
Article:
Sheeran, P and Conner, M orcid.org/0000-0002-6229-8143 (2019) Degree of reasoned action predicts increased intentional control and reduced habitual control over health behaviors. Social Science and Medicine, 228. pp. 68-74. ISSN 0277-9536

https://doi.org/10.1016/j.socscimed.2019.03.015

Degree of Reasoned Action Predicts Increased Intentional Control and Reduced Habitual Control over Health Behaviors

Paschal Sheeran

University of North Carolina at Chapel Hill

Center for Advanced Hindsight, Duke University

Mark Conner

University of Leeds

Paschal Sheeran, Department of Psychology and Neuroscience, University of North Carolina at Chapel Hill and Center for Advanced Hindsight, Duke University.

Mark Conner, School of Psychology, University of Leeds, UK.

Paschal Sheeran was supported by a grant from the John Templeton Foundation (#23145). The opinions expressed here are those of the authors and do not necessarily reflect the views of the John Templeton Foundation.

Direct correspondence to Paschal Sheeran, Department of Psychology and Neuroscience, University of North Carolina at Chapel Hill, 323B Davie Hall, Chapel Hill, NC 27514. Email: psheeran@unc.edu

Abstract

Background: Research is needed to understand factors that attenuate the association between habits and health behavior performance. *Purpose*. We tested whether *degree of reasoned action* moderates both intention-behavior and habit-behavior relations. Degree of reasoned action was defined by how well cognitions predict behavioral intentions, and was measured by the respective within-participants multiple correlation (*R*). *Methods*: Four studies were undertaken. Two pilot studies established the validity of our measure of degree of reasoned action. Studies 1 ($N = 663$) and 2 ($N = 1{,}014$) were prospective surveys of 8 and 6 health behaviors, respectively. Intentions were measured via standard scales and habits were indexed by measures of frequency of performance × context stability. *Results*: In both studies, habits attenuated the predictive validity of intention. However, well reasoned intentions better predicted health behaviors than poorly reasoned intentions, and habits offered weaker prediction of behavior when intentions were well reasoned. Three-way degree of reasoned action × intention × habit interactions were also observed. Habits best predicted health behaviors when intentions were weak and poorly reasoned (Study 1), or offered poorest prediction of health behaviors when intentions were both strong and well reasoned (Study 2). *Conclusions*: Degree of reasoned action predicts increased intentional control and reduced habitual control over multiple health behaviors.

Keywords: habit, past behavior, intention-behavior gap, health behavior

Degree of Reasoned Action Predicts Increased Intentional Control and Reduced Habitual Control over Health Behaviors

Understanding what factors predict health behaviors is an important first step in developing interventions to change those behaviors (Sheeran et al., 2017). Behavioral intentions are construed as a key predictor of action in several health behavior theories (Ajzen, 1991; Bandura, 1998; Rogers et al., 1983). However, research on the *intention-behavior gap* indicates that people do not always realize their intentions to perform health behaviors (Sheeran, 2002; Sheeran and Webb, 2016). One explanation that is often adduced to explain discrepancies between intentions and action concerns habits (Ouellette and Wood, 1998; Webb and Sheeran, 2006). For instance, habitual consumption of sugar-sweetened beverages could undermine intentions to maintain a healthy weight. Habits are formed when behaviors are performed repeatedly in stable contexts (e.g., similar times and places); behavior gradually comes under the control of contextual cues that automatically elicit action. Once habits have formed, intentions become weaker guides to future behavior compared to habits (Gardner et al., 2011; Hagger et al., 2018; Ouellette and Wood, 1998, Webb and Sheeran, 2006). Because habits constitute a formidable barrier to efforts to intentionally change health behaviors, research is needed to examine how intentional control of behavior can be increased and habitual control can be reduced (Rothman et al., 2015). The present article examines whether *degree of reasoned action* moderates intention-behavior and habit-behavior relations. Degree of reasoned action refers to the extent to which intentions are well thought through, or grounded in relevant beliefs about the behavior; well reasoned intentions are strongly predicted by behavior-relevant cognitions whereas cognitions only modestly predict poorly reasoned intentions. We test moderation by

degree of reasoned action in two longitudinal studies that involved multiple health-risk (e.g., smoking) and health-protective behaviors (e.g., regular exercise).

Intentional Versus Habitual Control of Behavior

Correlational and experimental evidence indicates that the gap between intentions and health behaviors is substantial (Sheeran, 2002; McEachan et al., 2011; Webb and Sheeran, 2006; Rhodes and Dickau, 2012). Decomposition of the intention-behavior relation suggests that only one-half of intentions are successfully translated into action (Sheeran, 2002; Godin and Conner, 2008; Orbell and Sheeran, 1998; Rhodes and de Bruijn, 2013). A sizeable literature has developed on moderators of intention-behavior consistency (reviews by Rhodes and de Bruijn, 2013; Sheeran and Webb, 2016). Findings indicate that self-schemas, anticipated regret, moral norms, and attitudinal (vs. normative) control are each associated with improved prediction of behavior by intention (Godin et al., 2006; Sheeran et al., 1999; Sheeran and Orbell, 2000). These variables appear to stabilize intentions and intention stability mediates their moderating effects on the intention-behavior relation (Sheeran and Abraham, 2003).

Correlational and experimental evidence also indicates that habit moderates the intention-behavior relationship (Gardner et al., 2011; Ouellette and Wood, 1998; Webb and Sheeran, 2006). When behaviors are frequently performed in stable contexts (i.e., circumstances conducive to habit formation), intention offers poorer prediction of behavior compared to infrequently performed behaviors in unstable contexts. Whereas moderators of intention-behavior relations have attracted considerable research, relatively little is known about factors that moderate the habit-behavior relation. We could locate just a single study that observed attenuation of the predictive validity of habit by a feature of intentions. Greater stability of

intentions was associated with weaker prediction of future behavior by past behavior (Sheeran et al., 1999).

Degree of Reasoned Action

Habit's role in obstructing health behavior change, combined with the paucity of research on factors that could disrupt the influence of habit, offer a clear rationale for new studies to identify moderators of both intention-behavior and habit-behavior relations (Rothman et al., 2015). The present research tests *degree of reasoned action* as a potential moderator. Degree of reasoned action (DRA) can be defined as the extent to which a person's determination to act is based on relevant expectancies, or how well behavior-relevant cognitions predict intentions. Relevant cognitions can pertain to instrumental or affective consequences of acting, normative considerations, concerns about control and feasibility, or any other factor that could potentially influence intention. Operationally, DRA is indexed by the multiple correlation (*R*) for intention (i.e., how well relevant cognitions determine intentions). As it is not possible to compute correlations between respective predictors and a measure of intention for a single behavior, it is necessary to measure DRA at the level of the person by conducting within-participants regressions of intention on the predictors for a suite of behaviors. To increase correspondence between the behaviors used to compute DRA and the behaviors used assess whether DRA moderates intention-behavior and habit-behavior relations, all analyses reported here use the same suite of behaviors in both analyses. Moderation is tested using multilevel models that treat individual health behaviors as Level-1 variables and DRA as a Level-2 moderator.

Some prior research has suggested that carefully considering the consequences of acting influences intention-behavior consistency. Pieters and Verplanken (1985) observed that "amount

of reasoning" (indexed by items such as "How much have you been thinking about the coming elections … ?") strengthened the association between intentions and voting behavior. In an experimental study, participants who were encouraged to deliberate about their means of transport exhibited stronger intention-behavior relations regarding car use compared to no-deliberation controls (Verplanken et al., 1998; see also Bagozzi and Yi, 1989). Although these findings indicate that self-reported reasoning influences intention-behavior consistency, it would be desirable to test a non-reactive index that does not rely on meta-judgments given the limited predictive validity of such measures (Bassili, 1996).

Three lines of research offer grounds for expecting moderation of the habit-behavior relation by DRA. First, neuroimaging evidence indicates that there are individual differences in "model free" (habit) versus "model-based" (goal-directed) learning, based at least in part upon deliberation or comprehension, that predict how well people can overcome habits (Gillan et al., 2015). Second, Chapman and Ogden's qualitative analysis of successful dieters pointed to habit change via an "active" path that involves the "accumulation of evidence" (e.g., signs of increasing weight) and "triggers to action" (e.g., comments from significant others) that lead to setting new goals (Chapman and Ogden, 2009). This analysis resonates with the idea of well-reasoned intentions. Third, Danner et al. (2011) showed that thinking through and forming new health-related intentions could inhibit habits. Participants who were encouraged to form healthful intentions showed greater inhibition of habitual behaviors according to reaction time indices compared to participants who were not encouraged to form behavioral intentions. In sum, there are reasons to suspect that degree of reasoned action could moderate both intention-behavior and habit-behavior relations.

The Present Research

The present research tests whether degree of reasoned action influences how well intentions and habits predict subsequent health behavior. We undertook two pilot studies to validate the measure of degree of reasoned action used in the main studies. Moderation was tested in two prospective studies involving 8 behaviors (Study 1) and 6 behaviors (Study 2).

Pilot Studies

Pilot Study 1

The first pilot study aimed to demonstrate that DRA measured by the multiple correlation (*R*) for intention is associated with an independent index of how well thought through are respective intentions. Participants (*N* = 132, 49.2% female, *M*-age = 37.94, *SD* = 13.45) were recruited via Amazon Mechanical Turk and completed standard measures of attitude, subjective norm, PBC, and intention in relation to 10 health behaviors (fruit and vegetable consumption, eating a low-fat diet, sunscreen use, exercise, teeth flossing, alcohol consumption, driving under the influence, smoking cigarettes, and exceeding the posted speed limit). To index how carefully considered was each intention, participants responded to the stem "How well thought through is your intention to …?" on 7-point scales (not at all well thought through-extremely well thought through; alpha = .84).

To compute DRA, intention was regressed on attitude, subjective norm, and perceived behavioral control in a within-participants analysis. Degree of reasoned action was the multiple correlation from this regression; the multiple correlations were submitted to Fisher's *Z* transformation to normalize the distribution.

Consistent with predictions, DRA was significantly and positively correlated with participants' self-reports of how well thought through were their health behavioral intentions, $r = .27$, $p = .002$. This correlation is similar to that observed between objectively measured

ambivalence and self-reported (felt) ambivalence (r = .25; Russell et al., 2011) and indicates that people may not be very accurate in reporting how well reasoned are their intentions, perhaps due to lack of meta-cognitive knowledge (Bassili, 1996).

Pilot Study 2

To corroborate the proposal that DRA predicts intention-behavior consistency, we computed the correlation between the multiple correlation for the prediction of intention and the strength of the association between intentions and behavior from 27 tests of theory of planned behavior in two key reviews (Ajzen, 1991; Godin and Kok, 1996; see Table S1 in the Supplementary Materials for the relevant data and Figure S1 for the scatterplot). As expected, how well attitude, subjective norm, and perceived behavioral control predicted intentions was significantly and positively related to how well intentions predicted behavior (r = .49, p < .01).

In sum, our pilot studies indicate that the measure of DRA used here is (a) correlated with self-reports of carefully considering one's intentions to act healthily, and (b) the extent of consistency between intentions and subsequent behavior.

Study 1: Moderation of Intention-Behavior and Habit-Behavior Relations for 8 Health Behaviors over 3 Months by Degree of Reasoned Action

Study 1 examined 8 health behaviors that could be performed frequently (i.e., daily). DRA, intentions, and habits were measured at baseline and behavior was measured three months later.

Method

Respondents and Procedure

Participants were recruited via the crowdsourcing platform, Prolific Academic (https://prolific.ac) and paid £7.80 (approximately $10) for completing questionnaires on two

occasions in September and December 2017. Data for the present analyses come from a larger project. Across baseline and three-month follow-ups 908 and 633 questionnaires, respectively, were returned. There were 633 participants with data matched across time points (*ns* = 402 women, 230 men, 1 non-binary) with a mean age of 33.8 years (*SD* = 9.37). The research protocol was approved by the University of Leeds IRB.

Measures

Participants provided informed consent and then completed questionnaires measuring the same constructs for each of 8 health-related behaviors (eating fruit and vegetables, undertaking recommended levels of physical activity, flossing daily, not drinking more than the recommended weekly levels of alcohol, not sitting for extended periods of time, not consuming unhealthy snacks, eating a low fat diet, avoiding eating red meat). The health-related behaviors were selected in order to represent both health-protective and health-risk behaviors. The wording of items followed recommendations for each construct (Conner and Sparks, 2015). Only items relevant to the current research are reported here (the full questionnaires plus data and analysis output can be obtained from the second author).

Questionnaire items were consistent across behaviors. *Intention* was measured by two items (e.g., "I intend to eat 5 portions of fruits and vegetables per day over the next four weeks, strongly disagree-strongly agree"; "I am likely to eat 5 portions of fruits and vegetables per day over the next four weeks, very unlikely-very likely"; mean *alpha* = .91). Four items were used to index *attitudes* (e.g., "Eating 5 portions of fruits and vegetables per day over the next four weeks would be: pointless-worthwhile, not enjoyable-enjoyable, unimportant-important, unpleasant-pleasant"; mean alpha = .78). *Subjective norm* was measured by two items (e.g., "Most people that are important to me think that… I should-I should not… exercise regularly over the next

four weeks"; "I think that most people who are important to me will exercise regularly over the next four weeks, definitely no-definitely yes"; mean alpha = .60) as was *perceived behavioral control* (e.g., "If it were entirely up to me, I am confident that I could exercise regularly over the next four weeks, strongly disagree-strongly agree"; "I have control over whether or not I exercise regularly over the next four weeks, strongly disagree-strongly agree"; mean alpha = .62).

Accumulated evidence indicates that multiplying frequency of past behavior by the stability of the context of behavioral performance offers a superior index of habit strength compared to past behavior (Aldrich et al., 2011; Labrecque and Wood, 2015; Neal et al., 2011; Ouellette and Wood, 1998; Wood et al., 2005). Accordingly, *habit* was indexed by the multiplicative combination of measures of frequency of *past behavior* (e.g., "In the past four weeks, I have eaten 5 portions of fruits and vegetables per day", 7-point scale, never-always) and context stability (e.g., "Is eating five portions of fruit and vegetables a day something that you would do at the same times and in the same places each time?, 7-point scale, definitely no-definitely yes).

To compute *degree of reasoned action* (DRA), intention at baseline was regressed on baseline attitude, subjective norm, and perceived behavioral control in a within-participants analysis. Degree of reasoned action was the multiple correlation and indicates the strength of the association between the predictors and intention for each person. The multiple correlations were submitted to Fisher's *Z* tranformation to normalize the distribution and mean centered for analysis. *ZR* scores ranged from 0.10 to 3.80 (M = 1.42, SD = 0.56) (range for R = 0.10 to 0.999).

Behavior at one-month follow-up was measured using a single item that asked participants to indicate how frequently they had performed each behavior in the past month (e.g., "In the past four weeks I have eaten five portions of fruit and vegetables a day, never - always";

scored 1 to 7).

Analyses

Data were analyzed in SPSS (version 20, SPSS Inc.) and HLM (version 7, SSI). Participants who had missing data for the DRA measure or at least one variable missing for each behavior were again excluded; there were no significant differences in age, gender, or highest educational qualification (*p*s > .30) between the 10 participants excluded and the 623 participants whose data were retained. A total of 4856 person-behavior data points spread across 623 participants were used in analysis. Hierarchical Linear Modeling analyses used an intercept only model as the comparison model. Model 1 added the main effects of intention and habit to the equation. Model 2 added the intention × habit interaction. Model 3 added the three cross-level interactions (DRA × intention, DRA × habit, and DRA × intention × habit) to the equation. When an interaction was significant, it was probed using simple slope analyses decomposed by means of the free software provided by Preacher (Model 1 for level 1 interactions; Model 3 for cross-level interactions) at http://www.quantpsy.org/interact/hlm2.htm.

Results

In Model 1, the main effects of intention and the habit measure had significant and positive coefficients. Model 2 added the intention × habit interaction which proved to be marginally significant ($p = .067$) and negative. Simple slopes indicated that intentions better predicted behavior when habit was low ($M - 1SD$; B = .487, $SE = .020$, $p < .001$) as compared to high ($M + 1SD$; B = .427, $SE = .030$, $p < .001$).

Model 3 added the three cross-level interactions (intention × DRA, habit × DRA, and intention × habit × DRA) to the equation. The coefficients for each of these interactions proved significant. We decomposed the two-way interactions via simple slopes. Well-reasoned

intentions exhibited a stronger association with behavior ($M + 1SD$; B = .615, SE = .071, $p <$ .001) compared to poorly-reasoned intentions ($M - 1SD$; B = .528, SE = .035, $p < .001$). Simple slope analyses also indicated that DRA influenced how well habits predicted behavior. In particular, habit offered weaker prediction of behavior when intentions were well reasoned (B = .022, SE = .012, p = .071) as compared to poorly reasoned (B = .036, SE = .006, $p < .001$).

In order to explore the three-way intention × habit × DRA interaction, we ran separate multi-level models (Model 2) for participants with low versus high DRA (based on a median split). When intentions were low ($M - 1SD$), the predictive validity of habit was higher when DRA was low (B = .074, SE = .009, $p < .001$) compared to when DRA was high (B = .038, SE = .009, $p < .001$), $Z_{difference}$ = 2.85, p = .002 (one-tailed). However, when participants had high intentions ($M + 1SD$), this difference in the predictive power of habit for high and well-reasoned intentions (B = .043, SE = .005, $p < .001$) as compared to high but poorly-reasoned intentions (B = .042, SE = .005, $p < .001$) was still significant but attenuated, $Z_{difference}$ = 1.77, p = .04 (one-tailed). Habitual control over health behaviors was highest when participants had low, poorly reasoned intentions to act (see Figure 1).

Discussion

Consistent with the idea that habits obstruct behavior change (e.g., Rothman et al., 2015) intentions were poorer predictors of behavior when strong as compared to weak. However, in line with predictions, we also observed that DRA moderated both intention-behavior and habit-behavior relations. Intentions better predicted performance of 8 health behaviors over a 3-month period, and habits offered weaker prediction of those behaviors when intentions were well reasoned as compared to poorly reasoned. There was also a significant three-way DRA × intention × habit interaction. Weak and poorly reasoned intentions were associated with stronger

relationships between habits and subsequent health behaviors.

Study 2: Moderation of Intention-Behavior and Habit-Behavior Relations for 6 Health Behaviors Over 1 Month by Degree of Reasoned Action

Although Study 1 tested multiple behaviors over an extended period, readers might justifiably be concerned about how replicable are the interactions observed in Study 1. To allay this concern, we analyzed data from a second study to offer an additional test of moderation of intention-behavior and habit-behavior relations by DRA.

Method

Respondents and Procedure

Participants were recruited via the crowdsourcing platform, Prolific Academic (https://prolific.ac) and paid £3 (approximately $4) for completing questionnaires on two occasions in July and August 2016. Data for the present analyses come from a subset of a larger project (e.g., Wilding et al., 2019). Across baseline and one-month follow-ups 1,294 and 1,014 questionnaires, respectively, were returned. There were 1,014 participants with data matched across time points (*ns* = 515 women, 482 men, 13 non-binary) with a mean age of 31.9 years (*SD* = 11.3). The research protocol was approved by the University of Leeds IRB.

Measures

Participants provided informed consent and then completed questionnaires measuring the same constructs for each of 6 health-related behaviors (eating fruit and vegetables, undertaking recommended levels of physical activity, flossing daily, not drinking more than the recommended weekly levels of alcohol, not sitting for extended periods of time, not consuming unhealthy snacks). Again, both health-protective and health-risk behaviors were represented and wording of items followed recommendations for each construct (Conner and Sparks, 2015). Only

items relevant to the current research are reported here (the full questionnaires plus data and analysis output can be obtained from the second author).

Questionnaire items were consistent across behaviors. *Intention* was measured by three items (e.g., "I intend to eat 5 portions of fruits and vegetables per day over the next four weeks, strongly disagree-strongly agree"; "I am likely to eat 5 portions of fruits and vegetables per day over the next four weeks, very unlikely-very likely"; mean *alpha* = .61). For health-risk behaviors, intention items were framed in terms of avoiding the respective behavior (e.g., "I intend to avoiding consuming unhealthy snacks"). Four items were used to index *attitudes* (e.g., "Eating 5 portions of fruits and vegetables per day over the next four weeks would be: pointless-worthwhile, not enjoyable-enjoyable, unimportant-important, unpleasant-pleasant"; mean alpha = .62). *Subjective norm* was measured by two items (e.g., "Most people that are important to me think that… I should-I should not… exercise regularly over the next four weeks"; "I think that most people who are important to me will exercise regularly over the next four weeks, definitely no-definitely yes"; mean alpha = .61) as was *perceived behavioral control* (e.g., "If it were entirely up to me, I am confident that I could exercise regularly over the next four weeks, strongly disagree-strongly agree"; "I have control over whether or not I exercise regularly over the next four weeks, strongly disagree-strongly agree"; mean alpha = .60). The frequency measure of *past behavior* was measured using a single item ("In the past four weeks, I have eaten 5 portions of fruits and vegetables per day", 7-point scale, never-always). The habit measure was based on Wood et al. and derived from the multiplicative combination of the past behavior frequency measure and a stability of context measure ("Is eating five portions of fruit and vegetables a day something that you would do at the same times and in the same places each time?, 7-point scale, definitely no-definitely yes) (Wood et al., 2005).

Degree of reasoned action was computed in the same manner as Study 1; ZR scores ranged from 0.09 to 3.80 (M = 1.80, SD = 0.79) (range for R = 0.09 to 0.999).

Behavior at one-month follow-up was measured using a single item that asked participants to indicate how frequently they had performed each behavior in the past month (e.g., "In the past four weeks I have eaten five portions of fruit and vegetables a day, never - always"; scored 1 to 7).

Analyses

Data were again analyzed in SPSS (version 20, SPSS Inc.) and HLM (version 7, SSI). Participants who had missing data for the DRA measure or at least one variable missing for each behavior were again excluded; there were no significant differences in age, gender, or highest educational qualification (ps > .30) between the 22 participants excluded and the 992 participants whose data were retained. A total of 5952 person-behavior data points spread across 992 individuals were used in analysis. Hierarchical Linear Modeling analyses were equivalent to those used in Study 1. An intercept only model was our comparison model. Model 1 added the main effects of intention and habit to the equation; Model 2 added the intention × past behavior/habit interaction and Model 3 added the three cross-level interactions to the equation.

Results

Table 2 presents the results of the multilevel modeling. Intention and habit measure had significant coefficients in Model 1. Model 2 added the intention × habit interaction which proved significant and negative. Simple slopes indicated that intentions better predicted behavior when habit was low (M – 1SD; B = .130, SE = .010, p < .001) as compared to high (M + 1SD; B = .051, SE = .023, p = .02).

In Model 3, the three cross-level interactions (DRA × intention , DRA × habit, and DRA

× intention × habit) proved significant. We decomposed the two-way interactions via simple slopes. Well-reasoned intentions again exhibited a stronger association with behavior (M + 1SD; B = .217, SE = .029, p < .001) compared to poorly reasoned intentions (M – 1SD; B = .175, SE = .014, p < .001). Simple slope analyses also indicated that DRA influenced how well habits predicted behavior. In particular, habit offered weaker prediction of behavior when intentions were well reasoned (B = .042, SE = .008, p < .001) as compared to poorly reasoned (B = .051, SE = .004, p < .001).

In order to explore the three-way intention × habit × DRA interaction, we ran separate multi-level models (Model 2) for participants with low versus high DRA (based on a median split). When intentions were low (M – 1SD), it made no difference to the predictive validity of habit whether DRA was low (B = .062, SE = .004, p < .001) or high (B = .063, SE = .004, p < .001), $Z_{Difference}$ = -0.17, p = .43 (one-tailed). However, when participants had high intentions (M + 1SD), then DRA influenced how well habits predicted behavior. In particular, habit was more weakly associated with behavior when participants had high and well-reasoned intentions (B = .042, SE = .003, p < .001) as compared to high but poorly-reasoned intentions (B = .052, SE = .003, p < .001), $Z_{Difference}$ = 2.72, p = .003 (one-tailed). Habitual control over health behaviors was lowest when participants had strong, well-reasoned intentions to act.

Discussion

Findings from Study 2 corroborated the results obtained in Study 1. Habits moderated the intention-behavior relation but when intentions were well reasoned, then habits offered weaker prediction of future behavior. DRA was also associated with improved prediction of behavior by intention. The three-way intention × habit × DRA interaction again proved significant, albeit in different form. Whereas habits best predicted health behaviors when intentions were weak and

poorly reasoned in Study 1, habits predicted health behaviors least when intentions were strong and well reasoned in Study 2. These findings are conceptually equivalent as they indicate DRA and intention strength combine to determine the predictive validity of habits.

General Discussion

Accumulated evidence suggests that intention is the single best predictor of health behaviors and explains greater variance in behavior compared to both other cognitions (e.g., attitudes, norms, perceived behavioral control) and personality factors (e.g., conscientiousness) (Conner & Sparks, 2015; McEachan et al., 2011; Sheeran, 2002; Sheeran and Webb, 2016). Only one factor appears to out-predict intention for frequently performed behaviors, namely, habits (McEachan et al., 2011; Ouellette and Wood, 1998). Consistent with this analysis, habits undermined intentional control of health behaviors in the studies reported here; intentions better predicted behavior when habits were weak as compared to strong.

The present research aimed to understand how habits can be thwarted and intentional control of health behaviors can be enhanced. In particular, we tested whether degree of reasoned action moderates both intention-behavior and habit-behavior relations. In two studies, we observed significant interactions such that intentions were more likely to be translated into action and habits were less likely to be translated into action if participants' intentions were well reasoned. Significant three-way interactions were also obtained indicating that habitual control of behavior depended on the strength and DRA of intentions. Weak and poorly reasoned intention enhanced habit-behavior consistency in Study 1 whereas strong and well-reasoned intentions reduced habit-behavior consistency in Study 2.

Several factors serve to increase confidence in the moderating role of degree of reasoned action observed here. First, we indexed habit using a well validated index – past behavior

frequency × context stability (Neal et al., 2011; Ouellette and Wood, 1998; Wood et al., 2005).. Second, the associations among intentions, habits, and behavior in the present studies were consistent with previous research and so the present data would seem to offer a fair test of our hypotheses. In particular, habit index better predicted behavior compared to intention (McEachan et al., 2011; Ouellette and Wood, 1998; Wood et al., 2005), and we observed the classic, negative interaction between intention and habit in predicting health behaviors (Gardner et al., 2011; Wood et al., 2005). Thus, moderation by degree of reasoned action was observed in datasets that exhibited relationships that are typical for intentions and habits. Third, we assessed multiple health behaviors in both studies (8 behaviors in Study 1, 6 behaviors in Study 2), which helps to rule out the idea that degree of reasoned action only moderates relations for particular behaviors. Fourth, we used a person-level measure of degree of reasoned action so our findings depend in part on consistency of the influence of an individual difference variable across various behaviors. The implication is that DRA's moderation of intention-behavior and habit-behavior relationships could be even stronger should a behavior-level measure of DRA be developed.

Limitations and Directions for Future Research

At the same time, we acknowledge that the present studies have limitations and that much research still remains to be undertaken on degree of reasoned action. The first limitation is that single items were used to index past behavior, context stability, and future behavior – in order to reduce research costs and participant burden. Corroboration of the present findings using multi-item measures of these constructs is needed. Second, reliability was modest for several variables. We therefore reran the analyses using single item measures of intention and using single items to index DRA; findings remained the same. Third, we used past behavior and performance frequency × context stability to index habits. Future tests should also consider measures of

perceived automaticity (see Gardner 2015, for a review). Fourth, behavior was measured using self-reports. It was not feasible to obtain objective measures of the multiple behaviors examined here, and so tests of the moderating role of degree of reasoned action using non-reactive outcomes should be a priority for future research. Fifth, the follow-up periods for behavior (3 months in Study 1, 1 month in Study 2) were relatively short. Further tests over longer periods would be desirable to confirm the moderating role of well-reasoned intentions. Finally, the present studies measured, but did not manipulate, degree of reasoned action. The use of correlational designs seems justified in this first test of the role of degree of reasoned action in relation to health behaviors. However, experimental tests must follow.

The present research suggests that degree of reasoned action shows promise both in closing the intention-behavior gap and in overcoming the influence of habit. However, additional research is needed both to uncover the mechanisms underlying moderation by degree of reasoned action and to discover how this construct can be exploited effectively in behavior change interventions. Neuroimaging or EEG evidence would be valuable in order to corroborate the idea that degree of reasoned action reflects deeper consideration of the basis of intention or greater deliberation about the focal behavior. There are several plausible mechanisms of well-reasoned intentions that warrant investigation in future research. For instance, degree of reasoned action could be associated with greater temporal stability of intention, and studies indicate that intention stability moderates intention-behavior relations and the past behavior-behavior relation Cooke and Sheeran, 2004; Sheeran and Webb, 2016; Sheeran et al., 1999). Degree of reasoned action could also be a marker for executive function (EF), and there is evidence that greater EF is associated with improved translation of intentions into action and also improved capacity to inhibit habitual behaviors (Goldstein and Volkow, 2002; Hall et al., 2008, 2014). It is also

possible that DRA could promote strategic self-regulation processes such as self-monitoring or if-then planning that have been shown to increase intentional control over health behaviors and reduce habitual control (Adriaanse et al., 2010; Gollwitzer and Sheeran, 2006; Harkin et al., 2016, Quinn et al., 2010). In short, there is much work to be done in order to uncover precisely why degree of reasoned action moderates the strength of both intention-behavior and habit-behavior relations.

To effectively exploit the potential of degree of reasoned action for interventions to promote health behavior change will likely require two lines of basic research (Sheeran et al., 2017). On the one hand, studies of *target validation* are needed to corroborate the finding that degree of reasoned action moderates intention-behavior and habit-behavior relations. On the other hand, and pertinent to intervention development, studies of *target engagement* are needed to discover the best strategies for improving degree of reasoned action. Research on target engagement take change in the target (degree of reasoned action) as the dependent variable, and tests various different manipulations in order to determine how DRA scores can be maximized. In short, as the present research offers only the first empirical test of degree of reasoned action, further research along the lines suggested here will be needed in order to realize DRA's potential for behavior change interventions.

Conclusions

The present research offers evidence that a new construct – degree of reasoned action – can simultaneously improve intentional control and reduce habitual control over health behaviors. These findings were observed among relatively large samples (N = 663 and 1014), using an established index of habit, and for multiple health behaviors. The present studies have limitations, however, and additional tests are needed to confirm the generality of the findings

observed here. A program of research on how degree of reasoned action can best be engaged also seems warranted.

References

Abraham, C., & Sheeran, P. (2003). Acting on intentions: The role of anticipated regret. *British Journal of Social Psychology*, *42*(4), 495–511. doi:10.1348/014466603322595248

Adriaanse, M. A., Oettingen, G., Gollwitzer, P. M., Hennes, E. P., De Ridder, D. T. D., & De Wit, J. B. F. (2010). When planning is not enough: Fighting unhealthy snacking habits by mental contrasting with implementation intentions (MCII). *European Journal of Social Psychology*, *40*(7), 1277–1293. http://doi.org/10.1002/ejsp.730

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Aldrich, J. H., Montgomery, J. M., & Wood, W. (2010). Turnout as a habit. *Political Behavior*, *33*(4), 535–563. http://doi.org/10.1007/s11109-010-9148-3

Bagozzi, R. P., & Yi, Y. (1989). The degree of intention formation as a moderator of the attitude-behavior relationship. *Social Psychology Quarterly*, *52*(4), 266–279. doi: 10.2307/2786991?ref=search-gateway:ab61a60b77f7fe9ef446dab7641c1b81

Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychology & Health, 13*(4), 623-649. http://dx.doi.org/10.1080/08870449808407422

Bassili, J. N. (1996). Meta-judgmental versus operative indexes of psychological attributes: The case of measures of attitude strength. *Journal of Personality and Social Psychology*, *71*(4), 637–653. http://doi.org/10.1037//0022-3514.71.4.637

Bryk, A. S. & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods,* Thousand Oaks, CA: Sage Publications, Inc.

Chapman, K., & Ogden, J. (2009). How do people change their diet? *Journal of Health Psychology*, *14*(8), 1229–1242. http://doi.org/10.1177/1359105309342289

Conner, M., McEachan, R., Taylor, N., O'Hara, J., & Lawton, R. (2015). Role of affective attitudes and anticipated affective reactions in predicting health behaviors. *Health Psychology*, *34*(6), 642–652. http://doi.org/10.1037/hea0000143

Conner, M., & Sparks, P. (2015). The theory of planned behaviour and the reasoned action approach. In M. Conner & P. Norman (Eds.), *Predicting and changing health behaviour: Research and practice with social cognition models* (pp. 142-188). Buckingham, UK: OUP.

Cooke, R., & Sheeran, P. (2004). Moderation of cognition- intention and cognition-behaviour relations: A meta- analysis of properties of variables from the theory of planned behaviour. *British Journal of Social Psychology*, *43*(2), 159–186. http://doi.org/10.1348/0144666041501688

Danner, U. N., Aarts, H., Papies, E. K., & de Vries, N. K. (2010). Paving the path for habit change: Cognitive shielding of intentions against habit intrusion. *British Journal of Health Psychology*, *16*(1), 189–200. http://doi.org/10.1348/2044-8287.002005

Gardner, B. (2015). A review and analysis of the use of 'habit' in understanding, predicting and influencing health-related behaviour. *Health Psychology Review*, *9*(3), 277-295.

Gardner, B., De Bruijn, G.-J., & Lally, P. (2011). A systematic review and meta-analysis of applications of the self-report habit index to nutrition and physical activity behaviours. *Annals of Behavioral Medicine*, *42*(2), 174–187. doi: 10.1007/s12160-011-9282-0

Godin, G., & Conner, M. (2008). Intention-behavior relationship based on epidemiologic indices: an application to physical activity. *American Journal of Health Promotion*, *22*(3), 180–182. http://doi.org/10.4278/ajhp.22.3.180

Godin, G., Conner, M., & Sheeran, P. (2010). Bridging the intention-behaviour gap: The role of moral norm. *British Journal of Social Psychology*, *44*(4), 497–512. http://doi.org/10.1348/014466604X17452

Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications to health-related behaviors. *American Journal of Health Promotion*, *11*(2), 87-98.

Goldstein, R. Z., & Volkow, N. D. (2002). Drug addiction and its underlying neurobiological basis: Neuroimaging evidence for the involvement of the frontal cortex. *American Journal of Psychiatry*, *159*(10), 1642-1652. doi: 10.1176/appi.ajp.159.10.1642

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38,* 69-119. http://doi.org/10.1016/50065-2601(06)38002-1

Hagger, M. S., Polet, J., & Lintunen, T. (2018). The reasoned action approach applied to health behavior: Role of past behavior and tests of some key moderators using meta-analytic structural equation modeling. *Social Science & Medicine, 213*, 85-94. https://doi.org/10.1016/j.socscimed.2018.07.038

Hall, P. A., Fong, G. T., Epp, L. J., & Elias, L. J. (2008). Executive function moderates the intention-behavior link for physical activity and dietary behavior. *Psychology & Health*, *23*(3), 309–326. http://doi.org/10.1080/14768320701212099

Hall, P. A., Zehr, C. E., Ng, M., & Zanna, M. P. (2012). Implementation intentions for physical activity in supportive and unsupportive environmental conditions: An experimental examination of intention–behavior consistency. *Journal of Experimental Social Psychology*, *48*(1), 432–436. doi:10.1016/j.jesp.2011.09.004

Harkin, B., Webb, T. L., Chang, B. P. I., Prestwich, A., Conner, M., Kellar, I., et al. (2016). Does monitoring goal progress promote goal attainment? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *142*(2), 198–229. http://doi.org/10.1037/bul0000025

Labrecque, J. S., & Wood, W. (2015). What measures of habit strength to use? Comment on Gardner (2015). *Health Psychology Review*, *9*(3), 303-310.

McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the Theory of Planned Behaviour: A meta-analysis. *Health Psychology Review*, *5*(2), 97–144. http://doi.org/10.1080/17437199.2010.521684

Neal, D. T., Wood, W., Wu, M., & Kurlander, D. (2011). The pull of the past. *Personality and Social Psychology Bulletin*, *37*(11), 1428–1437.doi:10.1177/0146167211419863

Orbell, S., & Sheeran, P. (1998). "Inclined abstainers": A problem for predicting health-related behaviour. *British Journal of Social Psychology*, *37*(2), 151–165. http://doi.org/10.1111/j.2044-8309.1998.tb01162.x

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*(1), 54–74. http://doi.org/10.1037/0033-2909.124.1.54

Pieters, R. G. M., & Verplanken, B. (1995). Intention-behaviour consistency: Effects of consideration set size, involvement and need for cognition. *European Journal of Social Psychology*, *25*(5), 531–543. http://doi.org/10.1002/ejsp.2420250505

Quinn, J. M., Pascoe, A., Wood, W., & Neal, D. T. (2010). Can't control yourself? Monitor those bad habits. *Personality and Social Psychology Bulletin*, *36*(4), 499–511. http://doi.org/10.1177/0146167209360665

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1). New York: Sage.

Rhodes, R. E., & De Bruijn, G.-J. (2013). What predicts intention-behavior discordance? A review of the action control framework. *Exercise and Sport Sciences Reviews*, *41*(4), 201–207. http://doi.org/10.1097/JES.0b013e3182a4e6ed

Rhodes, R. E., & Dickau, L. (2013). Moderators of the intention-behaviour relationship in the physical activity domain: a systematic review. *British Journal of Sports Medicine*, *47*(4), 215–225. doi:10.1136/bjsports-2011-090411

Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In J. T. Cacioppo & R. E. Petty (Eds.), *Social psychophysiology: A sourcebook* (pp. 153-176). London: Guilford.

Rothman, A. J., Gollwitzer, P. M., Grant, A. M., Neal, D. T., Sheeran, P., & Wood, W. (2015). Hale and hearty policies: How psychological science can create and maintain healthy habits. *Perspectives on Psychological Science*, *10*(6), 701–705. doi: 10.1177/1745691615598515

Sheeran, P. (2002). Intention-behavior relations: A conceptual and empirical review. *European Review of Social Psychology*, *12*(1), 1–36. http://doi.org/10.1080/14792772143000003

Sheeran, P., & Abraham, C. (2003). Mediator of moderators: Temporal stability of intention and the intention-behavior relation. *Personality and Social Psychology Bulletin*, *29*(2), 205–215. http://doi.org/10.1177/0146167202239046

Sheeran, P., Klein, W. M. P., & Rothman, A. J. (2017). Health behavior change: Moving from observation to intervention. *Annual Review of Psychology*, *68*(1), 573–600. http://doi.org/10.1146/annurev-psych-010416-044007

Sheeran, P., & Orbell, S. (2000). Self-schemas and the theory of planned behaviour. *European Journal of Social Psychology*, *30*, 533-550.

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*(6), 724–734. http://doi.org/10.1177/0146167299025006007

Sheeran, P., & Webb, T. L. (2016). The intention-behavior gap. *Social and Personality Psychology Compass*, *10*(9), 503–518. http://doi.org/10.1111/spc3.12265

Verplanken, B., Aarts, H., Knippenberg, A., & Moonen, A. (1998). Habit versus planned behaviour: A field experiment. *British Journal of Social Psychology*, *37*(1), 111–128. http://doi.org/10.1111/j.2044-8309.1998.tb01160.x

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *132*(2), 249–268. http://doi.org/10.1037/0033-2909.132.2.249

Wilding, S., Conner, M., Prestwich, A., Lawton, R., & Sheeran, P. (in press). Using the question-behavior effect to change multiple health behaviors: An exploratory randomized controlled trial. *Journal of Experimental Social Psychology*, doi: 10.1016/j.jesp.2018.07.008

Wood, W., Tam, L., & Witt, M. G. (2005). Changing circumstances, disrupting habits. *Journal of Personality and Social Psychology*, *88*(6), 918–933. http://doi.org/10.1037/0022-3514.88.6.918

Table 1

Hierarchical Multi-Level Regressions of Behavior on Intention, Degree of Reasoned Action, Habit, and Interactions in Study 2 (N of participants = 623; N of observations = 4856).

Predictors	B	SE	Beta
Model 1			
Intercept (γ_{00})	2.981	.029	
Intentions (γ_{10})	0.463	.018	.457***
Habit (γ_{20})	0.046	.004	.235***
Model 2			
Intercept (γ_{00})	2.981	.029	
Intentions (γ_{10})	0.458	.019	.452***
Habit (γ_{20})	0.049	.004	.250***
Intention × habit (γ_{30})	-0.004	.002	-.027+
Model 3			
Intercept (γ_{00})	2.980	.029	
Intentions (γ_{10})	0.458	.019	.452***
Habit (γ_{20})	0.049	.004	.250***
Intention × habit (γ_{30})	-0.004	.002	-.027*
Degree of reasoned action (γ_{01})	0.031	.059	.012
Cross-level interactions with DRA			
Intentions (γ_{11})	0.095	.037	.094**
Habit (γ_{21})	-0.019	.008	-.097**
Intention × habit (γ_{31})	0.009	.004	.061*

Note. B = unstandardized coefficient; *SE* = standard error; Beta = standardized coefficient. Baseline Intercept only Model, Deviance = 17093.4; Model 1, Deviance = 14947.4; Model 2, Deviance = 14947.7; Model 3, Deviance = 14965.7.
+ p = .067, * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2

Hierarchical Multi-Level Regressions of Behavior Behavior on Intention, Degree of Reasoned Action, Past Behavior, Habit, and Interactions in Study 2 (N of participants = 992; N of observations = 5952).

Predictors	B	SE	Beta
Model 1			
Intercept (γ_{00})	2.876	.015	
Intentions (γ_{10})	0.158	.009	.274***
Habit (γ_{20})	0.053	.002	.412***
Model 2			
Intercept (γ_{00})	2.876	.015	
Intentions (γ_{10})	0.149	.009	.257***
Habit (γ_{20})	0.057	.002	.443***
Intention × habit (γ_{30})	-0.004	.001	-.064***
Model 3			
Intercept (γ_{00})	2.875	.015	
Intentions (γ_{10})	0.148	.009	.257***
Habit (γ_{20})	0.057	.002	.443***
Intention × habit (γ_{30})	-0.004	.001	-.064***
Degree of reasoned action (γ_{01})	0.081	.019	.055***
Cross-level interactions with DRA			
Intentions (γ_{11})	0.027	.011	.047*
Habit (γ_{21})	-0.006	.003	-.047*
Intention × habit (γ_{31})	-0.002	.001	-.032*

Note. B = unstandardized coefficient; *SE* = standard error; Beta = standardized coefficient. Baseline Intercept only Model, Deviance = 37433.9; Model 1, Deviance = 16795.2; Model 2, Deviance = 16770.4; Model 3, Deviance = 16774.2.
* $p < .05$; ** $p < .01$; *** $p < .001$.

Figure 1
Simple Slopes for Habit by Degree of Reasoned Action and Intention (Study 1)