hospital workers in the UK	Familiar	Public	CTRL	5.60
Courneya et al. (2001)	24	attend aqua-training exercise class.	Breast cancer survivors who were members of a boat racing team	Familiar	Public	CTRL	5.39
Courneya et al. (2005)	399	exercise regularly.	Non-Hodgkin's lymphoma survivors`	Familiar	Public	CTRL	5.30
Courneya & Bobick (2000)	427	participate in physical exercise at least 3 times per week every week.	Undergraduate psych students from Canada	Familiar	Public	CTRL	5.62
Courneya, Bobick et al. (1999) Study 1	300	participate in physical exercise at least 3 times per week every week.	Female undergraduates at Canadian university	Familiar	Public	CTRL	5.42

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Study 2	67	participate in physical exercise at least 3 times per week every week.	Female undergraduates enrolled in five different university aerobic exercise classes	Familiar	Public	CTRL	5.71
Courneya & Friedenreich (1999)	194	exercise during cancer treatment.	Female breast cancer survivors under 70	Familiar	Public	CTRL	4.45
Courneya, Friedenreich et al. (1999)	66	exercise regularly over the next 4 months.	Postsurgical colorectal cancer patients	Familiar	Public	CTRL	5.07
Courneya, Keats et al. (2000)	37	exercise every day during stay in the bone marrow transplant unit.	Cancer patients receiving high dose chemo	Familiar	Public	CTRL	4.54
Courneya, Plotnikoff et al. (2000)	1557	get regular vigorous physical activity over the next 6 months.	Population based community sample (Ottawa-Carleton region)	Familiar	Public	PBC	5.13
Davis et al. (2002)	166	complete the present school year.	African American urban high school students	Familiar	Public	CTRL	5.71
De Bruijn, Kremers, De Vet, De Nooijer, et al. (2007)	521	eat two pieces of fruit per day in the next four weeks.	Random sample of Dutch Internet panel	Familiar	Public	PD	3.96
De Bruijn, Kremers, De Vries, Van Mechelen, et al. (2007)	208	consume a limited amount of soft drink in the next six months.	Patients aged 12-18 of family practice centers in the Netherlands	Familiar	Public	CTRL	5.55
Dodgson et al. (2003)	209	breastfeeding for 3 or more months.	First-time breast feeding mothers in Hong Kong	Unfamiliar	Private	CTRL	4.31
Downs (2006)	63	exercise regularly during my postpartum.	Low-income postpartum women (who gave birth within 1 year ago)	Familiar	Public	CTRL	4.48
Downs & Hausenblas (2003)	89	exercise during my second trimester of pregnancy.	Pregnant women in USA	Familiar	Public	CTRL	4.68
Drossaert et al. (2003)	2657	participate in the coming round of breast cancer screening.	Patients aged 50-69 of Dutch Breast Cancer screening program	Familiar	Private	SE	6.55
Duckett et al. (1998) Study 1	180	breastfeed for 6 or more months.	First-time mothers who are homemakers in USA	Unfamiliar	Private	CTRL	5.94

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Study 2	110	breastfeed for 6 or more months.	First-time mothers who are employed less time in the USA	Unfamiliar	Private	CTRL	5.53
Study 3	312	breastfeed for 6 or more months.	First-time mothers who are employed more time in the USA	Unfamiliar	Private	CTRL	4.93
Elliott et al. (2003)	598	keep within the speed limit while driving in built-up areas in the next 3 months.[10]	Random sample of people with a driver's license in UK	Familiar	Public	CTRL	5.75
Elliott et al. (2007) Study 1	74	avoid exceeding the speed limit while driving in the next week.	Random sample of people with a driver's license in UK	Familiar	Public	CTRL	4.02
Study 2	123	avoid exceeding the speed limit while driving in the next week.	Random sample of people with a driver's license in UK	Familiar	Public	CTRL	4.02
Study 3	61	avoid exceeding the speed limit while driving in the next week.	Random sample of people with a driver's license in UK	Familiar	Public	CTRL	4.19
Galea & Bray (2006)	62	engage in 30 or more minutes of walking activity on 3 or more days in the upcoming week .	People with Peripheral arterial disease (PAD) that were from a medical facility specializing in the treatment of PAD.	Familiar	Public	CTRL	4.94
Giles & Lamoure (2000)	108	apply for promotion when the next opportunity becomes available.	Employees of a Northern Irish Organization	Familiar	Private	CTRL	3.88
Giles et al. (2004)	100	intend to give blood at the new blood transfusion service at the University this week.	1st year undergraduate students in the UK	Unfamiliar	Private	SE	3.99
Greenslade & White (2005)	141	engage in three or more hours of volunteer work per week during the next month	Older Volunteers from a non-profit organization in Australia	Familiar	Public	CTRL	4.78
Gretebeck et al. (2007)	1096	be physically active for 30 minutes 3 days a week.	Retirees from a large Midwestern university	Familiar	Public	PD	5.23

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Hagger et al. (2003)	295	do active sports and/or vigorous physical activities.	High school students in the UK	Familiar	Public	CTRL	5.32
Hagger et al. (2005) Study 1	222	do active sports and/or vigorous physical activities in the next 5 weeks.	British high school students	Familiar	Public	CTRL	5.30
Study 2	93	do active sports and/or vigorous physical activities in the next 5 weeks.	Greek high school students	Familiar	Public	CTRL	5.10
Study 3	103	do active sports and/or vigorous physical activities in the next 5 weeks.	Polish high school students	Familiar	Public	CTRL	4.60
Study 4	133	do active sports and/or vigorous physical activities in the next 5 weeks.	Singaporean high school students	Familiar	Public	CTRL	4.41
Harland et al. (1999) Study 1	277	use unbleached paper.	Future members of an environmental program in the Netherlands	Familiar	Public	SE	5.58
Study 2	263	reduce meat consumption.	Future members of an environmental program in the Netherlands	Familiar	Public	SE	5.47
Study 3	198	use other forms of transportations (instead of using the car).	Future members of an environmental program in the Netherlands	Familiar	Public	SE	5.30
Study 4	277	use energy saving light bulbs.	Future members of an environmental program in the Netherlands	Familiar	Public	SE	4.97
Study 5	275	turn off the faucet.	Future members of an environmental program in the Netherlands behavior)	Familiar	Private	SE	5.72
Hausenblas & Downs (2004)	104	exercise during my first trimester of pregnancy.	Women in their first trimester of pregnancy in the USA	Familiar	Public	CTRL	4.38
Higgins & Conner (2003)	162	resist smoking.	Secondary school kids in the UK (likely at the age where they might start smoking)	Unfamiliar	Public	CTRL	1.98

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Hill et al. (1996) Study 1	49	introduce a benchmarking program within two years.	Managers *with* experience in benchmarking in Australia	Familiar	Public	CTRL	4.38
Study 2	46	introduce a benchmarking program within two years.	Managers *without* experience in benchmarking in Australia	Unfamiliar	Public	CTRL	4.05
Hunt-Shanks et al. (2006) Study 1	126	accumulate 30 minutes of moderately intense exercise at least 3 days per week over the next month.	Recently diagnosed with breast cancer and is receiving active treatment	Familiar	Public	CTRL	4.79
Study 2	82	accumulate 30 minutes of moderately intense exercise at least 3 days per week over the next month.	Recently diagnosed with prostate cancer and is receiving active treatment	Familiar	Public	CTRL	4.98
Hynie et al. (2006)	143	use condoms each time I have sexual intercourse between now and the beginning of the next school term.	Sexually experienced Undergraduate students in Canada	Familiar	Private	CTRL	5.60
Johnston & White (2003)	289	drink five or more standard alcoholic beverages in a single session in the next two weeks.	First year undergraduate students in Australia	Familiar	Public	CTRL	4.29
Jones et al. (2006)	70	exercise regularly over the next month.	Multiple myeloma cancer survivors	Familiar	Public	CTRL	4.60
Jones et al. (2004)	450	exercise regularly over the next 2 weeks.	Undergraduates in Canada	Familiar	Public	CTRL	5.11
Knussen et al. (2004)	252	recycle during the next month.	Random sample of adults from the UK	Familiar	Public	PD	3.12
Kosma et al. (2007)	223	participate in regular physical activity over the next 6 months.	Adults with physical disabilities	Familiar	Public	CTRL	4.40
Latimer & Ginis (2005a)	325	engage in regular physical activity.	Undergraduates in Canada	Familiar	Public	CTRL	5.59

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Latimer & Ginis (2005b)	104	participate in leisure time, physical activity for at least 30 min on most days in the next week.	People with a spinal cord injury	Familiar	Public	CTRL	5.53
Legare et al. (2003) Study 1	172	adopt hormone replacement therapy (HRT) at menopause within the next year.	Premenopausal women in Canada	Unfamiliar	Private	PD	4.38
Study 2	209	adopt hormone replacement therapy (HRT) at menopause within the next year	Perimenopausal women in Canada	Unfamiliar	Private	PD	4.09
Levin (1999)	527	wear gloves when there is a potential for blood contact in the next month.	Registered nurses and health care workers	Familiar	Public	CTRL	5.90
Louis et al. (2007)	137	eat healthy in the next two weeks.	Undergraduate students from Australia	Familiar	Public	CTRL	5.40
Lowe et al. (2002)	996	exercise in my leisure time over the next 6 months.	Patients from general practices in UK	Familiar	Public	SE	5.94
Martin & Kulinna (2005)	43	teach lessons that provide physical activity.	Physical education Teachers in the USA	Familiar	Public	SE	6.21
Martin et al. (2005)	548	do physical activity that makes me breath hard and feel tired tomorrow.	African American children (9-12) in the USA	Familiar	Public	CTRL	5.74
Masalu & Astrom (2001)	1123	avoid between-meal intake of sugared snacks and drinks in future.	Students of higher learning institutions in Tanzania	Familiar	Public	CTRL	3.10
McFarland & Ryan (2006) Study 1	1095	lie on a selection test (in this case, a personality test that you take when applying for a job).	Undergraduate students in the USA	Unfamiliar	Private	CTRL	3.94
Study 2	547	lie on a selection test (in this case, a personality test that you take when applying for a job).	Undergraduate students in the USA	Unfamiliar	Private	CTRL	3.76
McMillan et al. (2005)	741	smoke this school term.	School children in England (12-13)	Unfamiliar	Public	CTRL	6.34
Moan et al. (2005)	159	smoke indoors around kids.	People who had children born in 1998	Familiar	Public	CTRL	6.41

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Moan & Rise (2005)	698	quit smoking in next 6 months.	University students from Norway who smoked on a daily basis	Familiar	Public	CTRL	4.32
Moan & Rise (2006)	145	smoke less in the following year.	9^{th} grade smokers from Norway	Familiar	Public	CTRL	5.76
Myers & Horswill (2006)	85	wear high factor sunscreen this summer.	Young adults at University of Reading, UK who sunbathe	Familiar	Public	CTRL	5.65
Norman & Conner (2005) Study 1	125	take regular physical activity in the future.	Undergraduates from the UK	Familiar	Public	CTRL	5.43
Study 2	102	exercise at least three times over the next week.	Undergraduates from the UK	Familiar	Public	CTRL	5.29
Norman & Conner (2006)	398	engage in a binge drinking session during the next week.	Undergraduates from the UK	Familiar	Public	CTRL	5.88
Norman & Hoyle (2004)	95	perform breast self-examination in the next month.	Female employees at a telesales company in the UK (Note: BSE isn't promoted as much as it is in the USA)	Unfamiliar	Private	SE	6.30
Norman et al. (2005) Study 1	48	confront oppositional fan.	Male soccer fans from the UK	Familiar	Public	CTRL	4.24
Study 2	129	trip an opposing team member.	Male field hockey players	Familiar	Public	CTRL	5.43
Norman et al. (2000)	87	take regular physical activity over the next 6 months.	Patients attending health promotion clinics at their physicians general practice	Familiar	Public	CTRL	5.71
Norman & Smith (1995)	83	take regular physical activity over the next 6 months.	Undergraduates from the UK	Familiar	Public	CTRL	5.20
Okun et al. (2003)	363	engage in exercise during the next 6 months.	undergraduates from the USA	Familiar	Public	CTRL	5.70

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Orbell (2003)	81	do at least 3 hours of studying per module per week, in the next 2 weeks.	Undergraduates from the UK	Familiar	Private	CTRL	4.76
Orbell et al. (2006)	660	attending all appointments at the colposcopy clinic in the next 15 months.	Women with abnormal cervical screening results	Unfamiliar	Private	CTRL	6.04
Palmer et al. (2005)	115	participate in 3 endurance sessions per week.	Female athletes in the England Netball World Class Start program	Unfamiliar	Public	CTRL	5.33
Parker et al. (1998)	270	initiate road rage in a given situation.	Drivers from the UK	Unfamiliar	Public	CTRL	4.46
Payne et al. (2002)	241	exercise.	Employees of a large company	Familiar	Public	SE	4.32
Prapavessis et al. (2005)	58	participate in regular exercise in the next 4 weeks.	Congenital heart disease patients	Familiar	Public	CTRL	5.10
Rapaport & Orbell (2000)	185	provide practical assistance/emotional support to a parent in need of care.	Undergraduates from the UK	Unfamiliar	Public	CTRL	4.67
Rhodes & Courneya (2005)	585	exercise regularly over the next 2 weeks.	Undergraduates from Canada	Familiar	Public	CTRL	5.71
Rhodes & Matheson (2005)	241	exercise regularly over the next 2 weeks.	Undergraduates from Canada	Familiar	Public	PBC	5.62
Rhodes et al. (2002)	303	exercise regularly.	Undergraduates from Canada	Familiar	Public	CTRL	5.85
Rhodes et al. (2003)	300	exercise regularly over the next 2 weeks.	Undergraduates from Canada	Familiar	Public	CTRL	4.81
Rivis & Sheeran (2003)	333	exercise at least 6 times in 2 weeks.	Undergraduates from the UK	Familiar	Public	CTRL	5.33
Robinson & Doverspike (2006)	112	take a course online rather than in person.	Undergraduates from the USA	Unfamiliar	Public	PBC	4.15
Shankar et al. (2007)	54	engage in active sports or physical activity for at least 40 min, 4 days per week during leisure time, over next 5 weeks.	Students in UK	Familiar	Public	PD	6.43
Sheeran & Abraham (2003)	185	exercise at least 4 times in next 2 weeks.	Undergraduates from the UK	Familiar	Public	CTRL	4.93

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Sheeran & Orbell (2000)	283	exercise at least 6 times in 2 weeks.	Undergraduates from the UK	Familiar	Public	CTRL	4.72
Sheeran & Silverman (2003)	271	attend a fire training course in the next three months.	Employees at a University in the UK	Unfamiliar	Public	CTRL	4.04
Sheeran et al. (1999)	164	study 4 to 6 days a week over winter vacation.	Undergraduates from the UK	Familiar	Public	CTRL	3.47
Smith et al. (2006)	187	drink my preferred beer in the next 2 weeks.	Undergraduates from Australia	Familiar	Public	CTRL	5.72
Smith & Biddle (1999)	155	stick to the health club's exercise program regularly over the coming months.	Employees with new health club membership	Familiar	Public	CTRL	5.00
Sparks & Shepherd (2002) Study 1	61	buy tomatoes produced with the use of genetically engineered growth hormone.	Random sample from UK	Unfamiliar	Public	PBC	4.68
Study 2	100	eat meat.	Random sample from UK	Familiar	Public	CTRL	6.12
Terry & O'Leary (1995)	56	exercise for at least 20 minutes, 3 times a week, for the next fortnight.	Undergraduates from Australia	Familiar	Public	PBC	5.45
Terry et al. (1999)	143	engage in household recycling during the next fortnight.	People with access to recycling bins in Australia	Familiar	Public	CTRL	5.70
Umeh & Patel (2004)	200	take ecstasy in the next two months.	Undergraduates from the UK	Familiar	Private	CTRL	5.15
Verplanken (2006)	128	eat snack food during the coming week.	Undergraduates from Norway	Familiar	Public	CTRL	2.60
Verplanken et al. (1998)	200	choose to take the car to destinations outside the village.	People with a driver's license and a car in a small village in the Netherlands	Familiar	Public	PBC	6.37
Warburton & Terry (2000)	296	volunteer during the next month.	Older people living in Australia	Familiar	Public	CTRL	1.53
Yzer et al. (2001)	94	bringing up condom use with my partner.	Dutch adults who had casual sex partners	Familiar	Private	CTRL	5.73

Author(s) (year)	*N*	Intention to…	Population	Familiar or Unfamiliar Context	Public or Private Context	PBC Measure	Mean PBC
Yzer & van den Putte (2006)	3428	quit smoking within the next 3 months.	Smokers in the Netherlands	Familiar	Public	SE	3.81

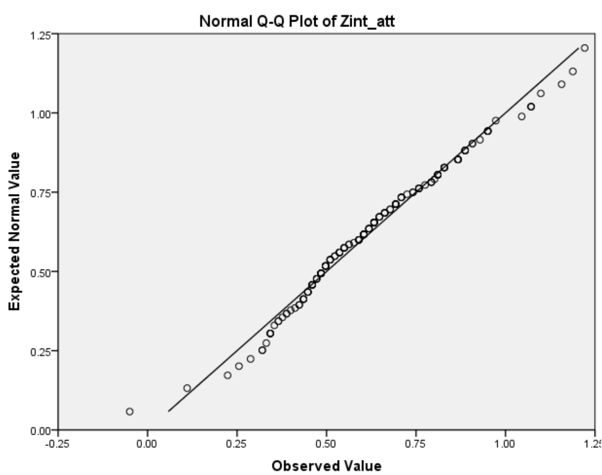
Appendix D

Examination of the *r-to-Z* Transformed Correlations

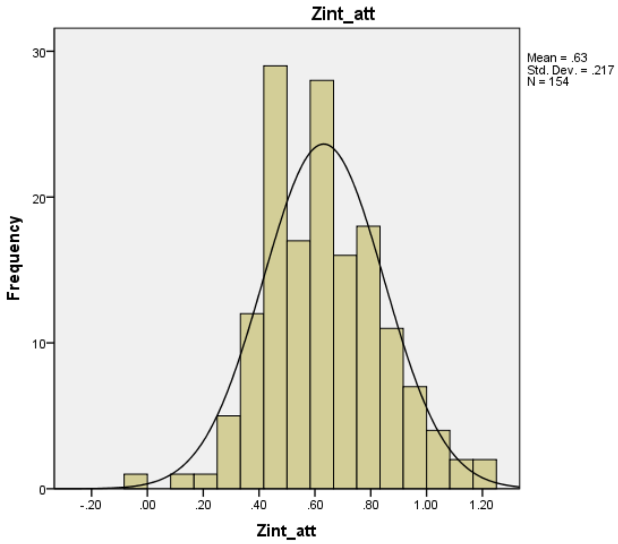
Stem-and Leaf-Plot for *r-to-Z* Transformed Correlation Between Attitude and Intention (*k* = 154)

```
Frequency    Stem &  Leaf
    1.00 Extremes    (=<-.05)
    1.00        1 .  1
    3.00        2 .  258
   13.00        3 .  2234444566788
   31.00        4 .  0122333344445555577788888999999
   21.00        5 .  111122333344446679999
   33.00        6 .  000000111133333333444666677999999
   15.00        7 .  000024455557999
   19.00        8 .  0111112222666668888
    9.00        9 .  002555557
    5.00       10 .  47779
    2.00       11 .  58
    1.00       12 .  2
 Stem width:      .10
 Each leaf:       1 case(s)
```

Q-Q Plot for *r*-to-*Z* Transformed Correlation Between Attitude and Intention (*k* = 154)



Histogram Showing the Frequency of the *r*-to-*Z* Transformed Correlation Between Attitude and Intention (*k* = 154)

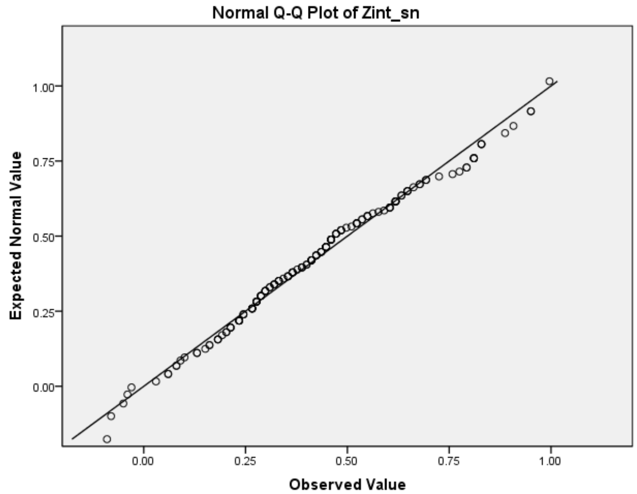


Stem-and Leaf-Plot for *r*-to-*Z* Transformed Correlation Between Norm and Intention (*k* = 154)

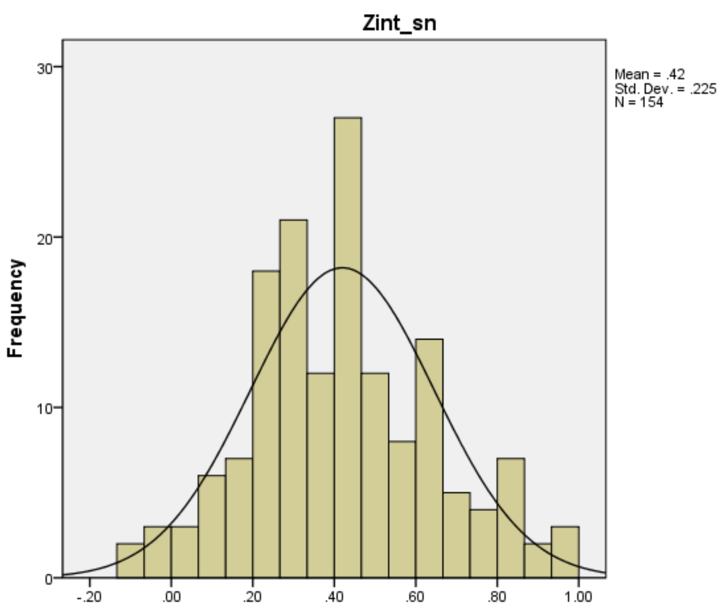
Frequency	Stem &	Leaf
5.00	-0 .	34589
6.00	0 .	366889
10.00	1 .	0335668889
31.00	2 .	0011133333444666667777788889999
20.00	3 .	00222333455566667888
34.00	4 .	0011111122233334444445555555777888 9
13.00	5 .	1222233444679
18.00	6 .	000111113344467799
5.00	7 .	25799
8.00	8 .	11112228
3.00	9 .	055
1.00 Extremes		(>=1.00)

Stem width: .10
Each leaf: 1 case(s)

Q-Q Plot for *r*-to-*Z* Transformed Correlation Between Norm and Intention (*k* = 154)



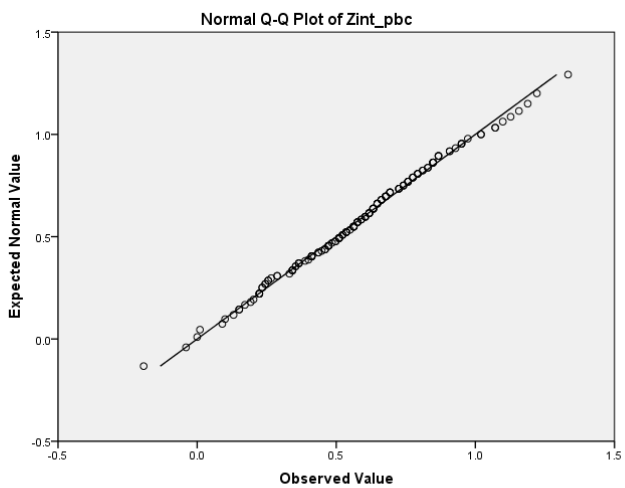
Histogram Showing the Frequency of the *r*-to-*Z* Transformed Correlation Between Norm and Intention (*k* = 154)



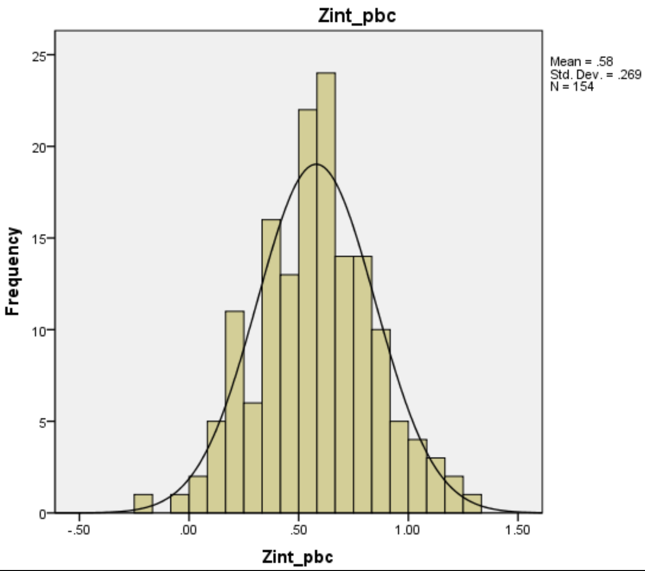
Stem-and Leaf-Plot for *r*-to-*Z* Transformed Correlation Between PBC and Intention (*k* = 154)

```
Frequency    Stem &  Leaf
    1.00 Extremes    (=<-.19)
    1.00       -0 .  4
    3.00        0 .  019
    6.00        1 .  035579
   14.00        2 .  02222334455688
   11.00        3 .  34444556668
   19.00        4 .  0111113345577777899
   24.00        5 .  111112233334666666777799
   30.00        6 .  000011113333334444466677779999
   16.00        7 .  2224445555777999
   12.00        8 .  112244444666
    7.00        9 .  0025557
    5.00       10 .  22779
    3.00       11 .  258
    1.00       12 .  2
    1.00 Extremes    (>=1.33)
 Stem width:       .10
 Each leaf:       1 case(s)
```

Q-Q Plot for *r*-to-*Z* Transformed Correlation Between PBC and Intention (*k* = 154)



Histogram Showing the Frequency of the *r*-to-*Z* Transformed Correlation Between PBC and Intention (*k* = 154)

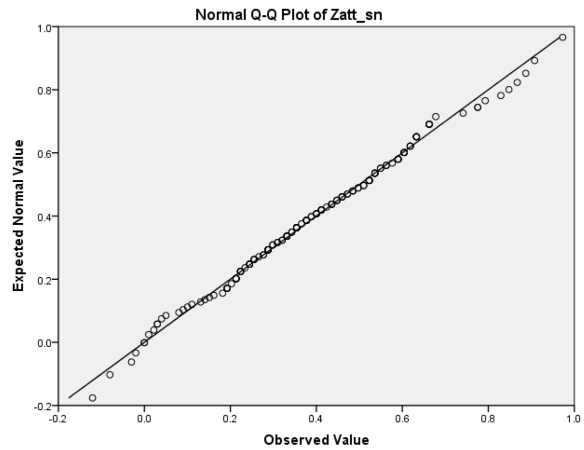


Stem-and Leaf-Plot for *r*-to-*Z* Transformed Correlation Between Attitude and Norm (*k* = 154)

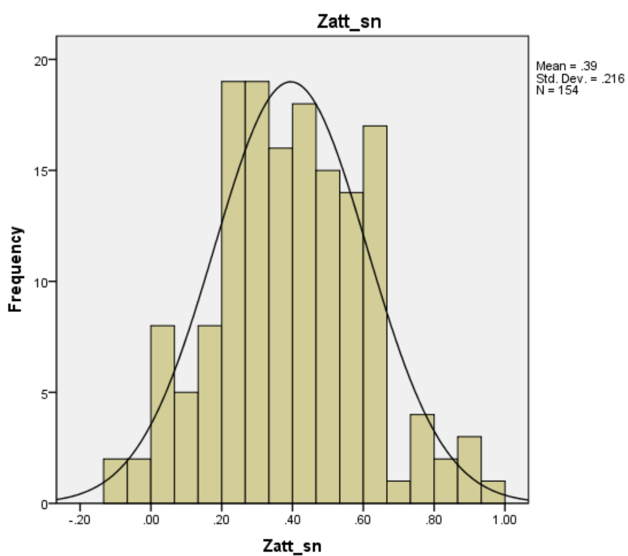
Frequency	Stem &	Leaf
1.00	-1 .	2
3.00	-0 .	238
10.00	0 .	0012334589
11.00	1 .	01345689999
29.00	2 .	01111122222344445555677888888899
25.00	3 .	0022333334455555567777788
25.00	4 .	0001111233334445557788899
22.00	5 .	1122222233333446679999
18.00	6 .	000011133333366667
4.00	7 .	4779
4.00	8 .	2468
2.00	9 .	07

Stem width: .10
Each leaf: 1 case(s)

Q-Q Plot for *r*-to-*Z* Transformed Correlation Between Attitude and Norm (*k* = 154)



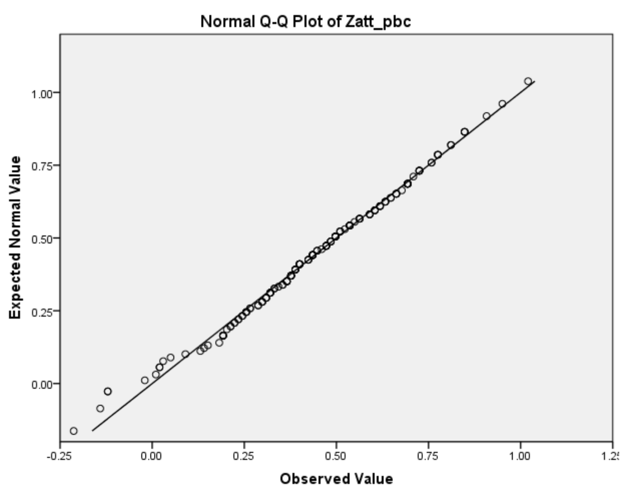
Histogram Showing the Frequency of the *r*-to-*Z* Transformed Correlation Between Attitude and Norm (*k* = 154)



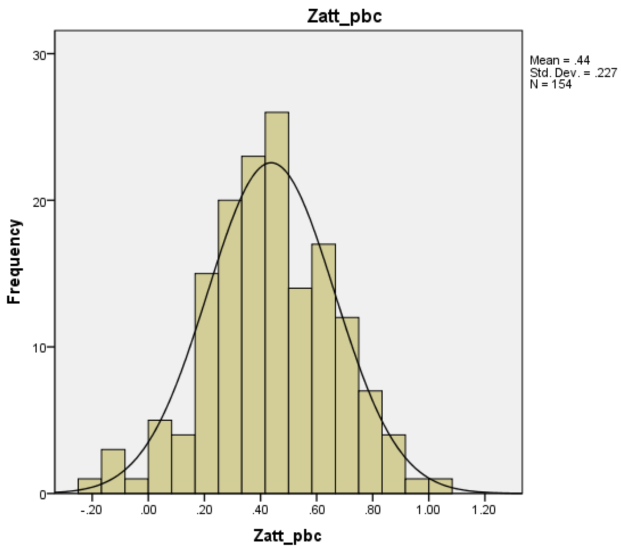
Stem-and Leaf-Plot for *r*-to-*Z* Transformed Correlation Between Attitude and PBC (*k* = 154)

```
Frequency    Stem &  Leaf
    1.00 Extremes    (=<-.21)
    3.00       -1 .  224
    1.00       -0 .  2
    6.00        0 .  122359
    9.00        1 .  345899999
   19.00        2 .  0112233445556688999
   28.00        3 .  0002222233455666677777788888
   31.00        4 .  0000022233333344577777888999999
   17.00        5 .  11123333346666999
   21.00        6 .  000111333446667999999
   10.00        7 .  0222255777
    5.00        8 .  11444
    2.00        9 .  05
    1.00       10 .  2
 Stem width:      .10
 Each leaf:       1 case(s)
```

Q-Q Plot for *r*-to-*Z* Transformed Correlation Between Attitude and PBC (*k* = 154)



Histogram Showing the Frequency of the *r*-to-*Z* Transformed Correlation Between Attitude and PBC (*k* = 154)

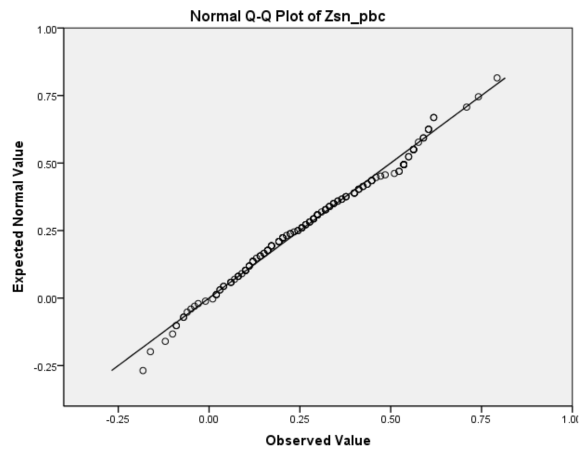


Stem-and Leaf-Plot for *r*-to-*Z* Transformed Correlation Between Norm and PBC (*k* = 154)

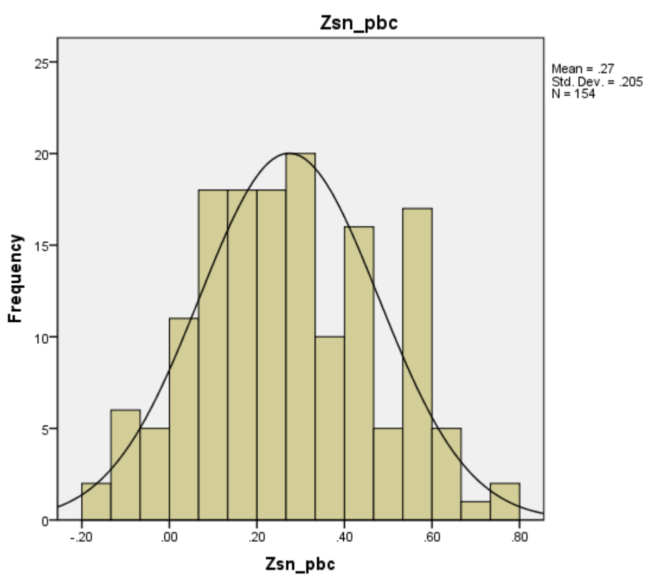
Frequency	Stem &	Leaf
2.00	-1 .	68
2.00	-1 .	02
6.00	-0 .	567799
3.00	-0 .	134
8.00	0 .	12223344
8.00	0 .	66678889
16.00	1 .	0000111222223444
15.00	1 .	556666777779999
11.00	2 .	00001222344
19.00	2 .	5555666777888899999
11.00	3 .	02222333444
7.00	3 .	5566777
15.00	4 .	000011122334444
3.00	4 .	578
12.00	5 .	122333333344
8.00	5 .	66666799
5.00	6 .	00011
.00	6 .	
2.00	7 .	04
1.00	7 .	9

Stem width: .10
Each leaf: 1 case(s)

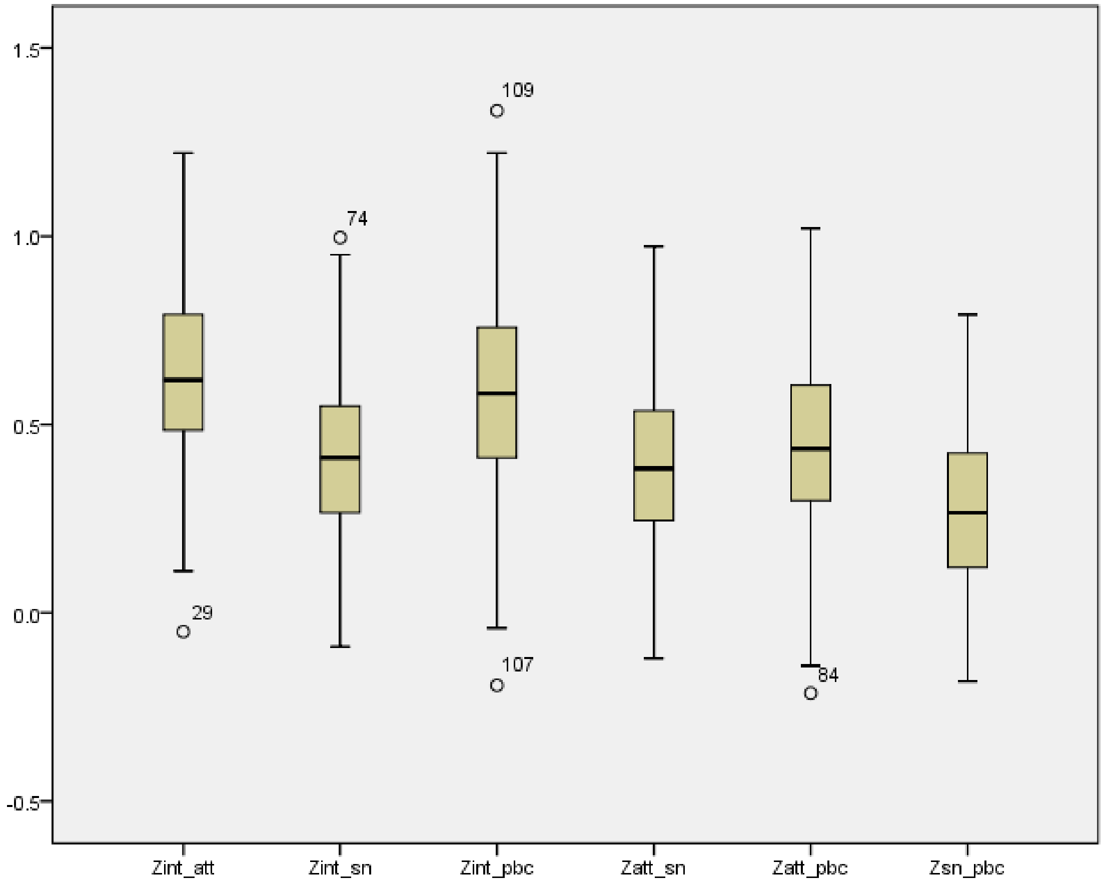
Q-Q Plot for *r*-to-*Z* Transformed Correlation Between Norm and PBC (*k* = 154)



Histogram Showing the Frequency of the *r*-to-*Z* Transformed Correlation Between Norm and PBC (*k* = 154)



Box Plots for the Six *r*-to-*Z* Transformed Correlations (*k* = 154)

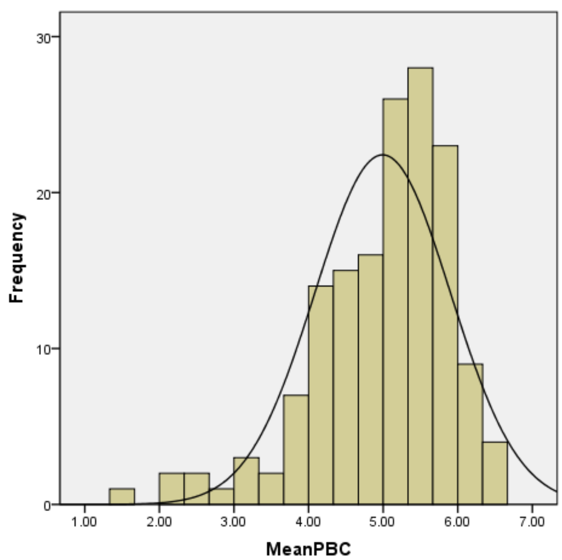


29 = Courneya, Blanchard, & Laing, 2001, *z*-score = -3.1
74 = Prapavessis et al., 2005, *z*-score = 2.6
109 = Giles & Lamoure, 2000, *z*-score = 2.8
107 = Burak & Vian, 2007, *z*-score = -2.9
84 = Verplanken, 2006, *z*-score = -2.9

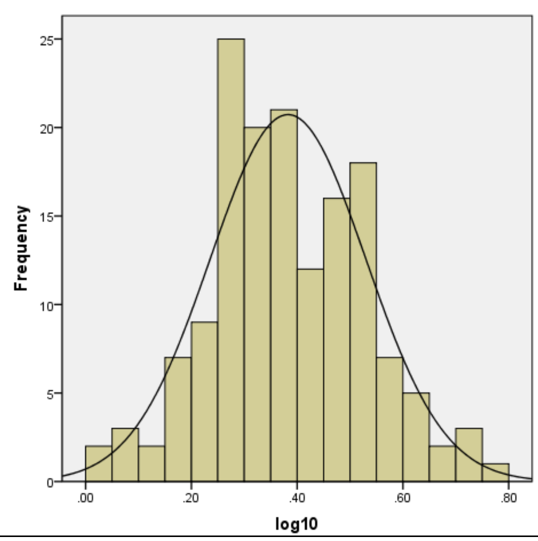
Appendix E

Examination of Mean PBC

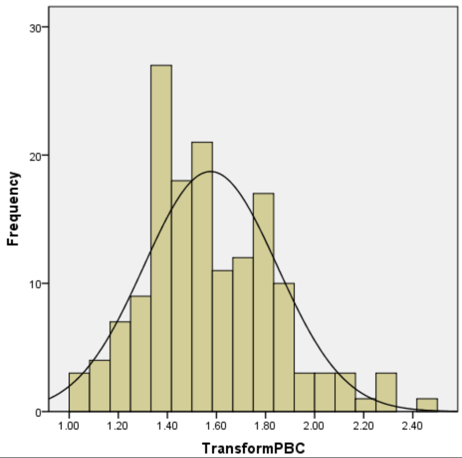
Histogram Showing the Frequency of Overall PBC Measure (*k* = 153)



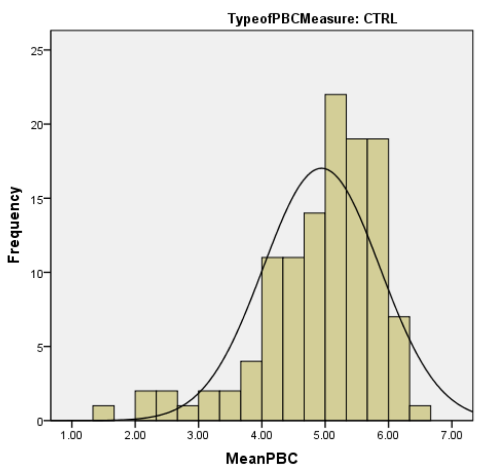
Histogram Showing the Frequency of Log10 Transformed Overall PBC Measure (*k* = 153)



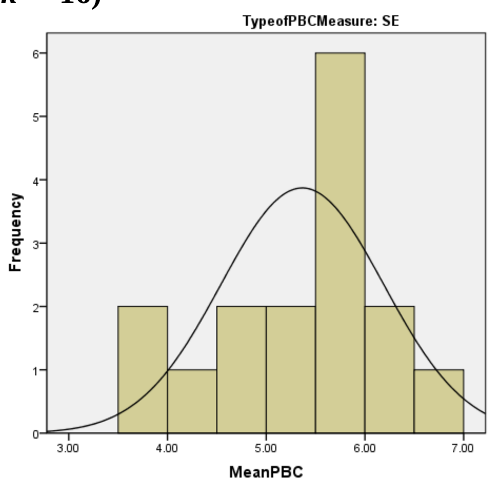
Histogram Showing the Frequency of Square Root Transformed Overall PBC Measure (*k* = 153)



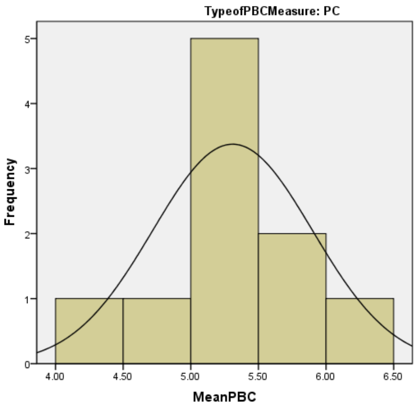
Histogram Showing the Frequency of CTRL Operationalization (*k* = 118



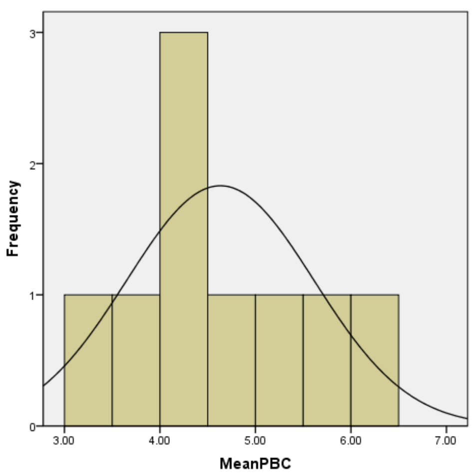
Histogram Showing the Frequency of SE Operationalization (*k* = 16)



Histogram Showing the Frequency of PC Operationalization (*k* = 10)



Histogram Showing the Frequency of PD Operationalization (*k* = 9)



Histogram Showing the Frequency of Log10 Transformed CTRL Operationalization (*k* = 118)

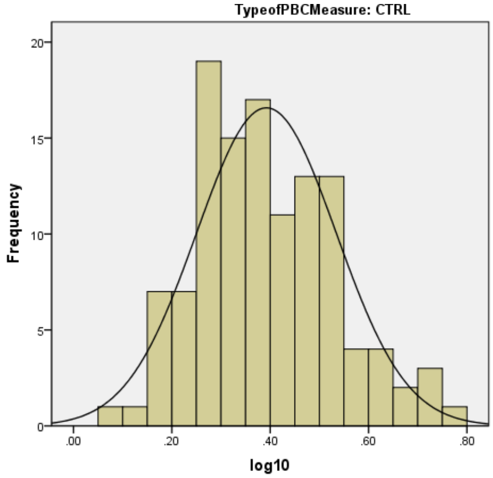


Table E1

Statistics for Overall PBC Measure

		Untransformed PBC	SqrtPBC	log10
N	Valid	153	153	153
	Missing	0	0	0
Mean		4.9929	1.5760	.3826
Median		5.2000	1.5330	.3711
Std. Deviation		.90739	.27175	.14722
Skewness		-1.113	.617	.133
Std. Error of Skewness		.196	.196	.196
Kurtosis		1.562	.390	-.053
Std. Error of Kurtosis		.390	.390	.390
Minimum		1.53	1.00	.00
Maximum		6.55	2.45	.78

Table E2

Statistics for CTRL Measure

		Untransformed PBC	SqrtPBC	log10
N	Valid	118	118	118
	Missing	0	0	0
Mean		4.9430	1.5921	.3922
Median		5.1441	1.5511	.3813
Std. Deviation		.92189	.26959	.14199
Skewness		-1.270	.814	.384
Std. Error of Skewness		.223	.223	.223
Kurtosis		1.825	.572	-.115
Std. Error of Kurtosis		.442	.442	.442
Minimum		1.53	1.07	.06
Maximum		6.41	2.45	.78

Table E3

Statistics for SE Measure

		Untransformed PBC	SqrtPBC	log10
N	Valid	16	16	16
	Missing	0	0	0
Mean		5.3656	1.4538	.3104
Median		5.5650	1.4089	.2977
Std. Deviation		.82451	.27496	.16461
Skewness		-.631	.325	-.033
Std. Error of Skewness		.564	.564	.564
Kurtosis		-.561	-.673	-.548
Std. Error of Kurtosis		1.091	1.091	1.091
Minimum		3.81	1.00	.00
Maximum		6.55	1.93	.57

Table E4

Statistics for PC Measure

		Untransformed PBC	SqrtPBC	log10
N	Valid	10	10	10
	Missing	0	0	0
Mean		5.3090	1.4850	.3361
Median		5.4450	1.4509	.3233
Std. Deviation		.59105	.19975	.12082
Skewness		-.375	-.159	-.727
Std. Error of Skewness		.687	.687	.687
Kurtosis		1.466	1.686	2.386
Std. Error of Kurtosis		1.334	1.334	1.334
Minimum		4.15	1.09	.07
Maximum		6.37	1.84	.53

Table E5

Statistics for PD Measure

		Untransformed PBC	SqrtPBC	log10
N	Valid	9	9	9
	Missing	0	0	0
Mean		4.6322	1.6828	.4369
Median		4.3800	1.7804	.5011
Std. Deviation		.98028	.31086	.17856
Skewness		.502	-.952	-1.387
Std. Error of Skewness		.717	.717	.717
Kurtosis		.344	.995	2.103
Std. Error of Kurtosis		1.400	1.400	1.400
Minimum		3.12	1.06	.05
Maximum		6.43	2.10	.65

Appendix F

Fixed-Effects Models: SPSS Macro Output Screenshots and SEM Model Fit Indices

Model F1. Dependent Variable: $\overline{ES}_{Zr}$ Att–Int. (Hypothesis 1)

```
 *****  Inverse Variance Weighted Regression  *****

 *****  Fixed Effects Model via OLS  *****

------- Descriptives -------
     Mean ES     R-Square          k
       .6053        .0032     153.0000

------- Homogeneity Analysis -------
                  Q           df           p
Model          4.1989       1.0000       .0405
Residual    1318.3509     151.0000       .0000
Total       1322.5498     152.0000       .0000

------- Regression Coefficients -------
              B       SE  -95% CI  +95% CI        Z        P     Beta
Constant   .6273    .0118    .6042    .6505  53.1299    .0000    .0000
log10     -.0589    .0287   -.1152   -.0026  -2.0491    .0405   -.0563

------ END MATRIX -----
```

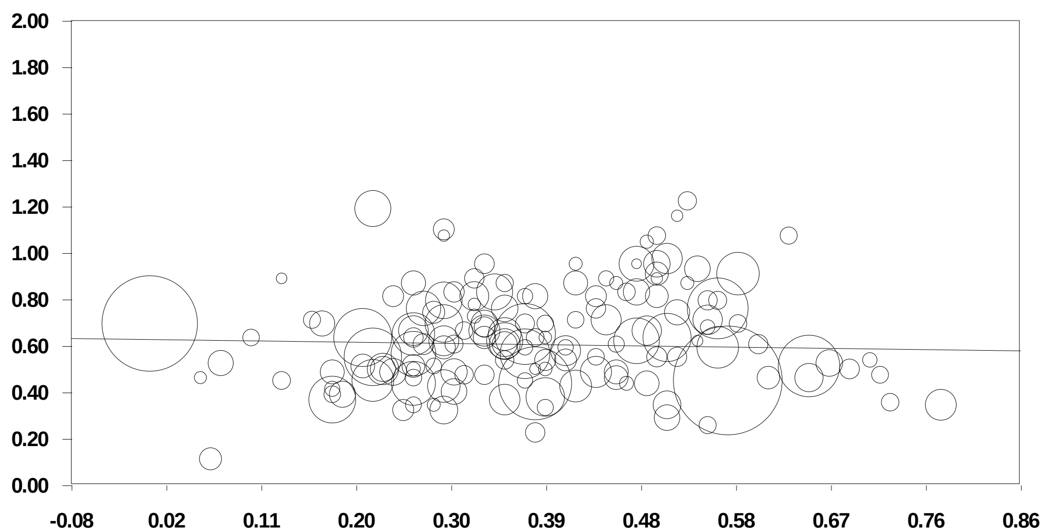


Figure F1. A scatterplot of the relationship between *r*-to-*Z* transformed attitude-intention effect size across different levels of log10 PBC. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F2. Dependent Variable: $\overline{ES}_{Zr}$ Norm–Int *r*-to-*Z*. (Hypothesis 2)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.3813	.0207	153.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	31.9271	1.0000	.0000
Residual	1509.6308	151.0000	.0000
Total	1541.5579	152.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.3207	.0118	.2976	.3438	27.1617	.0000	.0000
log10	.1624	.0287	.1061	.2187	5.6504	.0000	.1439

------ END MATRIX -----

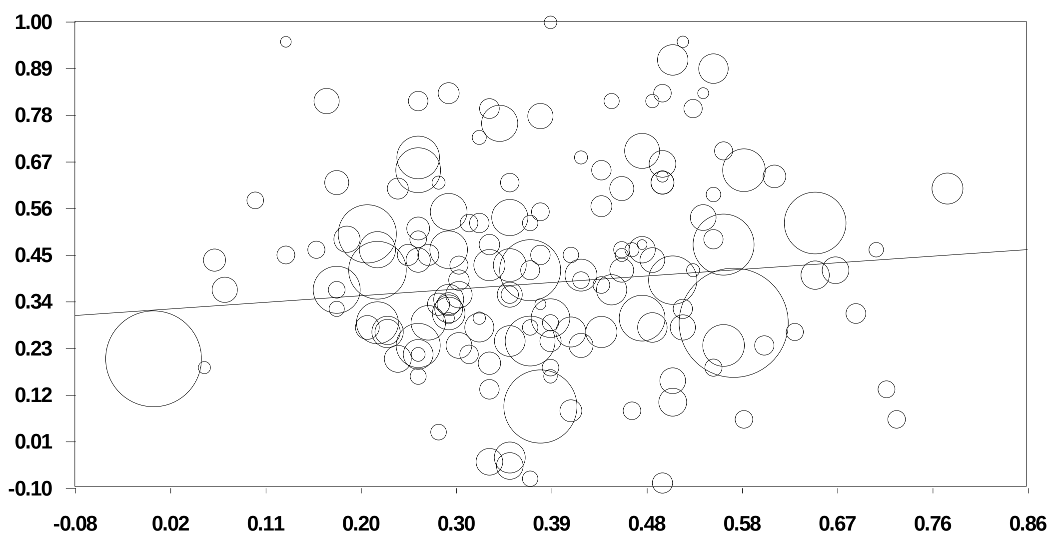


Figure F2. A scatterplot of the relationship between *r*-to-*Z* transformed norm-intention effect size across different levels of log10 PBC. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F3. Dependent Variable: $\overline{ES}_{Zr}$ Att–Int. (Hypothesis 3: Familiar/Unfamiliar)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.6053	.1202	153.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	158.9602	3.0000	.0000
Residual	1163.5895	149.0000	.0000
Total	1322.5498	152.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.5982	.0053	.5878	.6087	112.0093	.0000	.0000
Centered	-.1980	.0308	-.2585	-.1376	-6.4200	.0000	-.1894
familiar	.0044	.0147	-.0244	.0332	.3011	.7633	.0085
PBCxFami	1.0629	.0882	.8901	1.2358	12.0533	.0000	.3649

------ END MATRIX -----

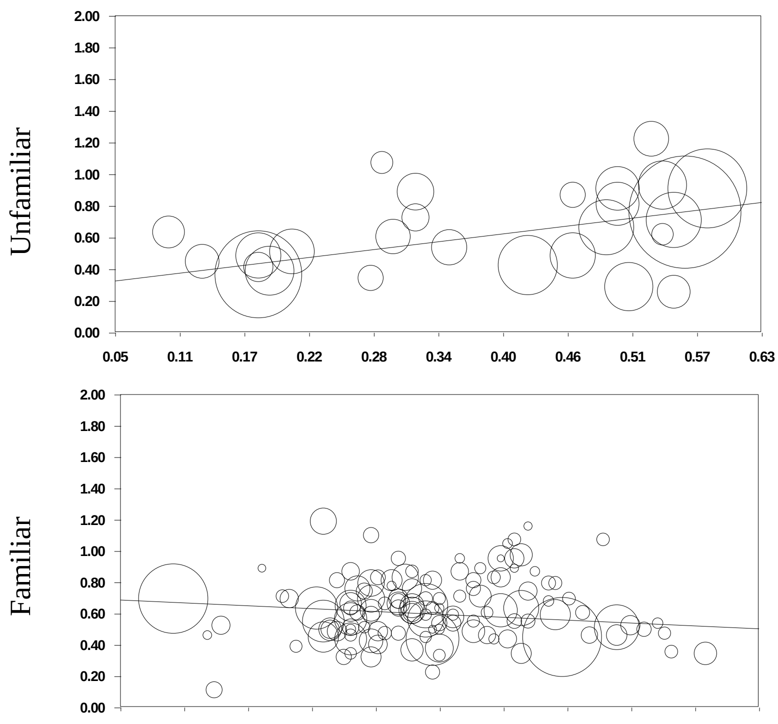


Figure F3. A scatterplot of the relationship between *r*-to-*Z* transformed att-intention effect size across different levels of log10 PBC, split by familiar/unfamiliar. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F4. Dependent Variable: $\overline{ES}_{Zr}$ Norm–Int. (Hypothesis 3: Familiar/Unfamiliar)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.3813	.0726	153.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	111.9309	3.0000	.0000
Residual	1429.6270	149.0000	.0000
Total	1541.5579	152.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.3636	.0053	.3532	.3741	68.0867	.0000	.0000
Centered	.1144	.0308	.0539	.1748	3.7089	.0002	.1014
familiar	.1179	.0147	.0890	.1467	8.0171	.0000	.2106
PBCxFami	.1825	.0882	.0097	.3554	2.0697	.0385	.0580

------ END MATRIX -----

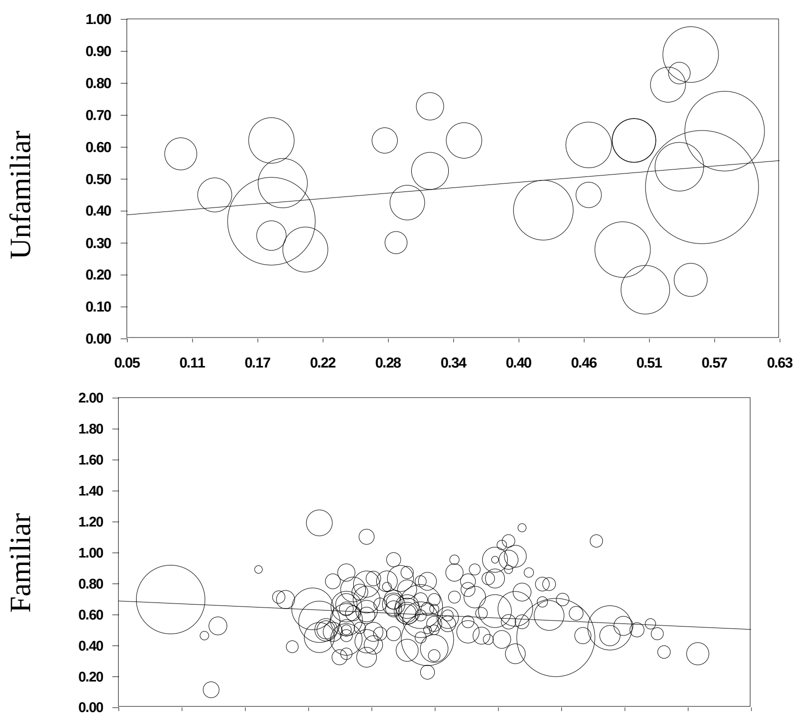


Figure F4. A scatterplot of the relationship between *r*-to-*Z* transformed norm-intention effect size across different levels of log10 PBC, split by familiar/unfamiliar. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F5. Dependent Variable: $\overline{ES}_{Zr}$ Att–Int. (Hypothesis 4: Public/Private)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.6053	.0677	153.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	89.4982	3.0000	.0000
Residual	1233.0516	149.0000	.0000
Total	1322.5498	152.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.5843	.0057	.5730	.5955	101.7385	.0000	.0000
Centered	-.0931	.0396	-.1707	-.0155	-2.3512	.0187	-.0890
public	.1105	.0124	.0862	.1347	8.9327	.0000	.2596
PBCxPubl	.2372	.0603	.1190	.3554	3.9319	.0001	.1509

------ END MATRIX -----

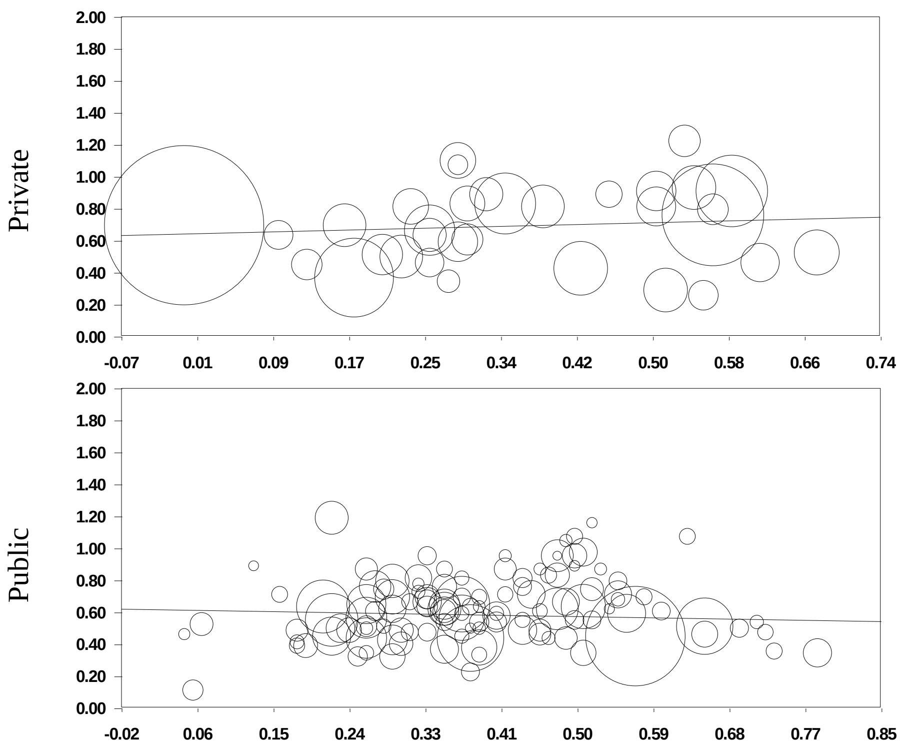


Figure F5. A scatterplot of the relationship between *r*-to-*Z* transformed att-intention effect size across different levels of log10 PBC, split by public/private. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F6. Dependent Variable: $\overline{ES}_{Zr}$ Norm–Int. (Hypothesis 4: Public/Private)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.3813	.1052	153.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	162.1060	3.0000	.0000
Residual	1379.4519	149.0000	.0000
Total	1541.5579	152.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.3694	.0057	.3581	.3806	64.3141	.0000	.0000
Centered	-.0300	.0396	-.1076	.0476	-.7585	.4482	-.0266
public	.0994	.0124	.0752	.1237	8.0406	.0000	.2164
PBCxPubl	.5684	.0603	.4502	.6867	9.4222	.0000	.3350

------ END MATRIX -----

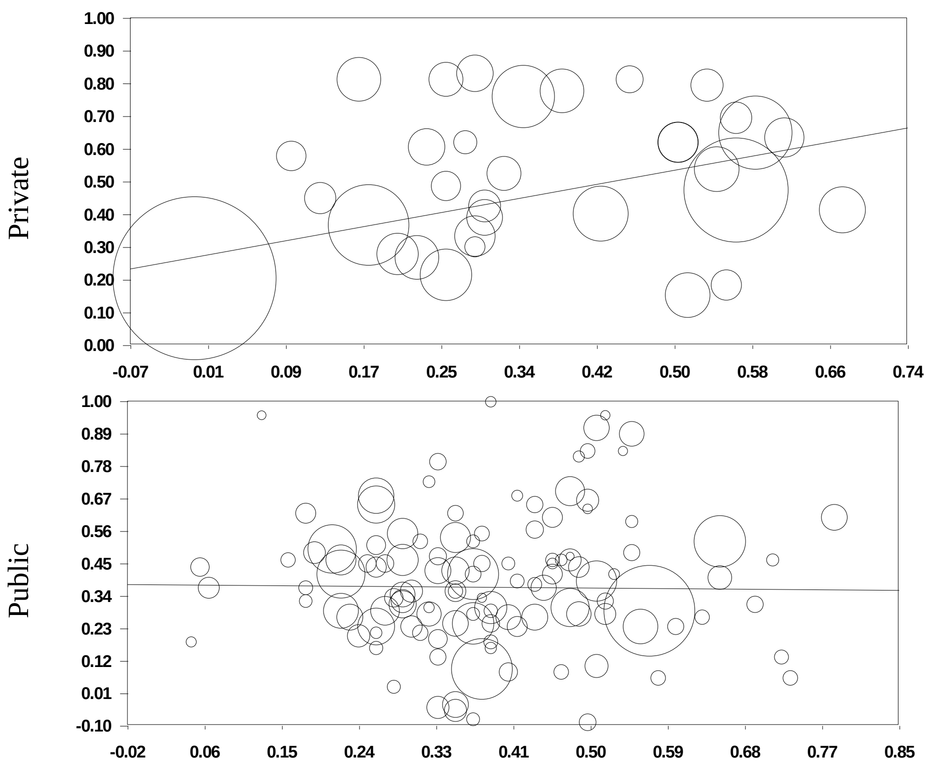


Figure F6. A scatterplot of the relationship between *r*-to-*Z* transformed norm-intention effect size across different levels of log10 PBC, split by public/private. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F7. Dependent Variable: $\overline{ES}_{Zr}$ Att–Int. (Research Question 1: CTRL)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.6173	.0218	118.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	20.9274	1.0000	.0000
Residual	939.1538	116.0000	.0000
Total	960.0812	117.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.5399	.0181	.5045	.5753	29.8699	.0000	.0000
log10	.1979	.0433	.1131	.2828	4.5746	.0000	.1476

------ END MATRIX -----

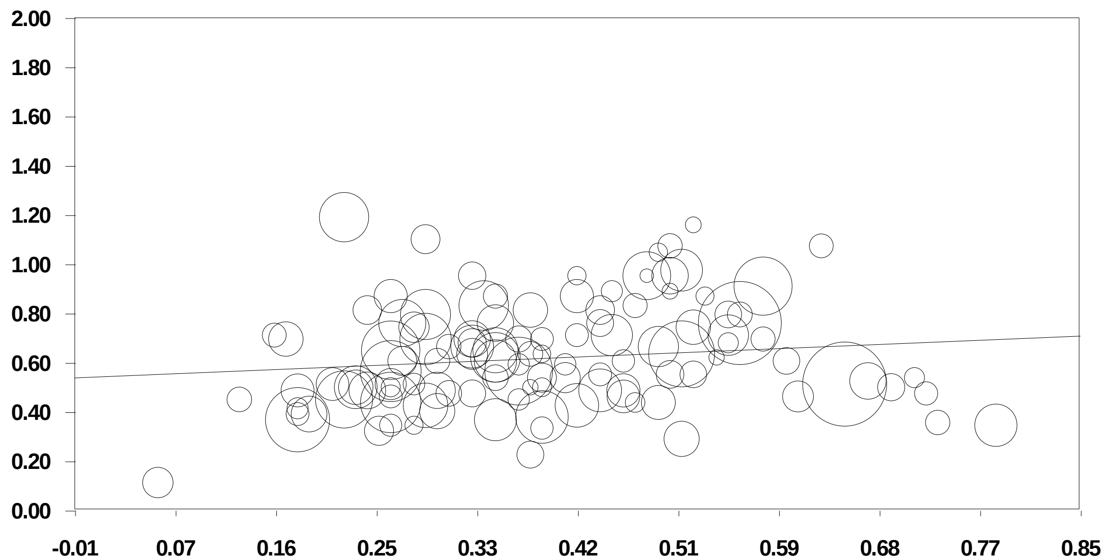


Figure F7. A scatterplot of the relationship between *r*-to-*Z* transformed attitude-intention effect size across different levels of log10 CTRL. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F8. Dependent Variable: $\overline{ES}_{Zr}$ Norm–Int. (Research Question 1: CTRL)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.4284	.0187	118.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	19.8085	1.0000	.0000
Residual	1038.3217	116.0000	.0000
Total	1058.1301	117.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.3530	.0181	.3176	.3885	19.5326	.0000	.0000
log10	.1926	.0433	.1078	.2774	4.4507	.0000	.1368

------ END MATRIX -----

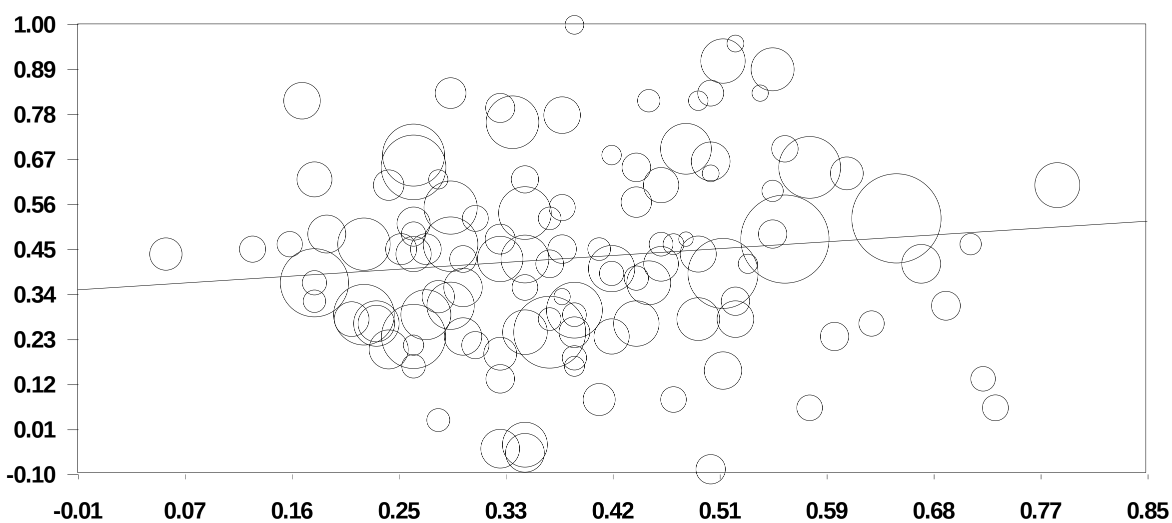


Figure F8. A scatterplot of the relationship between *r*-to-*Z* transformed norm-intention effect size across different levels of log10 CTRL. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F9. Dependent Variable: $\overline{ES}_{Zr}$ Att–Int. (Research Question 1: SE)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.5790	.6339	16.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	103.6996	1.0000	.0000
Residual	59.8853	14.0000	.0000
Total	163.5849	15.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.1160	.0465	.0248	.2072	2.4938	.0126	.0000
MeanPBC	.0886	.0087	.0715	.1056	10.1833	.0000	.7962

------ END MATRIX -----

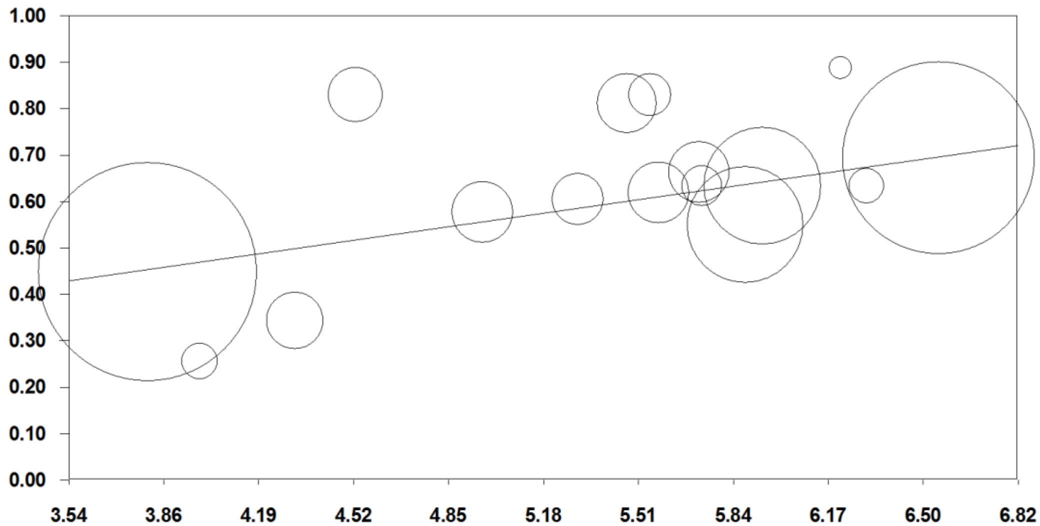


Figure F9. A scatterplot of the relationship between *r*-to-*Z* transformed attitude-intention effect size across different levels of SE. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F10. Dependent Variable: $\overline{ES}_{Zr}$ Norm–Int. (Research Question 1: SE)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.3087	.0010	16.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	.1470	1.0000	.7014
Residual	152.1032	14.0000	.0000
Total	152.2502	15.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.2912	.0465	.2000	.3824	6.2602	.0000	.0000
MeanPBC	.0033	.0087	-.0137	.0204	.3834	.7014	.0311

------ END MATRIX -----

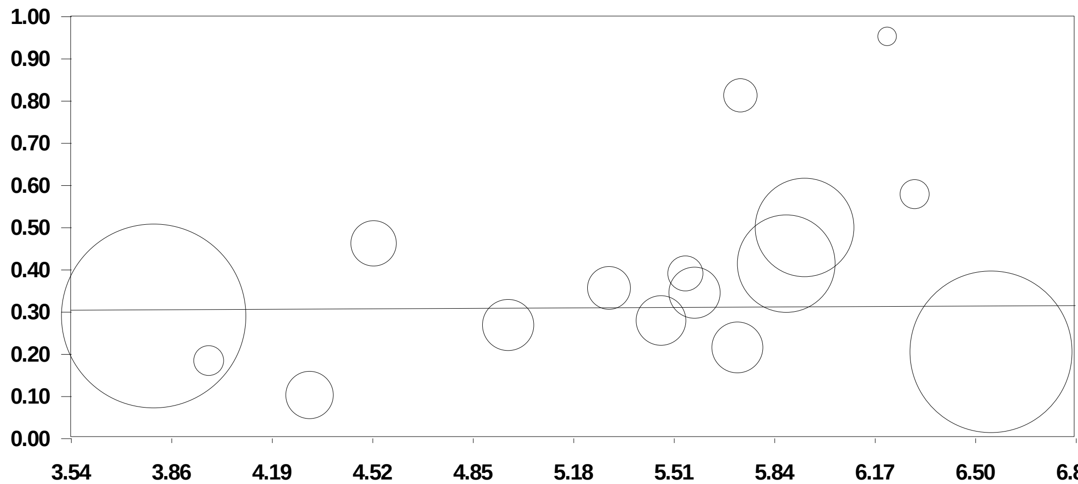


Figure F10. A scatterplot of the relationship between *r*-to-*Z* transformed norm-intention effect size across different levels of SE. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F11. Dependent Variable: $\overline{ES}_{Zr}$ Att–Int. (Research Question 1: PC)

```
 *****  Inverse Variance Weighted Regression  *****

 *****  Fixed Effects Model via OLS  *****

------- Descriptives -------
     Mean ES     R-Square          k
       .5293       .0862     10.0000

------- Homogeneity Analysis -------
                  Q          df          p
Model         9.5380      1.0000      .0020
Residual    101.1193      8.0000      .0000
Total       110.6573      9.0000      .0000

------- Regression Coefficients -------
              B       SE  -95% CI  +95% CI        Z        P     Beta
Constant  -.0742   .1964   -.4590    .3107   -.3776    .7057    .0000
SqrtPBC    .4022   .1302    .1470    .6575   3.0884    .0020    .2936

------ END MATRIX -----
```

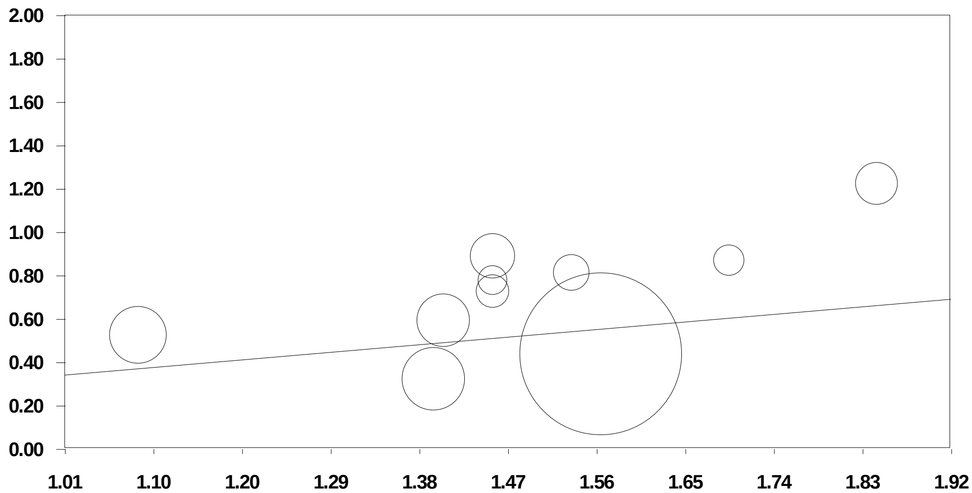


Figure F11. A scatterplot of the relationship between *r*-to-*Z* transformed att-intention effect size across different levels of square-root transformed PC. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F12. Dependent Variable: $\overline{ES}_{Zr}$ Norm–Int. (Research Question 1: PC)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.2185	.0104	10.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	1.1329	1.0000	.2872
Residual	108.2070	8.0000	.0000
Total	109.3399	9.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.4265	.1964	.0416	.8114	2.1720	.0299	.0000
SqrtPBC	-.1386	.1302	-.3939	.1167	-1.0644	.2872	-.1018

------ END MATRIX -----

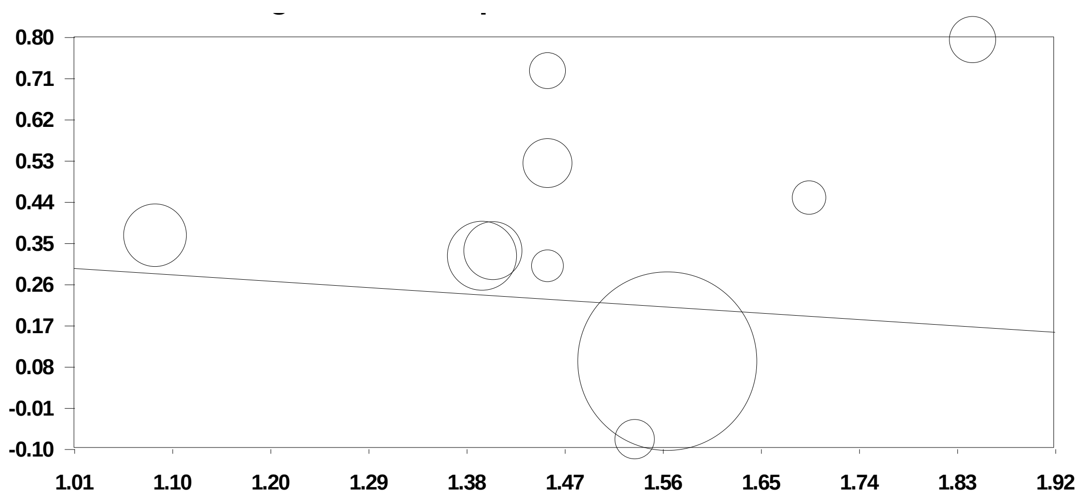


Figure F12. A scatterplot of the relationship between *r*-to-*Z* transformed norm-intention effect size across different levels of square-root transformed PC. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F13. Dependent Variable: $\overline{ES}_{Zr}$ Att–Int. (Research Question 1: PD)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.6615	.0280	9.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	1.4649	1.0000	.2262
Residual	50.9263	7.0000	.0000
Total	52.3912	8.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.5177	.1202	.2821	.7533	4.3073	.0000	.0000
MeanPBC	.0315	.0260	-.0195	.0825	1.2103	.2262	.1672

------ END MATRIX -----

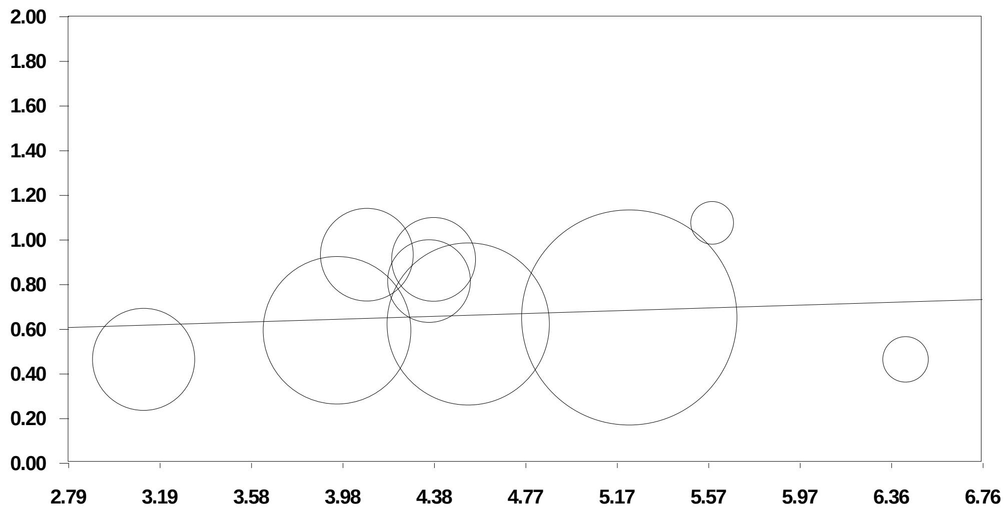


Figure F13. A scatterplot of the relationship between *r*-to-*Z* transformed att-intention effect size across different levels of PD. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F14. Dependent Variable: $\overline{ES}_{Zr}$ Norm–Int. (Research Question 1: PD)

***** Inverse Variance Weighted Regression *****

***** Fixed Effects Model via OLS *****

------- Descriptives -------

Mean ES	R-Square	k
.3837	.0016	9.0000

------- Homogeneity Analysis -------

	Q	df	p
Model	.0671	1.0000	.7956
Residual	42.5428	7.0000	.0000
Total	42.6098	8.0000	.0000

------- Regression Coefficients -------

	B	SE	-95% CI	+95% CI	Z	P	Beta
Constant	.3529	.1202	.1173	.5884	2.9360	.0033	.0000
MeanPBC	.0067	.0260	-.0443	.0577	.2590	.7956	.0397

------ END MATRIX -----

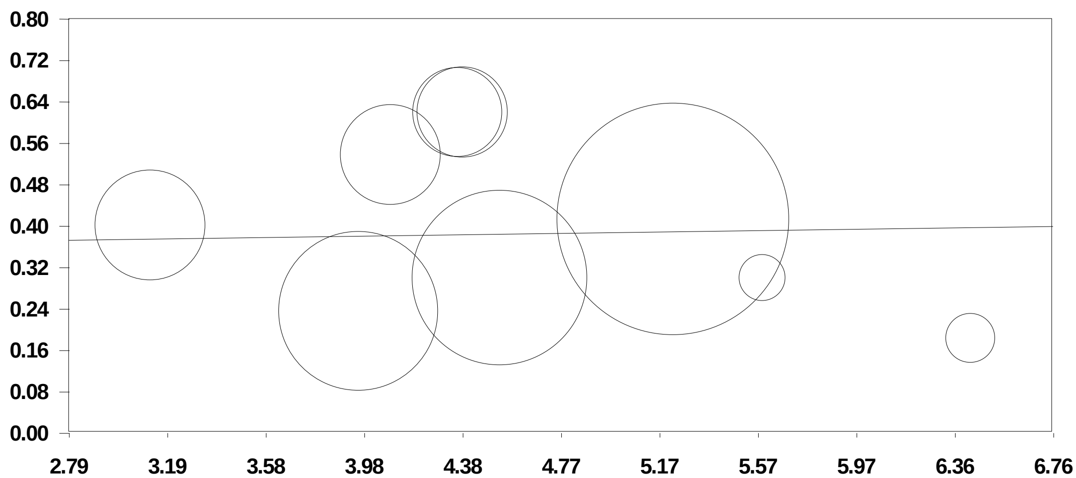


Figure F14. A scatterplot of the relationship between *r*-to-*Z* transformed norm-intention effect size across different levels of PD. The size of the circle is proportional to the study weight under the fixed-effects model assumptions.

Model F15. SEM Mediation Model Fit Indices Using a Correlation Matrix with Fixed Effects Weights at Three Different Sample Sizes (Hypothesis 5)

Table F1

Fit Indices for Structural Models (Using Pooled Correlations Under Fixed-Effects Assumptions)

Fit Indices	Recommended Value	*N* = 44,424	*N* = 3,428	*N* = 132
χ^2/df	≤ 3.00	4.56	292.00	11.16
Goodness-of-fit index (GFI)	≥ 0.90	0.90	0.92	0.92
Adjusted goodness-of-fit index (AGFI)	≥ 0.90	0.52	0.61	0.61
Standardized root mean-square residual (SRMR)	≤ 0.08	.13	0.11	0.11
Root mean-square error of approximation (RMSEA)	≤ 0.06	.29	0.29	0.28
Normalized fit index (NFI)	≥ 0.90	.78	0.84	0.84
Comparative fit index (CFI)	≥ 0.90	.80	0.84	0.85

Note. Recommended values are from Maruyama, 1998.

Appendix G

Previous TPB Meta-analyses

Author(s), year	Behavior Context	Examined PBC Interactions	Examined Influence of Behavior Type	Examined Influence of PBC Measures	RE or FE	*k* *N*	Univariate or Multivariate Analyses
Primary Purpose: Summarize Previous Literature to Test the Overall Efficacy/Predictive Utility of TPB							
Albarracin et al., 2001	Condom use	No	Yes	No	FE	*k* = 42 *N* = 13,991	Path analysis
Armitage & Conner, 2001	NA	No	No	Yes	FE	*k* = 185 *N* = NR	Univariate
Cooke & French, 2008	Attend screening programs	No	Yes	No	FE	*k* = 25 *N* = 10,746	Univariate
Downs & Hausenblas, 2005	Exercise behavior	No	No	Yes	RE	*k* = 83 *N* = NR	Multiple regression
Hagger et al., 2002[1]	Physical activity	No	No	Yes	RE	*k* = 49 *N* = 16,732	Path analysis
Hausenblas et al., 1997	Exercise behavior	No	No	No	FE	*k* = 10 *N* = NR	Univariate
McEachan et al., 2011[1]	Health behavior	No	Yes	No	RE	*k* = 206 *N* = 68,571	Multiple regression
Notani, 1998	NA	No	Yes	No	FE	*k* = 63 *N* = NR	Path analysis
Sheeran & Taylor, 1999	Condom use	No	No	No	FE	*k* = 24 *N* = 6,631	Univariate
Topa & Moriano, 2010	Smoking	No	No	No	FE	*k* = 35 *N* = 267,977	Path analysis

Author(s), year	Behavior Context	Examined PBC Interactions	Examined Influence of Behavior Type	Examined Influence of PBC Measures	RE or FE	*k* *N*	Univariate or Multivariate Analyses
Primary Purpose: Provide Empirical Support for the Inclusion of New Variables in the TPB							
Hagger & Chatzisarantis, 2009[1]	Health behavior	No	Yes	No	RE	*k* = 24 *N* = 5,708	Path analysis
Manning, 2009[1]	NA	No	Yes	No	RE	*k* = 159 *N* = NR	Path analysis
Rise et al., 2010[1]	NA	No	No	No	RE	*k* = 40 *N* = 11,607	Multiple regression
Rivas et al., 2009	NA	No	No	No	FE	*k* = 27 *N* = 8,793	Multiple regression
Rivis & Sheeran, 2003	Health Behavior	No	Yes	No	FE	*k* = 14 *N* = 5,810	Multiple regression
Sandberg & Conner, 2008	NA	No	No	No	RE	*k* = 24 *N* = 10,805	Multiple regression
Primary Purpose: Increase Power to Detect PBC Interaction Effects							
Boudewyns, 2013	NA	Yes	Yes	Yes	RE	*k* = 154 *N* = 44,424	Multiple regression and path analysis

Note. *k* = number of individual studies that contributed effect sizes related to PBC-INT; *N* = aggregate sample size; NR = not reported; RE = random-effects model; FE = fixed-effects model; NA = not applicable. This indicates that the meta-analysis did not restrict the studies to be in a specific behavior context.

[1] Corrected for measurement error

References

References marked with an asterisk indicate studies included in the meta-analysis.

*Abraham, C., Clift, S., & Grabowski, P. (1999). Cognitive predictors of adherence to malaria prophylaxis regimens on return from a malarious region: A prospective study. *Social Science & Medicine, 48,* 1641-1654. doi:10.1016/S0277-9536(98)00455-9

Abramson, L. Y., Seligman, M. E., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology, 87*, 49–74.

Aguinis, H. (1995). Statistical power problems with moderated multiple regression in management research. *Journal of Management*, *21*, 1141-1158. doi:10.1016/0149-2063(95)90026-8

Aguinis, H., & Stone-Romero, E. F. (1997). Methodological artifacts in moderated multiple regression and their effects on statistical power. *Journal of Applied Psychology, 82*, 192–206. doi:10.1037/0021-9010.82.1.192

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

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11- 39). Heidelberg, Germany: Springer.

Ajzen, I. (1988). *Attitudes, personality, and behavior.* Chicago, IL: Dorsey Press.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211. doi:10.1016/0749-5978(91)90020-T

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 32,* 665–683. doi:10.1111/j.1559-1816.2002.tb00236.x

Ajzen, I. (2006a). Constructing a TPB questionnaire: Conceptual and methodological considerations. Retrieved from *http://people.umass.edu/aizen/pdf/tpb.measurement.pdf*

Ajzen, I. (2006b), Behavioral interventions based on the theory of planned behavior. Retrieved from *http://people.umass.edu/aizen/pdf/tpb.intervention.pdf*

Ajzen, I. (2011). The theory of planned behavior. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology: Vol. 1.* (pp.438–469).

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin, 84,* 888–918. doi:10.1037//0033-2909.84.5.888

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I., & Fishbein, M. (2005). The influence of attitudes on behavior. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.), *The handbook of attitudes* (pp. 173-221). Mahwah, NJ: Erlbaum.

Ajzen, I., & Driver, B. L. (1992). Application of the theory of planned behavior to leisure choice. *Journal of Leisure Research, 24,* 207–224.

Ajzen, I., & Madden, T. J. (1986). Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology, 22,* 453–474. doi:10.1016/0022-1031(86)90045-4

Ajzen, I., & Sexton, J. (1999). Depth of processing, belief congruence, and attitude-behavior correspondence. In S. Chaiken & Y. Trope (Eds.), *Dual process theories in social psychology* (pp. 117–138). New York, NY: Guilford.

Albarracín, D., Johnson, B. T., Fishbein, M., & Muellerleile, P. A. (2001). Theories of reasoned action and planned behavior as models of condom use: A meta-analysis. *Psychological Bulletin, 127,* 142–161. doi:10.1037//0033-2909.127.1.142

*Alexandris, K., Barkoukis, V., & Tsormpatzoudis, C. (2007). Does the theory of planned behavior elements mediate the relationship between perceived constraints and intention to participate in physical activities? A study among older individuals. *European Review of Aging and Physical Activity, 4,* 39–48. doi:10.1007/s11556-007-0014-1

Allport, G.W. (1935). Attitudes. In C. Murchison (Ed.), *Handbook of social psychology*. Worcester, MA: Clark University Press.

Aloe, A. M., & Becker, B. J. (2012). An effect size for regression predictors in meta-analysis. *Journal of Educational and Behavioral Statistics, 37*, 278–297. doi:10.3102/1076998610396901

Anker, A. E., Reinhart, A. M., & Feeley, T. H. (2010). Meta-analysis of meta-analyses in communication: comparing fixed-and random-effects models. *Communication Quarterly, 58,* 257–278. doi:10.1080/01463373.2010.503154

*Armitage, C.J. (2005). Can the theory of planned behavior predict the maintenance of physical activity? *Health Psychology, 24,* 235–245. doi:10.1037/0278-6133.24.3.235

*Armitage, C. J., & Conner, M. (1999). Distinguishing perceptions of control from self-efficacy: Predicting consumption of a low-fat diet using the theory of planned behavior. *Journal of Applied Social Psychology, 29*, 72–90. doi:10.1111/j.1559-1816.1999.tb01375.x

Armitage, C. J., & Conner, M. (2001a). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology, 40*, 471–499. doi:10.1348/014466601164939

*Armitage, C. J., & Conner, M. (2001b). Social cognitive determinants of blood donation. *Journal of Applied Social Psychology, 31*, 1431–1457. doi:10.1111/j.1559-1816.2001.tb02681.x

*Armitage, C. J., Norman, P., & Conner, M. (2002). Can the theory of planned behaviour mediate the effects of age, gender and multidimensional health locus of control? *British Journal of Health Psychology, 7*, 299–316. doi:10.1348/135910702760213698

Arnold, H. J., & Evans, M. G. (1979). Testing multiplicative models does not require ratio scales. *Organizational Behavior and Human Performance, 24*, 41–59. doi:10.1016/0030-5073(79)90014-X

*Arnold, H. J., Loan-Clarke, J., Coombs, C., Wilkinson, A., Park, J., & Preston, D. (2006). How well can the theory of planned behavior account for occupational intentions? *Journal of Vocational Behavior, 69*, 374–390. doi:10.1016/j.jvb.2006.07.006

Asch, S. E. (1951). Interpersonal influence: Effects of group pressure upon the modification and distortion of judgments. In H. Guetzkow (Ed.). *Groups, leadership, and men* (pp. 177–190). Pitsburgh, PA: Carnegie Press.

*Astrom, A. N. (2004). Validity of cognitive predictors of adolescent sugar snack consumption. *American Journal of Health Behavior, 28*, 112–121. doi:10.5993/AJHB.28.2.2

*Astrom, A. N., & Mwangosi, I. E. (2000). Teachers' intention to provide dietary counseling to Tanzanian primary schools. *American Journal of Health Behavior, 24,* 281–289. doi:10.5993/AJHB.24.4.4

*Astrom, A. N., & Rise, J. (2001).Young adults' intention to eat healthy food. *Psychology & Health, 16*, 223–237. doi:10.1080/08870440108405501

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191–215. doi:10.1037//0033-295X.84.2.191

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44,* 1175-1184. doi:10.1037//0003-066X.44.9.1175

Bandura, A. (1992). A social cognitive approach to the exercise of control over AIDS infection. In R. J. DiClemente (Ed.), *Adolescents and AIDS: A generation in jeopardy* (pp. 89-116). Newbury Park, CA: Sage.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman & Co.

Bandura, A. (2000). Exercise of human agency through collective efficacy. *Current Directions in Psychological Science,* 9, 75-78.

Bandura, A. (2001). Social cognitive theory of mass communication. *Media Psychology, 3,* 265–299. doi:10.1207/S1532785XMEP0303_03

Bansal, H. S., & Taylor, S. F. (2002). Investigating interactive effects in the theory of planned behavior in a service-provider switching context. *Psychology & Marketing, 19*, 407–425. doi:10.1002/mar.10017

*Bebetsos, E., Chroni, S., & Theodorakis, Y. (2002). Physically active students' intentions and self-efficacy towards healthy eating. *Psychological Reports, 91,* 485–495. doi:10.2466/pr0.2002.91.2.485

Becker, B. J. (2000). Multivariate meta-analysis. In H. E. A. Tinsley & S. D. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modeling* (pp. 499–525). San Diego, CA: Academic Press.

Bentler, P M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107,* 238-246. doi:10.1037//0033-2909.107.2.238

Birnbaum, M. H. (1973). The devil rides again: Correlations as an index of fit. *Psychological Bulletin, 79,* 239–242. doi:10.1037/h0033853

*Bish, A., Sutton, S., & Golombok, S. (2000). Predicting uptake of a routine cervical smear test: A comparison of the health belief model and the theory of planned behavior. *Psychology & Health*, *15,* 35–50. doi:10.1080/08870440008400287

*Blanchard, C. M., Courneya, K. S., Rodgers, W. M., Daub, B., & Knapik, G. (2002). Determinants of exercise intention and behavior during and after phase 2 cardiac rehabilitation: An application of the theory of planned behavior. *Rehabilitation Psychology*, *47,* 308–323. doi:10.1037//0090-5550.47.3.308

*Blanchard, C. M., Courneya, K. S., Rodgers, W. M., Fraser, S. N., Murray, T. C., Daub, B., & Black, B. (2003). Is the theory of planned behavior a useful framework for understanding exercise adherence during phase II cardiac rehabilitation? *Journal* *of Cardiopulmonary Rehabilitation*, *23,* 29–39. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12576910

*Blanchard, C. M., Courneya, K. S., Rodgers, W. M., & Murnaghan, D. M. (2002). Determinants of exercise intention and behavior in survivors of breast and prostate cancer: An application of the theory of planned behavior. *Cancer Nursing, 25,* 88–95. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=ovfte&AN=00002820-200204000-00002

*Blanchard, C. M., Rhodes, R. E., Nehl, E., Fisher, J., Sparling, P., & Courneya, K. S. (2003). Ethnicity and the theory of planned behavior in the exercise domain. *American Journal of Health Behavior*, *27,* 579–591. doi:10.5993/AJHB.27.6.1

*Blue, C. L., & Marrero, D. G. (2006). Psychometric properties of the healthful eating belief scales for persons at risk of diabetes. *Journal of Nutrition Education and Behavior, 38,* 134–142. doi:10.1016/j.jneb.2006.01.010

*Bogers, R. P., Brug, J., van Assema, P., & Dagnelie, P. C. (2004). Explaining fruit and vegetable consumption: The theory of planned behaviour and misconception of personal intake levels. *Appetite, 42,* 157–166. doi:10.1016/j.appet.2003.08.015

Bollen, K. A. (1989). *Structural equations with latent variables*. New York, NY: Wiley.

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2005). *Comprehensive meta-analysis version 2*. Englewood Cliffs, NJ: Biostat.

Borland, R. (2010). Habits and temporality: A commentary on Hall and Fong's temporal self-regulation theory. *Health Psychology Review*, *4*, 66-69. doi:10.1080/17437191003700816

*Bosnjak, M., Tuten, T. L., & Wittmann, W. W. (2005). Unit (non)response in Web-based access panel surveys: An extended planned-behavior approach. *Psychology and Marketing, 22,* 489–505. doi:10.1002/mar.20070

Boudewyns, V. (2008). Understanding the predictive power of the normative component in the theory of planned behavior (Unpublished master's thesis). University of Minnesota, Minneapolis, MN.

Boudewyns, V. (2010). [Perceptions of health]. Unpublished raw data.

Boudewyns, V., & Paquin, R. S. (2011). Intentions and beliefs about getting tested for STDs: Implications for communication interventions, *Health Communication, 26,* 701-711. doi:10.1080/10410236.2011.563353

Boudewyns, V., Paquin, R. S., & Yzer, M. C. (2007, August). *Experimental evidence that self-efficacy moderates attitudinal effects on intention.* Paper presented at the annual conference of the Association for Education in Journalism and Mass Communication, Washington, D.C.

*Bozionelos, G., & Bennett, P. (1999). The theory of planned behavior as predictor of exercise. *Journal of Health Psychology, 4,* 517–529. doi:10.1177/135910539900400406

*Braithwaite, D., Sutton, S., & Steggles, N. (2002). Intention to participate in predictive genetic testing for hereditary cancer: The role of attitude toward uncertainty. *Psychology and Health, 17*, 761–772. doi:10.1080/0887044021000054764

*Brenes, G. A., Strube, M. J., & Storandt, M. (1998). An application of the theory of planned behavior to exercise among older adults. *Journal of Applied Social Psychology, 28*, 2274–2290. doi:10.1111/j.1559-1816.1998.tb01371.x

*Brickell, T. A., Chatzisarantis, N. L. D., & Pretty, G. M. (2006). Autonomy and control: Augmenting the validity of the theory of planned behaviour in predicting exercise. *Journal of Health Psychology, 11,* 51–63. doi:10.1177/1359105306058847

*Broadhead-Fearn, D., & White, K. M. (2006). The role of self-efficacy in predicting rule-following behaviors in shelters for homeless youth: A test of the theory of planned behavior. *Journal of Social Psychology, 146,* 307–325. doi:10.3200/SOCP.146.3.307-325

*Brug, J., de Vet, E., de Nooijer, J., & Verplanken, B. (2006). Predicting fruit consumption: Cognitions, intention, and habits. *Journal of Nutrition Education and Behavior, 38,* 73–81. doi:10.1016/j.jneb.2005.11.027

*Burak, L.J., & Vian, T. (2007). Examining and predicting under the table payments for health care in Albania: An application of the Theory of planned behavior. *Journal of Applied Social Psychology, 37,* 1060–1076. doi:10.1111/j.1559-1816.2007.00199.x

Busemeyer, J. R., & Jones, L. E. (1983). Analysis of multiplicative combination rules when causal variables are measured with error. *Psychological Bulletin, 93,* 549–562. doi:10.1037//0033-2909.93.3.549

Bushman, B. J., & Wang, M. C. (2009). Vote-counting procedures in meta-analysis. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (2nd ed., pp. 207–220). New York, NY: Sage.

*Byrne, C. A., & Arias, I. (2004). Predicting women's intentions to leave abusive relationships: An application of the theory of planned behavior. *Journal of Applied Social Psychology, 34,* 2586–2601. doi:10.1111/j.1559-

1816.2004.tb01993.x

*Caperchione, C., & Mummery, K. (2007). Psychosocial mediators of group cohesion on physical activity intention of older adults. *Psychology, Health & Medicine, 12*, 81–93. doi:10.1080/13548500600768254

Cappella, J. N. (2006). Integrating message effects and behavior change theories: Organizing comments and unanswered questions. *Journal of Communication, 56(Suppl.),* S265–S279. doi:10.1111/j.1460-2466.2006.00293.x

Card, N. A. (2012). *Applied meta-analysis for social science research*. New York, NY: Guilford Press.

Carver, C., Scheier, M., & Weintraub, J. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, *56*, 267–283. doi:10.1037//0022-3514.56.2.267

Champoux, J. E., & Peters, W. S. (1987). Form, effect size, and power in moderated regression. *Journal of Occupational Psychology*, *60*, 243–255. doi:10.1111/j.2044-8325.1987.tb00257.x

Chaplin, W. F. (1991). The next generation in moderation research in personality psychology. *Journal of Personality, 59,* 143–178. doi:10.1111/j.1467-6494.1991.tb00772.x

*Chatzisarantis, N. L. D., & Hagger, M. S. (2005). Effects of a brief intervention based on the theory of planned behavior on leisure-time physical activity participation. *Journal of Sport & Exercise Psychology*, *27,* 470–487. Retrieved from http://www.cabdirect.org/abstracts/20063003015.html;jsessionid=473F2E1F0C52971308CE3F352BE2D304

*Chatzisarantis, N. L. D., & Hagger, M. S. (2007). Mindfulness and the intention-behavior relationship within the theory of planned behavior. *Personality and Social Psychology Bulletin, 33,* 663–667. doi:10.1177/0146167206297401

*Chatzisarantis, N. L. D., Hagger, M. S., Smith, B., & Phoenix, C. (2004). The influences of continuation intentions on execution of social behaviour within the theory of planned behaviour. *British Journal of Social Psychology, 43,*551–583. doi:10.1348/0144666042565399

Cheung, S. F. (2000). Examining solutions to two practical issues in meta-analysis: Dependent correlations and missing data in correlation matrices. *Dissertation Abstracts International: Section B. Science and Engineering, 61*(8), 4469.

*Christian, J., & Abrams, D. (2003). The effects of social identification, norms and attitudes on use of outreach services by homeless people. *Journal of Community & Applied Social Psychology, 13,* 138–157. doi:10.1002/casp.719

*Christian, J., & Abrams, D. (2004). A tale of two cities: Predicting homeless people's uptake of outreach programs in London and New York. *Basic and Applied Social Psychology, 26*, 169–182. doi:10.1080/01973533.2004.9646403

*Christian, J., & Armitage, C. J. (2002). Attitudes and intentions of homeless people toward service provision in South Wales. *British Journal of Social Psychology, 41,* 219–231. doi:10.1348/014466602760060101

*Christian, J., Armitage, C. J., & Abrams, D. (2003). Predicting uptake of housing services: The role of self-categorization in the theory of planned behaviour. *Current Psychology, 22,* 206–217. doi:10.1007/s12144-003-1017-3

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and*

Psychological Measurement, 20, 37–46. doi:10.1177/001316446002000104

Cohen, J. (1978). Partialled products are interactions: Partialled powers are curve components. *Psychological Bulletin, 85,* 858–866. doi:10.1037/0033-2909.85.4.858

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillside, NJ: Erlbaum.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*, 155–159. doi:10.1037//0033-2909.112.1.155

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Combs, J. G., Ketchen, D. J., Crook, T. R., & Roth, P. L. (2011). Assessing cumulative evidence within 'Macro' research: Why meta-analysis should be preferred over vote counting. *Journal of Management Studies, 48*, 178-197. doi:10.1111/j.1467-6486.2009.00899.x

*Conner, M., & Abraham, C. (2001). Conscientiousness and the theory of planned behavior: Toward a more complete model of the antecedents of intentions and behavior. *Personality and Social Psychology Bulletin, 27,* 1547–1561. doi:0.1177/01461672012711014

*Conner, M., & Flesch, D. (2001). Having casual sex: Additive and interactive effects of alcohol and condom availability on the determinants of intentions. *Journal of Applied Social Psychology, 31,* 89–112. doi:10.1111/j.1559-1816.2001.tb02484.x

Conner, M., & McMillan, B. (1999). Interaction effects in the theory of planned behaviour: Studying cannabis use. *British Journal of Social Psychology, 38*, 195–222. doi:10.1348/014466699164121

Conner, M., & Norman, P., (2005). *Predicting health behaviour.* Maidenhead: Open University Press.

*Conner, M., Norman, P., & Bell, R. (2002). The theory of planned behavior and healthy eating. *Health Psychology, 21,* 194–201. doi:10.1037/0278-6133.21.2.194

*Conner, M., Sandberg, T., McMillan, B., & Higgins, A. (2006). Role of anticipated regret, intentions and intention stability in adolescent smoking initiation. *British Journal of Health Psychology, 11*, 85–101. doi:10.1348/135910705X40997

*Conner, M., Sheeran, P., Norman, P., & Armitage, C. J. (2000). Temporal stability as a moderator of relationships in the theory of planned behaviour. *British Journal of Social Psychology, 39*, 469–493. doi:10.1348/014466600164598

*Conner, M., Warren, R., Close, S., & Sparks, P. (1999). Alcohol consumption and theory of planned behavior: An examination of the cognitive mediation of past behavior. *Journal of Applied Social Psychology, 29,* 1676–1704. doi:10.1111/j.1559-1816.1999.tb02046.

Cooke, R., & Sheeran, P. (2004). Moderation of cognition-intention and cognition-behavior relations: A meta-analysis of properties of variables from the theory of planned behavior. *British Journal of Social Psychology, 43,* 159–186. doi:10.1348/0144666041501688

Cooper, H. (1997). Some finer points in meta-analysis. In M. Hunt (Ed.), *How science takes stock: The story of meta-analysis* (pp. 169-181). New York, NY: Sage.

Cooper, H. (2009). Hypotheses and problems in research synthesis. In H. Cooper, L. V.

Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (2nd ed., pp. 19–36). New York, NY: Sage.

Cooper, H., & Hedges, L. V. (2009). Research synthesis as a scientific process. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (2nd ed., pp. 3–16). New York, NY: Sage.

Cordano, M., & Frieze, I. H. (2000). Pollution reduction preferences of U. S. environmental managers: Applying Ajzen's theory of planned behavior. *Academy of Management Journal, 43,* 627–641. doi:10.2307/1556358

Cortina, J. M. (1993). Interaction, nonlinearity, and multicollinearity: Implications for multiple regression. *Journal of Management, 19,* 915–922.

*Courneya, K. S., Blanchard, C. M., & Laing, D. M. (2001). Exercise adherence in breast cancer survivors training for a dragon boat competition: A preliminary investigation. *Psycho-Oncology, 10,* 444–452. doi:10.1002/pon.524

*Courneya, K. S., & Bobick, T. M. (2000). Integrating the theory of planned behavior with the processes and stages of change in the exercise domain. *Psychology of Sport and Exercise, 1,* 41–56. doi:10.1016/S1469-0292(00)00006-6

*Courneya, K. S., Bobick, T. M., & Schinke, R. J. (1999). Does the theory of planned behavior mediate the relationship between personality and exercise behavior? *Basic and Applied Social Psychology, 21,* 317–324. doi:10.1207/S15324834BASP2104_5

*Courneya, K. S., & Friedenreich, C. M. (1999). Utility of the theory of planned behavior for understanding exercise during breast cancer treatment. *Psycho-Oncology, 8,* 112–122. doi:10.1002/(SICI)1099-1611(199903

*Courneya, K. S., Friedenreich, C. M., Arthur, K., & Bobick, T. M. (1999). Understanding exercise motivation in colorectal cancer patients. A prospective study using the theory of planned behavior. *Rehabilitation Psychology, 44,* 68–84. doi:10.1037/0090-5550.44.1.68

*Courneya, K. S., Keats, M. R., & Turner, A. R. (2000). Social cognitive determinants of hospital-based exercise in cancer patients following high-dose chemotherapy and bone marrow transplantation. *International Journal of Behavioral Medicine, 7,* 189–203. doi:10.1207/S15327558IJBM0703_01

*Courneya, K. S., Plotnikoff, R. C., Hotz, S. B., & Birkett, N. J. (2000). Social support and the theory of planned behavior in the exercise domain. *American Journal of Health Behavior*, *24*, 300–308. doi:10.5993/AJHB.24.4.6

*Courneya, K. S., Vallance, J. K. H., Jones, L. W., & Reiman, T. (2005). Correlates of exercise intentions in non-Hodgkin's lymphoma survivors: An application of the theory of planned behavior. *Journal of Sport & Exercise Psychology*, 27, 335–349. Retrieved from http://journals.humankinetics.com/jsep-back-issues/JSEPVolume27Issue3September/CorrelatesofExerciseIntentionsinNonHodgkinsLymphomaSurvivorsAnApplicationoftheTheoryofPlannedBehavior

Cusson, R. (1985). Attitudes toward breast-feeding among female high-school students. *Pediatric Nursing, 11*(3), 189–191.

*Davis, L. E., Ajzen, I., Saunders, J., & Williams, T. (2002). The decision of African American students to complete high school: An application of the theory of planned behavior. *Journal of Educational Psychology*, *94,* 810–819. doi:10.1037/0022-0663.94.4.810

*De Bruijn, G., Kremers, S. P. J., De Vet, E., De Nooijer, J., Van Mechelen, W., & Brug, J. (2007). Does habit strength moderate the intention-behavior relationship in the theory of planned behavior? The case of fruit consumption. *Psychology & Health, 22,* 899–916. doi:10.1080/14768320601176113

*De Bruijn, G., Kremers, S. P. J., De Vries, H., Van Mechelen, W., & Brug, J. (2007). Associations of social-environment and individual-level factors with adolescent soft drink consumption. *Health Education Research,* 22, 227–237. doi:10.1093/her/cyl066

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

De Fleur, M. L., & Westie, F. R. (1958). Verbal attitudes and overt actions: An experiment on the salience of attitudes. *American Sociological Review, 23,* 667–673.

Deutsch, M., & Gerard, H. B. (1955). A study of normative and informational social influences upon individual judgment. *Journal of Abnormal and Social Psychology, 51*, 629–636. doi:10.1037/h0046408

Dillard, J. P. (2011). An application of the integrative model to women's intention to be vaccinated against HPV: Implications for message design. *Health Communication, 26,* 479–486. doi:10.1348/014466699164121

DiIorio C, Dudley WN, Soet J, Watkins J, Maibach E. (2000). A social cognitive-based model for condom use among college students. *Nursing Research, 49*(4), 208-14.

*Dodgson, J. E., Henly, S. J., Duckett, L., & Tarrant, M. (2003). Theory of planned behavior-based models for breastfeeding duration among Hong Kong mothers.

Nursing Research, 52, 148–158. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=ovftf&AN=00006199-200305000-00004

*Downs, D. S. (2006). Understanding exercise intention in an ethnically diverse sample of postpartum women. *Journal of Sport & Exercise Psychology*, *28*, 159–170. Retrieved from http://www.cabdirect.org/abstracts/20063115125.html

*Downs, D. S., & Hausenblas, H. A. (2003). Exercising for two: Examining pregnant women's second trimester exercise intention and behavior using the framework of the theory of planned behavior. *Women's Health Issues*, *13*, 222–228. doi:10.1016/j.whi.2003.09.004

Downs, D. S., & Hausenblas, H. A. (2005). The theories of reasoned action and planned behavior applied to exercise: A meta-analytic update. *Journal of Physical Activity and Health*, *2*, 76–97. doi:10.1080/10413200591010111

*Drossaert, C. H. C., Boer, H., & Seydel, E. R. (2003). Prospective study on the determinants of repeat attendance and attendance patterns in breast cancer screening using the theory of planned behaviour. *Psychology and Health*, *18*, 551–564. doi:10.1080/0887044031000141207

*Duckett, L., Henly, S., Avery, M., Potter, S., Hills-Bonczyk, S., Hulden, R., & Savik, K. (1998). A theory of planned behavior-based structural model for breast-feeding. *Nursing Research*, *47*, 325–336. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=ovftf&AN=00006199-200305000-00004

Dulany, D. E. (1961). Hypotheses and habits in verbal "operant conditioning." *Journal of*

Abnormal and Social Psychology, 63, 251–263. doi:10.1037/h0047703

Dulany, D. E. (1968). Awareness, rules, and propositional control: A confrontation with S-R behavior theory. In T. R. Dixon & D. C. Horton (Eds.), *Verbal behavior and general behavior theory* (pp. 340-387). New York, NY: Prentice Hall.

*Elliott, M. A., Armitage, C. J., & Baughan, C. J. (2003). Drivers' compliance with speed limits: An application of the theory of planned behavior. *Journal of Applied Social Psychology*, *88,* 964–972. doi:10.1037/0021-9010.88.5.964

*Elliott, M. A., Armitage, C. J., & Baughan, C. J. (2007). Using the theory of planned behaviour to predict observed driving behaviour. *British Journal of Social Psychology, 46,* 69–90. doi:10.1348/014466605X90801

Evans, M. G. (1985). A Monte Carlo study of the effects of correlated method variance in moderated multiple regression analysis. *Organizational Behavior and Human Decision Processes*, *36*, 305–323. doi:10.1016/0749-5978(85)90002-0

Festinger, L. A. (1954). A theory of social comparison processes. *Human Relations, 7,* 117-140. doi:10.1177/001872675400700202

Field, A. P. (2001). Meta-analysis of correlation coefficients: A Monte Carlo comparison of fixed- and random-effects methods. *Psychological Methods, 6,* 161–180. doi:10.1037//1082-989X.6.2.161

Field, A. P. & Gillett, R. (2010). How to do meta-analysis. *British Journal of Mathematical and Statistical Psychology*, *63,* 665-94. doi: 10.1348/000711010X502733

Fink, E. L. (2009). The FAQs on data transformation. *Communication Monographs, 76,* 379–397. doi:10.1080/03637750903310352

Fishbein, M. (1966). The relationships between beliefs, attitudes, and behavior. In S. Feldmann (Ed.), *Cognitive consistencey: Motivational antecedents and behavioral consequents* (pp. 199–233). New York, NY: Academic Press.

Fishbein, M. (1967). A consideration of beliefs and their role in attitude measurement. In M. Fishbein (Ed.), *Readings in attitude theory and measurement* (pp. 477–492). New York, NY: Wiley.

Fishbein, M. (2000). The role of theory in HIV prevention. *AIDS Care, 12,* 273–278. doi:10.1080/09540120050042918

Fishbein, M., & Ajzen, I. (1974). Attitudes towards objects as predictors of single and multiple behavioral criteria. *Psychological Review, 81,* 59–74. doi:10.1037/h0035872

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Fishbein, M., & Ajzen. I. (2010). *Predicting and changing behavior: The reasoned action approach.* New York, NY: Psychology Press.

Fishbein, M., & Cappella, J. N. (2006). The role of theory in developing effective health communications. *Journal of Communication, 56* (*Suppl*.), S1–S17. doi:10.1111/j.1460-2466.2006.00280.x

Fishbein, M., & Yzer, M. C. (2003). Using theory to develop effective health behavior interventions. *Communication Theory, 13*, 164–183. doi:10.1093/ct/13.2.164

Fisher, R. A. (1928). *Statistical methods for research workers* (2nd ed.). London, UK: Oliver & Boyd.

Franken, R. E. (1994). *Human Motivation*. Belmont, CA: Brooks/Cole Publishing.

French, J. R. P., Jr., & Raven, B. (1959). The bases of social power. In D. Cartwright (Ed.), *Studies in social power* (pp. 150–167). Ann Arbor: University of Michigan Press.

Furlow, C. F. (2003). *Meta-analytic methods of pooling correlation matrices for structural equation modeling under different patterns of missing data* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 305295912)

*Galea, M. N., & Bray, S. R. (2006). Predicting walking intentions and exercise in individuals with intermittent claudication: An application of the theory of planned behavior. *Rehabilitation Psychology*, *51*, 299–305. doi:10.1037/0090-5550.51.4.299

*Giles, M., & Cairns, E. (1996). Church attendance in Northern Ireland: Catholics and Protestants compared. *Journal of Community and Applied Social Psychology, 6,* 299–305. Doi:10.1002/(SICI)1099-1298(199610)6:4<299::AID-CASP379>3.0.CO;2-E

*Giles, M., & Lamoure, S. (2000). The theory of planned behavior: A conceptual framework to view career development of women. *Journal of Applied Social Psychology, 30*, 2137–2157. doi:10.1111/j.1559-1816.2000.tb02429.x

*Giles, M., McClenahan, C., & Cairns, E., & Mallet, J. (2004). An application of the theory of planned behaviour to blood donation: The importance of self-efficacy. *Health Education Research, 19,* 380–391. doi:10.1093/her/cyg063

Greenhouse, J. B., & Iyengar, S. (2009). Sensitivity analysis and diagnosis. . In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research* *synthesis and meta-analysis* (2nd ed., pp. 417–433). New York, NY: Sage.

*Greenslade, J. H., & White, K. M. (2005). The prediction of above-average participation in volunteerism: A test of the theory of planned behaviour and the volunteers functions inventory. *Journal of Social Psychology, 145*, 155–172. doi:00224545

*Gretebeck, K. A., Black, D. R., Blue, C. L., Glickman, L. T., Huston, S. A., Gretebeck, R. J. (2007). Physical activity and function in older adults: Theory of planned behavior. *American Journal of Health Behavior, 31*, 203–214. doi:10.5993/AJHB.31.2.9

Hafdahl, A. R. (2001). *Multivariate meta-analysis for exploratory factor analytic research*. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 251408097)

Hagger, M. S., Chatzisarantis, N. L., Barkoukis, V., Wang, C. K., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. *Journal of Educational Psychology, 97*, 376–390. doi:10.1037/0022-0663.97.3.376

Hagger, M. S., & Chatzisarantis, N. L. D. (2009). Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta- analysis. *British Journal of Health Psychology, 14,* 275–302. doi:10.1348/135910708X373959

*Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, J. C. K., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model.

Journal of Educational Psychology, 97, 376–390. doi:10.1037/0022-0663.97.3.376

Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *Journal of Sport & Exercise Psychology, 24,* 3–32. Retrieved from http://journals.humankinetics.com/JSEP

*Hagger, M. S., Chartzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior. *Journal of Educational Psychology*, *95*, 784–795. doi:10.1037/0022-0663.95.4.784

Hankins, M., French, D., & Horne, R. (2000). **S**tatistical guidelines for studies of the theory of reasoned action and the theory of planned behaviour. *Psychology & Health*, *15*, 151–161. doi:10.1080/08870440008400297

*Harland, P., Staats, H., & Wilke, H. A. M. (1999). Explaining proenvironmental intention and behavior by personal norms and the theory of planned behavior. *Journal of Applied Social Psychology, 29,* 2505–2528. doi:10.1111/j.1559-1816.1999.tb00123.x

Hausenblas, H. A., Carron, A. V., & Mack, D. E. (1997). Application of the theories of reasoned action and planned behavior to exercise behavior: A meta- analysis. *Journal of Sport & Exercise Psychology, 19,* 36–51. Retrieved from http://journals.humankinetics.com/JSEP

*Hausenblas, H. A., & Downs, D. S. (2004). Prospective examination of the theory of planned behavior applied to exercise behavior during women's first trimester of pregnancy. *Journal of Reproductive and Infant Psychology, 22*, 199–210. doi:10.1080/02646830410001723788

Hedges, L. V. (1994). Statistical considerations. In H. Cooper & L.V. Hedges (Eds.), *The handbook of research synthesis* (pp. 357-381). New York, NY: Sage.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. Orlando, FL: Academic Press.

Hedges, L. V., & Vevea, J. L. (1998). Fixed- and random-effects models in meta-analysis. *Psychological Methods, 3,* 486-504. doi:10.1037//1082-989X.3.4.486

Hennessy, M., Bleakley, A. & Fishbein, M. (2012). Measurement model for reasoned action theory. *The Annals of the American Academy of Political and Social Science, 640,* 42-57. doi:10.1177/0002716211424709

*Higgins, A., & Conner, M. (2003). Understanding adolescent smoking: The role of the theory of planned behaviour and implementation intentions. *Psychology, Health, & Medicine, 8,* 173–186. doi:10.1080/1354850031000087555

*Hill, M., Mann, L., & Wearing, A. J. (1996). The effects of attitude, subjective norm and self-efficacy on intention to benchmark: A comparison between managers with experience and no experience in benchmarking. *Journal of Organizational Behavior, 17,* 313–327. doi:10.1002/(SICI)1099-1379(199607)17:4<313::AID-JOB753>3.0.CO;2-X

Hovland, C. I. (1959). Reconciling conflicting results derived from experimental and survey studies of attitude change. *American psychologist*, *14,* 8–17. doi:10.1037/h0042210

Hoyle, R. H. & Panter, A. T. (1995). Writing about structural equation models. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, Issues and applications* (pp. 158-176). Thousand Oaks, CA: Sage.

*Hsu, M., & Kuo, F. (2003). An investigation of volitional control in information ethics. *Behaviour & Information Technology, 22,* 53–62. doi:10.1080/01449290301781

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6,* 1-55. doi:10.1080/10705519909540118

Hu, L., Bentler, P. M., & Kano, Y. (1992). Can test statistics in covariance structure analysis be trusted? *Psychological Bulletin, 112,* 351-362. doi:10.1037//0033-2909.112.2.351

*Hunt-Shanks, T. T., Blanchard, C. M., Baker, F., Hann, D., Roberts, C. S., McDonald, J., . . . Kaw, O. C. (2006). Exercise use as complementary therapy among breast and prostate cancer survivors receiving active treatment: Examination of exercise intention. *Integrative Cancer Therapy, 5,* 109–116. doi:10.1177/1534735406288742

Hunter, J., & Schmidt, F. L. (1990). *Methods of meta-analysis: Correcting error and bias in research findings.* Newbury Park, CA: Sage.

Hunter, J. E., & Schmidt, F. L. (2004). *Methods of meta-analysis: Correcting error and bias in research findings* (2nd ed.). Thousand Oaks, CA: Sage.

Hunter, J. E., Schmidt, F. L., & Jackson, G. B. (1982). *Meta-analysis: Cumulating research findings across studies.* Beverly Hills, CA: Sage.

*Hynie, M., MacDonald, T. K., & Marques, S. (2006). Self-conscious emotions and self-regulation in the promotion of condom use. *Personality and Social Psychology Bulletin, 32,* 1072–1084. doi:10.1177/0146167206288060

Jemmott, J. B., & Jemmott, L. S. (2000). HIV behavioral interventions for adolescents in community settings. In J. L. Peterson & R. J. Di Clemente (Eds.), *Handbook of HIV prevention* (pp. 103-127). New York, NY: Kluwer.

*Johnston, K. L., & White, K. M. (2003). Binge-drinking: A test of the role of group norms in the theory of planned behavior. *Psychology & Health, 18,* 63–77. doi:10.1080/0887044021000037835

*Jones, L. W., Courneya, K. S., Vallance, J. K. H., Ladha, A. B., Mant, M. J., Belch, A. R., & Reiman, T. (2006). Understanding the determinants of exercise intentions in multiple myeloma cancer survivors: An application of the theory of planned behavior. *Cancer Nursing, 29,* 167–175. doi:00002820-200605000-00001

*Jones, L. W., Sinclair, R. C., Rhodes, R. E., & Courneya, K. S. (2004). Promoting exercise behavior: An integration of persuasion theories and the theory of planned behavior. *British Journal of Health Psychology, 9,* 505-521. doi:10.1348/1359107042304605

Jöreskog, K., & Sörbom, D. (1993). *LISREL 8: Structural equation modeling with the SIMPLIS command language.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Kanetkar, V., Evans, M. G., Everell, S, A., Irvine, D., & Millman, Z. (1995). The effect of scale changes on meta-analysis of multiplicative and main effects model. *Educational and Psychological Measurement, 55,* 206–224. doi:0.1177/0013164495055002005

Kidwell, B., & Jewell, R. D. (2003). The moderated influence of internal control: An examination across health-related behaviors. *Journal of Consumer Psychology, 13*, 377–386. doi:10.1207/S15327663JCP1304_05

Kim H. Y., & Chung, J. E. (2011). Consumer purchase intentions for organic personal care products. *Journal of Consumer Marketing, 28*, 40–47. doi:10.1108/07363761111101930

Kim, M.-S., & Hunter, J. E. (1993). Attitude–behavior relations: A meta-analysis of attitudinal relevance and topic. *Journal of Communication*, *43*, 101–141. doi:10.1111/j.1460-2466.1993.tb01251.x

*Knussen, C., Yule, F., MacKenzie, J., & Wells, M. (2004). An analysis of intentions to recycle household waste: The roles of past behaviour, perceived habit, and perceived lack of facilities. *Journal of Environmental Psychology, 24*, 237–246. doi:10.1016/j.jenvp.2003.12.001

*Kosma, M., Ellis, R., Cardinal, B. J., Bauer, J. J., & McCubbin, J. A. (2007). The mediating role of intention and stages of change in physical activity among adults with physical disabilities: An integrative framework. *Journal of Sport & Exercise Psychology, 29*, 21–38. Retrieved from http://www.cabdirect.org/abstracts/20073103598.html

Kraft, P., Rise, J., Sutton, S., & Røysamb, E. (2005). Perceived difficulty in the theory of planned behavior: Perceived behavioral control or affective attitude? *British Journal of Social Psychology*, *44*, 479–496. doi:10.1348/014466604X17533

Kraus, S. J. (1995). Attitudes and the prediction of behavior: A meta-analysis of the empirical literature. *Personality and Social Psychology Bulletin 21,* 58–75. doi:10.1177/0146167295211007

Lam, S. -P. (1999). Predicting intentions to conserve water from the theory of planned behavior, perceived moral obligation, and perceived water right. *Journal of Applied Social Psychology, 29*, 1058-1071. doi:10.1111/j.1559-1816.1999.tb00140.x

Langer, E. J. (1975). The illusion of control. *Journal of Personality and Social Psychology*, *32*, 311–328. doi:10.1037//0022-3514.32.2.311

*Latimer, A. E., & Ginis, K. A. M. (2005a). The importance of subjective norms for people who care what others think of them. *Psychology & Health, 20,* 53–62. doi:10.1080/08870440412331300002

*Latimer, A. E., & Ginis, K. A. M. (2005b). The theory of planned behavior in prediction of leisure time physical activity among individuals with spinal cord injury. *Rehabilitation Psychology, 50,* 389–396. doi:10.1037/0090-5550.50.4.389

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping.* New York, NY: Springer.

*Legare, F., Godin, G., Dodin, S., Turcot, L., & Lapierre, L. (2003). Adherence to hormone replacement therapy: A longitudinal study using the theory of planned behaviour. *Psychology and Health, 18,* 351–371. doi:10.1080/0887044031000146824

Lent, R. W., & Hackett, G. (1987). Career self-efficacy: Empirical status and future directions. *Journal of Vocational Behavior*, *30*, 347–382. doi:10.1016/0001-8791(87)90010-8

*Levin, P. F. (1999). Test of the Fishbein and Ajzen models as predictors of health care worker's glove use. *Research in Nursing & Health, 22,* 295–307.

doi:10.1002/(SICI)1098-240X(199908)22:4<295::AID-NUR4>3.0.CO;2-N

Light, R. J., & Smith, P. V. (1971). Accumulating evidence: Procedures for resolving contractions among different research studies. *Harvard Educational Review, 41,* 429-471. doi:10.2307/1169442

Lipsey, M. W. (2009). Identifying interesting variables and analysis opportunities. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (2nd ed.). New York, NY: Russell Sage Foundation.

Lipsey, M. W. & Wilson, D. B. (2001). *Practical meta-analysis.* Thousand Oaks, CA: Sage.

*Louis, W., Davies, S., Smith, J., & Terry, D. (2007). Pizza and pop and the student identity: The role of referent group norms in healthy and unhealthy eating. *Journal of Social Psychology, 147,* 57–74. Retrieved from http://www.tandfonline.com/toc/vsoc20/147/1

*Lowe, R., Eves, F., & Carroll, D. (2002). The influence of affective and instrumental beliefs on exercise intentions and behavior. *Journal of Applied Social Psychology, 32,* 1241–1252. doi:10.1111/j.1559-1816.2002.tb01434.x

Lubinski, D., & Humphreys, L. G. (1990). Assessing spurious “moderator effects”: Illustrated substantively with the hypothesized (“synergistic”) relation between spatial and mathematical ability. *Psychological Bulletin*, *107,* 385–393. doi:10.1037//0033-2909.107.3.385

Manning, M. (2009). The effects of subjective norms on behaviour in the theory of planned behaviour: A meta-analysis. British Journal of Social Psychology, 48, 649–705. doi:10.1348/014466608X393136

Manstead, A. S. R., & van Eekelen, S. A. M. (1998). Distinguishing between perceived behavioral control and self-efficacy in the domain of academic achievement intentions and behaviors. *Journal of Applied Social Psychology,* 28, 1375–92. doi:10.1111/j.1559-1816.1998.tb01682.x

*Martin, J. J., & Kulinna, P. H. (2005). A social cognitive perspective of physical-activity-related behavior in physical education. *Journal of Teaching in Physical Education, 24,* 265–281. Retrieved from http://www.eric.ed.gov/ERICWebPortal/detail?accno=EJ733331

*Martin, J. J., Kulinna, P. H., McCaughtry, N., Cothran, D., Dake, J., & Fahoome, G. (2005). The theory of planned behavior: Predicting physical activity and cardiorespiratory fitness in African American children. *Journal of Sport & Exercise Psychology, 27,* 456–469. Retrieved from http://www.ingenta.com/isis.browsing/TC

Maruyama, G.M. (1997). *Basics of structural equation modeling*. Thousand Oaks, CA: Sage.

*Masalu, J. P., & Astrom, A. N. (2001). Predicting intended and self-perceived sugar restriction among Tanzanian students using the theory of planned behavior. *Journal of Health Psychology, 6,* 435–445. doi:10.1177/135910530100600406

Matt, G. E., & Cook, T. D. (2009). Threats to the validity of generalized inferences. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (2nd ed., pp. 537–556). New York, NY: Sage.

McClelland, G. H., & Judd, C. M. (1993). Statistical difficulties of detecting interactions and moderator effects. *Psychological Bulletin, 114,* 376–390. doi:10.1037//0033-

2909.114.2.376

McEachan, R. R. C., Conner, M., Taylor, N., & Lawton, R. J. (2011). Prospective prediction of health-related behaviors with the theory of planned behavior: A meta-analysis. *Health Psychology Review*, *5*, 97–144. doi:10.1080/17437199.2010.521684

McEachan, R. R. C., Lawton, R. J., & Conner, M. (2010). Classifying health behaviours: Exploring similarities and differences amongst behavior. *British Journal of Health Psychology, 15,* 347–366. doi:10.1348/135910709X466487

*McFarland, L. A., & Ryan, A. M. (2006). Toward an integrated model of applicant faking behavior. *Journal of Applied Social Psychology*, *36,* 979–1016. doi:10.1111/j.0021-9029.2006.00052.x

McMillan, B., & Conner, M. (2003). Applying an extended version of the theory of planned behavior to illicit drug use among students. *Journal of Applied Social Psychology, 33,* 1662–1683. doi:10.1111/j.1559-1816.2003.tb01968.x

*McMillan, B., Higgins, A. R., & Conner, M. (2005). Using an extended theory of planned behaviour to understand smoking amongst schoolchildren. *Addiction Research & Theory*, *13,* 293–306. doi:10.1080/16066350500053679

Middlestadt, S. E., Bhattacharyya, K., Rosenbaum, J., Fishbein, M., & Shepherd, M. (1996). The use of theory based semistructured elicitation questionnaires: Formative research for CDC's Prevention Marketing Initiative. *Public Health Reports, 3*(*Suppl. 1*), 18–27.

Miller, N., & Pollock, V. E. (1994). Meta-analytic synthesis for theory development. In H. Cooper & L. V. Hedges (Eds.), *The handbook of research synthesis* (pp. 457–

483). New York, NY: Sage.

*Moan, I. S., & Rise, J. (2005). Quitting smoking: Applying an extended version of the theory of planned behavior to predict intention and behavior. *Journal of Applied Biobehavioral Research*, *10*, 39–68. doi:10.1111/j.1751-9861.2005.tb00003.x

*Moan, I. S., & Rise, J. (2006). Predicting smoking reduction among adolescents using an extended version of the theory of planned behaviour. *Psychology & Health*, *21*. 717–738. doi:10.1080/14768320600603448

*Moan, I. S., Rise, J., & Andersen, M. (2005). Predicting parents' intentions not to smoke indoors in the presence of their children using an extended version of the theory of planned behaviour. *Psychology & Health*, *20*, 353–371. doi:10.1080/08870440512331317706

Mueller, R. O. (1997). Structural equation modeling: Back to basics. *Structural Equation Modeling*, *4*, 353-369. doi:10.1080/10705519709540081

*Myers, L. B., & Horswill, M. S. (2006). Social cognitive predictors of sun protection intention and behavior. *Behavioral Medicine*, *32*, 57–63. doi:10.3200/BMED.32.2.57-63

*Norman, P., Clark, T., & Walker, G. (2005). The theory of planned behavior, descriptive norms, and the moderating role of group identification. *Journal of Applied Social Psychology*, *35*, 1008–1029. doi:10.1111/j.1559-1816.2005.tb02157.x

*Norman, P., & Conner, M. (2005). The theory of planned behavior and exercise: Evidence for the mediating and moderating roles of planning on intention-behavior relationships. *Journal of Sport & Exercise Psychology*, *27*, 488–504.

doi:10.1111/j.1559-1816.2005.tb02157.x

*Norman, P., & Conner, M. (2006). The theory of planned behaviour and binge drinking: Assessing the moderating role of past behaviour within the theory of planned behaviour. *British Journal of Health Psychology*, *11*, 55–70. doi:10.1348/135910705X43741

*Norman, P., Conner, M., & Bell, R. (2000). The theory of planned behaviour and exercise: Evidence for the moderating role of past behaviour. *British Journal of Health Psychology*, *5*, 249–261. doi:10.1348/135910700168892

Norman, P., & Hoyle, S. (2004). The theory of planned behavior and breast self-examination: Distinguishing between perceived control and self-efficacy. *Journal of Applied Social Psychology*, *34*, 694–708. doi:10.1111/j.15591816.2004.tb02565.x

*Norman, P., & Smith, L. (1995). The theory of planned behaviour and exercise: An investigation into the role of prior behaviour, behavioural intentions and attitude variability. *European Journal of Social Psychology*, *25*, 403–415. doi:10.1002/ejsp.2420250405

Nosek, B. A., Graham, J., Lindner, N. M., Kesebir, S., Hawkins, C. B., Hahn, C., . . . , Tenney, E. R. (2010). Cumulative and career-stage citation impact of social-personality psychology programs and their members. *Personality and Social Psychology Bulletin*, *36*, 1283–1300. doi:10.1177/0146167210378111

Notani, A. S. (1998). Moderators of perceived behavioral control's predictiveness in the theory of planned behavior: A meta-analysis. *Journal of Consumer Psychology*, *7*, 247–271. doi:10.1207/s15327663jcp0703_02

O'Connor, B. P. (2006). Programs for problems created by continuous variable distributions in moderated multiple regression, *Organizational Research Methods, 9*, p. 554–567. doi:10.1177/1094428106286984

*Okun, M. A., Ruehlman, L., Karoly, P., Lutz, R., Fairholme, C., & Schaub, R. (2003). Social support and social norms: Do both contribute to predicting leisure-time exercise? *American Journal of Health Behavior*, *27*, 493–507. doi:10.5993/AJHB.27.5.2

*Orbell, S. (2003). Personality systems interactions theory and the theory of planned behaviour: Evidence that self-regulatory volitional components enhance enactment of studying behaviour. *British Journal of Social Psychology*, *42*, 95–112. doi:10.1348/014466603763276144

*Orbell, S., Blair, C., Sherlock, K., & Conner, M. (2001). The theory of planned behavior and ecstasy use: Roles for habit and perceived control over taking versus obtaining substances. *Journal of Applied Social Psychology*, *31*, 31–47. doi:10.1111/j.1559-1816.2001.tb02480.x

*Orbell, S., Hagger, M., Brown, V., & Tidy, J. (2006). Comparing two theories of health behavior: A prospective study of noncompletion of treatment following cervical cancer screening. *Health Psychology*, *25*, 604–615. doi:10.1037/0278-6133.25.5.604

Orwin, R. G. (1983). A fail-safe *N* for effect size in meta-analysis. *Journal of Educational Statistics*, *8*, 157–59. doi:10.2307/1164923

Orwin, R. G., & Vevea, J. L. (2009). Evaluating coding decisions. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-*

analysis (2nd ed.). New York, NY: Sage.

Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: the multiple processes by which past behavior predicts future behavior. *Psychological bulletin*, *124*, 54–74. doi:10.1037//0033-2909.124.1.54

Overton, R. C. (1998). A comparison of fixed-effects and mixed (random effects) models for meta-analysis tests of moderator variable effects. *Psychological Methods, 3,* 354–379. doi:10.1037//1082-989X.3.3.354

*Palmer, C. L., Burwitz, L., Dyer, A. N., & Spray, C. M. (2005). Endurance training adherence in elite junior netball athletes: A test of the theory of planned behaviour and a revised theory of planned behaviour. *Journal of Sports Sciences*, *23*, 277–288. doi:10.1080/02640410410001730098

Park, S. H., Klein, K., A., Smith, S., & Martell, D. (2009). Separating subjective norms, university descriptive and injunctive norms, and U.S. descriptive and injunctive norms for drinking behavior intentions. *Health Communication, 24*, 746–751. doi:10.1080/10410230903265912

*Parker, D., Lajunen, T., & Stradling, S. (1998). Attitudinal predictors of interpersonally aggressive violations on the road. *Transportation Research, 1*, 11–24. doi:10.1016/S1369-8478(98)00002-3

*Payne, N., Jones, F., & Harris, P. (2002). The impact of working life on health behavior: The effect of job strain on the cognitive predictors of exercise. *Journal of Occupational Health Psychology*, *7*, 342–353. doi:10.1037/1076-8998.7.4.342

*Payne, N., Jones, F., & Harris, P. R. (2004). The role of perceived need within the theory of planned behaviour: A comparison of exercise and healthy eating. *British*

Journal of Health Psychology, 9, 489–504. doi:10.1348/1359107042304524

*Prapavessis, H., Maddison, R., Ruygrok, P. N., Bassett, S., Harper, T., & Gillanders, L. (2005). Using theory of planned behavior to understand exercise motivation in patients with congenital heart disease. *Psychology, Health & Medicine*, *10,* 335–343. doi:10.1080/14639220500093483

*Rapaport, P., & Orbell, S. (2000). Augmenting the theory of planned behaviour: Motivation to provide practical assistance and emotional support to parents. *Psychology & Health*, *15,* 309–324. doi:10.1080/08870440008401995

Raudenbush, S. W. (2009). Analyzing effect sizes: Random-effects models. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (2nd ed., pp. 295–316). New York, NY: Sage.

*Rhodes, R. E., & Courneya, K. S. (2005). Threshold assessment of attitude, subjective norm, and perceived behavioral control for predicting exercise intention and behavior, *Psychology of Sport and Exercise, 6,* 349–361. doi:10.1016/j.psychsport.2004.04.002

*Rhodes, R. E., Courneya, K. S., & Jones, L. W. (2003). Translating exercise intentions into behavior: Personality and social cognitive correlates. *Journal of Health Psychology*, *8,* 447–458. doi:10.1177/13591053030084004

*Rhodes, R. E., & Matheson, D. H. (2005). Discrepancies in exercise intention and expectation: Theoretical and applied issues. *Psychology & Health*, *20,* 63–78. doi:10.1080/08870440412331296071

Richard, F. D., Bond Jr, C. F., & Stokes-Zoota, J. J. (2003). One hundred years of social psychology quantitatively described. *Review of General Psychology*, *7,* 331–363.

doi:10.1037/1089-2680.7.4.331

Rippetoe, P. A., & Rogers, R. W. (1987). Effects of components of protection-motivation theory on adaptive and maladaptive coping with a health threat. *Journal of Personality and Social Psychology, 52*, 596–604. doi:10.1037//0022-3514.52.3.596

Rimal, R. N., Lapinski, M. K., Cook, R. J., & Real K. (2005). Moving toward a theory of normative influences: how perceived benefits and similarity moderate the impact of descriptive norms on behaviors. *Journal of Health Communication, 10,* 433–450. doi:10.1080/10810730591009880

Rimal, R. N., Lapinski, M. K., Turner, M. M., & Smith, K. C. (2011). The attribute-centered approach for understanding health behaviors: Initial ideas and future research directions. *Studies in Communication Sciences, 11*(1), 15–34.

Rise, J., Sheeran, P., & Hukkelberg, S. (2010). The role of self-identity in the theory of planned behavior: A meta-analysis. *Journal of Applied Social Psychology, 40*, 1085–1105. doi:10.1111/j.1559-1816.2010.00611.x

Rivis, A., & Sheeran, P. (2003a). Descriptive norms as an additional predictor in the theory of planned behaviour: A meta-analysis. *Current Psychology, 22,* 218–233. doi:10.1007/s12144-003-1018-2

*Rivis, A., & Sheeran, P. (2003b). Social influences and the theory of planned behaviour: Evidence for a direct relationship between prototypes and young people's exercise behaviour. *Psychology & Health, 18,* 567–583. doi:10.1080/0887044032000069883

Rivis, A., Sheeran, P., & Armitage, C. J. (2009). Expanding the affective and normative components of the theory of planned behavior: A meta-analysis of anticipated affect and moral norms. *Journal of Applied Social Psychology, 39*, 2985–3019. doi:10.1111/j.1559-1816.2009.00558.x

*Robinson, R. P., & Doverspike, D. (2006). Factors predicting the choice of an online versus a traditional course. *Teaching of Psychology*, *33*, 64–68. doi:10.1207/s15328023top3301_10

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In J. Cacioppo & R. E. Petty (Eds.), *Social Psychophysiology* (pp. 153-176). New York, NY: Guilford.

Rosenthal, R. R. (1984). *Meta-analytic procedures for social research.* Beverly Hills, CA: Sage.

Rosenthal, R. (1991). *Meta-analytic procedures for social research.* Newbury Park, CA: Sage.

Rothman, A. J. (2004). Is there nothing more practical than a good theory? Why innovations and advances in health behavior change will arise if interventions are used to test and refine theory. *International Journal of Behavioral Nutrition and Physical Activity*, *1*, 11–18. doi:10.1186/1479-5868-1-11

Rothman, A. J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: The role of message framing. *Psychological Bulletin, 121*, 3–19. doi:10.1037//0033-2909.121.1.3

Sandberg, T., & Conner, M. (2008). Anticipated regret as an additional predictor in the theory of planned behaviour: A meta-analysis. *British Journal of Social Psychology, 47*, 589–606. doi:10.1348/014466607X258704

Scargle, J. D. (2000). Publication bias: The “file-drawer” problem in scientific inference. *Journal of Scientific Exploration, 14*, 91–106. Retrieved from http://cdsweb.cern.ch/record/400675

Schmidt, F. L. (1973). Implication of a measurement problem for expectancy theory research. *Organizational Behavior and Human Performance, 10,* 243–251. doi:10.1016/0030-5073(73)90016-0

Schulze, R., & Whittmann, W. W. (2003). A meta-analysis of the theory of reasoned action and the theory of planned behaviour: The principle of compatibility and multidimensionality of beliefs as moderators. In R. Schulze, H. Holling & D. Bohning (Eds.), *Meta-analysis: New developments and applications in medical and social sciences* (pp. 129–250). Ashland, OH: Hogrefe & Huber.

Seligman, M. E. P. (1975). *Helplessness.* San Francisco, CA: Freeman.

*Shankar, A., Conner, M., & Bodansky, H. J. (2007). Can the theory of planned behaviour predict maintenance of a frequently repeated behaviour? *Psychology, Health & Medicine, 12*, 213–224. doi:10.1080/09540120500521327

Sheeran, P. (2002). Intention–behavior relations: A conceptual and empirical review. In W. Stroebe & M. Hewstone (Eds.), *European Review of Social Psychology* (Vol. 12, pp. 1–36). Chichester, UK: Wiley.

*Sheeran, P., & Abraham, C. (2003). Mediator of moderators: Temporal stability of intention and the intention-behavior relation. *Personality and Social Psychology Bulletin*, *29*, 205–215. doi:10.1177/0146167202239046

*Sheeran, P., & Orbell, S. (2000). Self-schemas and the theory of planned behaviour. *European Journal of Social Psychology*, *30*, 533–550. doi:10.1002/1099-

0992(200007/08)30:4<533::AID-EJSP6>3.0.CO;2-F

*Sheeran, P., Orbell, S., & Trafimow, D. (1999). Does the temporal stability of behavioral intentions moderate intention-behavior and past behavior-future behavior relations? *Personality and Social Psychology Bulletin, 25,* 724–734. doi:10.1177/0146167299025006007

*Sheeran, P., & Silverman, M. (2003). Evaluation of three interventions to promote workplace health and safety: Evidence for the utility of implementation intentions. *Social Science & Medicine*, *56*, 2153–2163. doi:10.1016/S0277-9536(02)00220-4

Sheeran, P., & Taylor, S. (1999). Predicting intentions to use condoms: A meta-analysis and comparison of the theories of reasoned action and planned behavior. *Journal of Applied Social Psychology*, *29*, 1624–1675. doi:10.1111/j.1559-1816.1999.tb02045.x

Skinner, E. A. (1992). Perceived control: Motivation, coping, and development. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp. 91-106). London, UK: Hemisphere Publishing Corporation.

*Smith, R. A., & Biddle, S. J. H. (1999). Attitudes and exercise adherence: Test of the theories of reasoned action and planned behaviour. *Journal of Sports Sciences, 17,* 269–281. doi:10.1080/026404199365993

*Sparks, P., & Shepherd, R. (2002). The role of moral judgments within expectancy-value-based attitude-behavior models. *Ethics & Behavior, 12,* 299–321. doi:10.1207/S15327019EB1204_01

*Smith, J. R., Terry, D. J., & Hogg, M. A. (2006). Who will see me? The impact of type of audience on willingness to display group-mediated attitude–intention consistency. *Journal of Applied Social Psychology*, *36*, 1173–1197. doi:10.1111/j.0021-9029.2006.00037.x

*Spence, A., & Townsend, E. (2006). Examining consumer behavior toward genetically modified (GM) food in Britain. *Risk Analysis*, *26*, 657–670. doi:10.1111/j.1539-6924.2006.00777.x

Steiger, J. H. (1990). Structural model evaluation and modification: an interval estimation approach. *Multivariate Behavioral Research*, 25, 173-180. doi:10.1207/s15327906mbr2502_4

Stretcher, V. J., Becker, M. H., Kirscht, J. P., Eraker, S. A., & Graham-Tomasi, R. P. (1985). Psychological aspects of changes in cigarette-smoking behavior. *Patient Education and Counseling, 7*, 249–262. doi:10.1016/0002-9343(85)90289-X

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Allyn & Bacon.

*Terry, D. J., Hogg, M. A., & White, K. M. (1999). The theory of planned behaviour: Self-identity, social identity and group norms. *British Journal of Social Psychology*, *38*, 225–244. doi:10.1348/014466699164149

*Terry, D. J., & O'Leary, J. E. (1995). The theory of planned behavior: The effects of perceived behavioural control and self-efficacy. *British Journal of Social Psychology,* 34, 199–220. doi:10.1111/j.2044-8309.1995.tb01058.x

Topa, G., & Moriano, J. A. (2010). Theory of planned behavior and smoking: Meta-analysis and SEM model. *Substance Abuse and Rehabilitation, 1*, 23–33. doi:10.2147/SAR.S15168

*Umeh, K., & Patel, R. (2004). Theory of planned behaviour and ecstasy use: An analysis of moderator-interactions. *British Journal of Health Psychology*, *9*, 25–38. doi:10.1348/135910704322778704

Van Ryn, M., Lytle, L. A., & Kirscht, J. P. (1996). A test of the theory of planned behavior for two health-related practices. *Journal of Applied Social Psychology*, *26*, 871–883. doi:10.1111/j.1559-1816.1996.tb01115.x

van Stralen, M. M., De Vries, H., Mudde, A. N., Bolman, C., & Lechner, L. (2009). Determinants of initiation and maintenance of physical activity among older adults: a literature review. *Health Psychology Review*, *3*, 147-207. doi:10.1080/17437190903229462

*Verplanken, B. (2006). Beyond frequency: Habit as mental construct. *British Journal of Social Psychology*, *45*, 639–656. doi:10.1348/014466605X49122

*Verplanken, B., Aarts, H., Knippenberg, A., & Moonen, A. (1998). Habit versus planned behaviour: A field experiment. *British Journal of Social Psychology*, *37*, 111–128. doi:10.1111/j.2044-8309.1998.tb01160.x

Viswesvaran C., & Ones, D. (1995). Theory testing: Combining psychometric meta-analysis and structural equations modeling. *Personnel Psychology*, *48,* 865–885. doi:10.1111/j.1744-6570.1995.tb01784.x

*Vondras, D. D., & Madey, S. F. (2004). The attainment of important health goals throughout adulthood: An integration of the theory of planned behavior and aspects of social support. *International Journal of Aging and Human Development*, *59*, 205–234. doi:10.2190/78UQ-5NMW-7YLD-TFWV

von Haeften, I., Fishbein, M., Kasprzyk, D., & Montano, D. (2001). Analyzing data to obtain information to design targeted interventions. *Psychology, Health & Medicine, 6*(2), 151–164. doi:10.1080/13548500125076

*Wall, A.-M., Hinson, R. E., & McKee, S. A. (1998). Alcohol outcome expectancies, attitudes toward drinking and the theory of planned behavior. *Journal of Studies on Alcohol and Drugs, 59*, 409. Retrieved from http://www.jsad.com/jsad/article/Alcohol_Outcome_Expectancies_Attitudes_toward_Drinking_and_the_Theory_of_P/531.html

Wambach, K. A. (1997). Breastfeeding intention and outcome: A test of the theory of planned behavior. *Research in Nursing and Health, 20*, 51–59. doi:10.1002/(SICI)1098-240X(199702)20:1<51::AID-NUR6>3.0.CO;2-T

*Warburton, J., & Terry, D. J. (2000). Volunteer decision making by older people: A test of a revised theory of planned behavior. *Basic and Applied Social Psychology, 22,* 245–257. doi:10.1207/S15324834BASP2203_11

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92*, 548–573. doi:10.1037//0033-295X.92.4.548

Weiner B. (1992). *Human motivation: Metaphors, theories, and research*. Newbury Park, CA: Sage.

Weinstein, N. D., & Rothman, A. J. (2005). Commentary: Revitalizing research on health behavior theories. *Health Education Research*, *20*, 294–297. doi:10.1093/her/cyg125

White, R. W. (1959). Motivation reconsidered: the concept of competence. *Psychological Review, 66*, 297-333. doi:10.1037/h0040934

Wicker, A. W. (1969). Attitudes versus actions: The relationship of verbal and overt behavioral responses to attitude objects. *Journal of Social Issues, 25,* 41–78. doi:10.1111/j.1540-4560.1969.tb00619.x

Wills, T. A. (1990). Multiple networks and substance use. *Journal of Social and Clinical Psychology*, *9,* 78–90. doi:10.1521/jscp.1990.9.1.78

Wilson, D. B. (2010). Meta-analysis macros for SAS, SPSS, and Stata. Retrieved from http://mason.gmu.edu/_dwilsonb/ma.html

Witte, K. (1994). Fear control and danger control: A test of the extended parallel process model (EPPM). *Communication Monographs, 61*, 113–134. doi:10.1080/03637759409376328

Witte, K., & Allen, M. (2000). A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health Education and Behavior, 27*, 591–615. doi:10.1177/109019810002700506

Wood, J. (1989). Theory and research concerning social comparisons of personal attributes. *Psychological Bulletin*, *106*, 231–248. doi:10.1037//0033-2909.106.2.231

Wulfert, E. (1996). Social learning: Albert Bandura. *In International Encyclopedia of Psychology* (Vol. 2, pp 1578-1582). London, UK: Fitzroy Dearborn Publishers.

Yzer, M. C. (2007). Does perceived control moderate attitudinal and normative effects on intention? A review of conceptual and methodological issues. In I. Ajzen, D. Albarracín, & R. Hornik (Eds.), *Prediction and change of health behavior: Applying the reasoned action approach (pp. 107-123)*. Mahwah, NJ: Lawrence Erlbaum.

Yzer, M. C. (2012). Perceived behavioral control in reasoned action theory: A dual-aspect interpretation. *The ANNALS of the American Academy of Political and Social Science, 640*, 101–117. doi:10.1177/0002716211423500

*Yzer, M. C., Cappella, J. N., Fishbein, M., Hornik, R., Sayeed, S., & Ahern, R. K. (2004). The role of distal variables in behavior change: Effects of adolescents' risk for marijuana use on intention to use marijuana. *Journal of Applied Social Psychology*, *34*, 1229–1250. doi:10.1111/j.1559-1816.2004.tb02005.x

Yzer, M. C., Hennessy, M., & Fishbein, M. (2004). The usefulness of perceived difficulty for health research. *Psychology, Health & Medicine* 9:149–62. doi:10.1080/13548500410001670681

*Yzer, M. C., Siero, F. W., & Buunk, B. P. (2001). Bringing up condom use **a**nd using condoms with new sexual partners: Intentional or habitual? *Psychology and Health, 16,* 409–421. doi:10.1080/08870440108405516

*Yzer, M. C., & van den Putte, B. (2006). Understanding smoking cessation: The role of smokers' quit history. *Psychology of Addictive Behaviors*, *20*, 356–361. doi:10.1037/0893-164X.20.3.356