



When attitudes and habits don't correspond: Self-control depletion increases persuasion but not behavior



Guy Itzchakov^{a,*,1}, Liad Uziel^{b,2}, Wendy Wood^c

^a The Israel Academic College, Israel

^b Bar-Ilan University, Israel

^c University of Southern California, United States

ARTICLE INFO

Keywords:

Ego depletion
Self-control
Attitude change
Behavior change
Attitude-behavior association
Habits

ABSTRACT

Changing attitudes does not necessarily involve the same psychological processes as changing behavior, yet social psychology is only just beginning to identify the different mechanisms involved. We contribute to this understanding by showing that the moderators of attitude change are not necessarily the moderators of behavior change. The results of three studies ($N_s = 98, 104, 137$) employing an ego depletion manipulation indicate that although people are more likely to agree with a persuasive message when executive control is reduced they are not more likely to change their behavior. Rather, under conditions of ego depletion, attitudes became less correlated with behaviors after persuasion. Moreover, in Study 3, we provide an explanation for this phenomenon: People are more likely to agree with a persuasive message when depleted but are also more likely to fall back on habits that may conflict with their new evaluations. A mini meta-analysis of the data indicated that ego-depletion had a medium effect size on the difference between attitude change and behavior change, $N = 339$, $\bar{d} = -0.51$, 95% CI $[-0.72, -0.29]$. Jointly, these studies suggest an integrative, resource-based explanation to attitude-behavior discrepancies subsequent to persuasion.

Social psychologists often assume that the factors that control attitude change also control behavior change (e.g., Ajzen, 1991; Johnson, Siegel, & Crano, 2014; Mancha & Yoder, 2015; McEachan et al., 2016; Wurtele & Maddux, 1987). For this reason, the field of persuasion has mostly focused on attitude and intention change, believing that behaviors will follow. Recent evidence, however, suggests that change in attitudes does not always yield a change in behaviors. Specifically, meta-analyses of experiments employing persuasion manipulations and other means of intention change have found that medium-to-large changes in intentions only led to small-to-medium changes in behavior (Rhodes & Dickau, 2012; Webb & Sheeran, 2006). Moreover, statistical simulations suggested that a change in attitudes does not guarantee a change in behavior (Fife-Schaw, Sheeran, & Norman, 2007). At the very least, it seems easier to change intentions than change behavior. These findings also hint that some unique psychological processes are involved in attitude and behavior change.

In the present article, we first demonstrate that attitude and behavior change do not always correspond. The importance of demonstrating this discrepancy is highlighted by recent analyses indicating

that many studies assessing attitudes and intentions do not also assess behavior (Baumeister, Vohs, & Funder, 2007). As a result, the extent to which this discrepancy occurs is largely unknown. We then explore two accounts for the divergence between attitude and behavior change, one involving attitude strength and the second involving habit. We present three studies, the first two of which illustrate the attitude change - behavior change discrepancy. The third describes a test of the underlying mechanism.

To generate conditions in which attitudes and behavior do not change in tandem, we manipulated the extent of thought that participants could allocate to thinking about attitude and behavior change. Specifically, we varied ego-depletion. This manipulation not only established a precondition for this discrepancy but also revealed the processes that contribute to it.

1. Attitude strength

The first explanation why attitudes change without comparable behavior change comes from dual process theories of attitude change,

* Corresponding author at: The Israel Academic College—Ramat-Gan, 52275, Israel.

E-mail address: guy.itzchakov@mail.huji.ac.il (G. Itzchakov).

¹ Guy Itzchakov's contribution was supported by a grant from the Israel Academic College.

² Liad Uziel's contribution was supported by a grant from the Israel Science Foundation (ISF grant No. 481/17) and by a grant from the United States - Israel Binational Science Foundation (BSF), Jerusalem, Israel.

especially the elaboration likelihood model of persuasion (ELM; Petty & Cacioppo, 1986). According to the ELM, the impact of persuasion attempts on attitude change depends on the recipients' motivation and ability to think (Petty, Wells, & Brock, 1976). When motivation or ability is low, attitudes change through low-level elaboration processes that depend on peripheral cues such as the number of arguments supporting one side (e.g., Haugtvedt & Petty, 1992). Attitude change under low elaboration results in relatively weak attitudes (e.g., low in accessibility, certainty, extremity) that are less predictive of behavior than the stronger attitudes formed under high elaboration (Krosnick & Petty, 1995).

In this view, recipients may change their attitudes, but not their behavior when attitudes are weak. That is, discrepancies between attitude and behavior change may be due to the fact that newly changed attitudes are too weak to guide behavior. Tests of this model have provided support for this hypothesis. However, these studies have only examined behavioral intentions and not actual behavior (e.g., Barden & Petty, 2008).

2. Habit

The second possibility is that expressing attitudes and behavior may involve somewhat different psychological mechanisms. Recent models of habitual action suggest that people can develop response habits through instrumental learning that are relatively resistant to change from persuasion (e.g., Amodio & Ratner, 2011; Wood & Rünger, 2016). Habits are context-response associations that develop with repeated responding in a given context. Once habits form, the perception of the context automatically triggers activation of the response in mind (Wood, 2017).

The idea that persuasive messages that change people's attitudes do not necessarily change habitual behavior comes from Webb and Sheeran's (2006) meta-analytic review. In their analysis, persuasion and other interventions that successfully changed people's behavioral intentions had little traction in changing their habits. That is, intention to change did not translate into behavioral change in domains in which participants could form habits. In non-habitual domains, however, changed intentions corresponded closely with changed behavior. These findings suggest that the cause of the attitude change - behavior change discrepancy does not lie in weak attitudes but rather in the strength of behavior.

Whether people act out of habit or respond more deliberately depends in part on their ability to deliberate. When the capacity to think is low, such as following ego depletion, they are especially likely to act out of habit. The tendency for people to backslide into responding habitually when self-control falters has been observed with choice of food among dieters (Kahan, Polivy, & Herman, 2003), consumption of alcohol among social drinkers (Muraven, Collins, & Neinhuis, 2002), and the prescription of medications by physicians (Linder et al., 2014). In addition, participants with low willpower are less likely to follow situationally appropriate self-presentation strategies and instead fall back on habitual modes of presenting themselves (Vohs, Baumeister, & Ciarocco, 2005). This does not only refer to bad habits. As Neal, Wood, and Drolet (2013) showed, people exhibit more good habits as well as more bad habits consecutive to an ego depleting task. Depleted individuals are more likely to implement their habitual response because they are less able to reject the automatically activated response or choose an alternative response (or even not respond).

Crucially, in both attitude strength and habit accounts of the attitude change - behavior change discrepancy, attitude change adheres to the processes specified by the ELM (Petty & Cacioppo, 1986). When people can only engage in limited thought, as in the case of ego depletion, they are more likely to change their attitudes when given positive peripheral cues (e.g., a pleasant speaker's voice; Petty et al., 1976) and are less likely to do so when given negative peripheral cues (e.g., an unattractive message source). The two accounts also correspond in

anticipating that, under limited thought, behavior change will not always correspond to attitude change. In the ELM, behavior fails to change when attitudes are weak whereas the habit account emphasizes mechanisms in terms of the behavior. Although our focus here was primarily on testing the influence of habit (given the novelty of this aspect of our analysis), we acknowledge that both mechanisms probably contribute to attitude change - behavior change discrepancies in daily life.

3. Ego depletion

Ego depletion refers to a state in which a person's ability and motivation to engage in effortful deliberation and control of thoughts and actions is reduced, typically as a result of performing a control-demanding task (Baumeister, Muraven, & Tice, 2000). In some views, this phenomenon reflects that self-regulation draw upon a limited resource that has been temporarily diminished from use (Muraven, Tice, & Baumeister, 1998). In other views, depletion is due to a reduced level of motivation, as people become less motivated to engage in deliberative activities and more motivated to engage in activities that are more satisfying, interesting, and enjoyable (Inzlicht & Schmeichel, 2012).

Previous work has devoted little attention to the effect of depletion on attitude strength (although see: Wan, Rucker, Tormala, & Clarkson, 2010). It is assumed that depletion should result in relatively weak attitudes caused by the peripheral processing of a persuasive message. This ELM-based prediction is consistent with work showing that processing difficulty reduces attitude certainty (Haddock, Rothman, Reber, & Schwarz, 1999), and with recent studies showing that depleted people who are presented with persuasion attempts rely on heuristics when forming their attitudes (Janssen & Fennis, 2017).

Studies that have examined the effect of depletion on attitude change report that depletion impairs the ability to resist persuasive attempts, which leads to attitude change in the direction of this attempt. Specifically, depleted participants were shown to be less able to counterargue specious persuasive messages (Wheeler, Briñol, & Hermann, 2007), and were more susceptible to persuasion when resistance required effort (Burkley, 2008; Clarkson, Hirt, Jia, & Alexander, 2010). Depletion was also found to increase susceptibility to persuasion in studies employing social influence techniques, which consist of a sequence of requests, such as the foot-in-the-door (Fennis & Janssen, 2010; Fennis, Janssen, & Vohs, 2009; Janssen, Fennis, Pruyn, & Vohs, 2008). Advertising research has also showed that depletion amplifies the effectiveness of persuasion (Gillespie, Joireman, & Muehling, 2012).

Thus, consistent with previous work we hypothesized that:

H1. Depleted participants should show more attitude change than non-depleted participants consecutive to a persuasive message.

We also anticipated that depletion would reduce the association between the newly-formed attitude and its corresponding behavior. This could occur when the new attitude is weak and does not have sufficient strength to guide action. Alternatively, behavior might be strong and habitually cued. Under these circumstances, the depletion-induced attitude change should fail to generate behavior change. This led to the following hypothesis:

H2. Ego-depletion should attenuate the association between attitude change and behavior change consecutive to persuasion.

These two hypotheses were both tested in Study 1 and Study 2 below. These studies highlight the importance of behavioral processes and the ways that successful persuasion may or may not translate into comparable success as behavior change. To more clearly identify the mechanisms behind any discrepancies, in Study 3 we assessed the habit strength of the behavior in the research. This allowed us to test whether habits could account for the posited lack of correspondence between attitude and behavior. We thus hypothesized that:

H3. Depleted participants are likely to fail to act in accordance with their newly-acquired attitude because they will fall back on their habits.

The current work innovates by measuring actual behavior rather than simply behavioral intentions. In so doing, we expand research on persuasion processes to include factors that influence people's actual responses as well as their self-report judgments. This made it possible to accurately evaluate the relationship between attitude and behavior change. It also captured processes central to behavior performance, such as habit strength, that are not accessible when measuring behavior intentions.

4. Overview of the studies

Three laboratory experiments were conducted. In each study, depletion was first manipulated, and was followed by a persuasion attempt and an attitude measure. Masked as a new, unrelated study, participants then completed a choice task that measured actual behavior. Across the studies, the messages were designed to have both strong arguments and strong peripheral cues to ensure that they were maximally persuasive. Specifically, in Study 1 and Study 2 we used emotional video clips, and in Study 3 we used a credible message source presenting research-based arguments. We report all measures, manipulations, and exclusions in these studies and in the supplementary materials.

5. Study 1

5.1. Method

5.1.1. Participants

One-hundred and twelve undergraduates participated in a study on personality characteristics and decision making in exchange for course credit ($M_{\text{age}} = 22.80$, $SD = 2.10$; 69% female). Because we were solely interested in participants who had a meat eating habit, we excluded participants who identified themselves as vegan or vegetarians. This left a final sample of 98 participants, which yielded a power³ of 0.84 to detect a medium-effect size in a 2×1 between-participant design, Cohen's $d = 0.60$ (Faul, Erdfelder, Lang, & Buchner, 2007).

5.1.2. Procedure

Participants were tested individually on a computer. Those in the depletion condition were presented with a paragraph in English (their second language; see Supplementary materials) prefaced with the following instructions (back translated from Hebrew):

"Please copy the following paragraph in the white box below. Work as quickly as possible and make as few mistakes as you can. You have a maximum of **6 minutes** to complete the task. **You must not press the space bar or the letter e.** In other words, you must copy the paragraph as if it did not have spaces or the letter e. Please work solely **with your non-dominant hand** (the left hand for most people). **You must not** go back or correct typos. Do not copy sections using copy + paste. **Type** the entire text. Once you have completed the task, click on the arrow bar and move on to the next task."

Participants in the non-depletion condition were given a paragraph to copy in Hebrew (their first language) and the following instructions:

"Copy the following paragraph into the white box below. Do not use shortcuts such as copy + paste. Once you have completed the task, click on the arrow bar and move on to the next task."

This task is a variant of a similar task that has been used in several

studies and was found to reduce self-regulatory resources (e.g., Janssen & Fennis, 2017; Schmeichel, 2007; Uziel & Baumeister, 2017). After the depletion manipulation, participants watched a 4-minute video clip⁴ that presented arguments in favor of a vegan diet. The video clip was preferred over a written text because depleted participants were expected to find it harder to concentrate and understand written arguments (Englert, Bertrams, Furley, & Oudejans, 2015). The use of a video clip thus increased the likelihood that any differences between the depletion conditions on attitude change would not be attributed to comprehension problems. Finally, participants answered demographic questions.

In order to avoid suspicion and demand effects, the decision-making phase was separated from the depletion and persuasion attempt.⁵ Specifically, after watching the video clip, a message appeared that stated that the first study was over and a new (unrelated) study would begin immediately. In the ostensibly-unrelated second study, participants read reviews of 4 restaurants⁶: two meat restaurants, and two vegan restaurants.⁷ Participants indicated their attitude towards each restaurant. Finally, participants were told that they could win a raffle ticket for a free meal at one of the four restaurants and were asked to choose a restaurant. Finally, participants were debriefed, compensated, and thanked.

5.2. Measures⁸

5.2.1. Depletion-manipulation check

Three items⁹ measured the extent to which participants felt depleted ("How difficult was this for you?" "To what extent did the task require your effort?" "How tiring was this task for you?"). The items were rated on a 7-point Likert-type scale anchored at 1 (*not at all*) and 7 (*very much*), $\alpha = 0.85$.

5.2.2. Attitude towards veganism

Participants rated their attitude towards veganism on six items¹⁰ ranging from 1 = *strongly disagree* to 9 = *strongly agree* ("veganism is a good thing", "I'm in favor of veganism", "veganism is a desired thing", "veganism is a negative thing", "veganism is silly", "veganism is a useful thing"), $\alpha = 0.94$.

5.2.3. Evaluation of restaurants

Participants rated each restaurant on atmosphere, food quality, price, and overall evaluation, on a 1 (*poor*) to 9 (*excellent*) Likert-type scale, with regard to: (a) atmosphere, (b) food quality, (c) price, (d) overall evaluation, $\alpha_{\text{meat}(1)} = 0.86$, $\alpha_{\text{meat}(2)} = 0.82$, $\alpha_{\text{vegan}(1)} = 0.93$, $\alpha_{\text{vegan}(2)} = 0.68$.

5.2.4. Attitude Extremity

Attitude extremity was used as a measure of attitude strength. It was calculated by the absolute deviation from the midpoint of the attitude scale (Downing, Judd, & Brauer, 1992). Scores ranged from 0 to 4. Higher scores indicated more extreme attitudes.

⁴ <https://www.youtube.com/watch?v=QaBrN5IrGno>.

⁵ At the end of each study the research assistant debriefed participants. None of the participants in any study expressed suspicion that the two (supposedly unrelated) studies were both parts of the same study.

⁶ The descriptions were the same length. To pilot the study, we asked the seven judges to rate the quality of each description to ensure that there were no differences.

⁷ One meat restaurant and one vegan restaurant were kosher according to Jewish tradition.

⁸ We also measured personality traits, which are reported in the Supplementary material.

⁹ In Hebrew (the mother-tongue of the participants) the meaning of the word we used for fatigue indicates attrition rather than sleep-related tiredness.

¹⁰ All six items loaded on a single factor, which explained 57.49% of the variance.

³ For purpose of consistency, in every power analysis, we converted the Z score for the Hotelling t-test for differences between correlations to a Cohen's d.

Table 1
Descriptive statistics and correlations for Study 1.

	<i>M</i>	<i>SD</i>	1	2	3	4	5
1. Depletion manipulation check	3.17	1.28					
2. Attitude towards veganism	5.85	2.15	.26				
3. Evaluation of meat restaurant	6.40	1.10	.24	.29			
4. Evaluation of vegan restaurant	6.82	1.18	<i>.20</i>	<i>.37</i>	<i>.67</i>		
5. Behavior (choice)	0.56	0.50	.06	.13	–.02	.13	
6. Attitude extremity	2.08	1.43	.04	.19	1.11	.13	.09

Note: Values in **bold** differ from 0 at $p < .05$; values in *italics* differ from 0 at $p < .10$.

5.2.5. Behavior

Choice of the meat restaurants were coded 0 and the vegan restaurants as 1.

5.2.6. Diet preferences

Participants classified their eating habits: 88% indicated they were carnivores, 10% indicated they were vegetarians, and 2% indicated they were vegan. As mentioned above, the vegan and vegetarian participants were omitted from the analysis.

5.3. Results and discussion

Table 1 presents the means, standard deviations and correlations between the variables.

5.3.1. Manipulation check

Participants in the depletion condition reported feeling more depleted, ($M = 3.70$, $SD = 1.12$) than participants in the non-depletion condition, ($M = 2.53$, $SD = 1.30$), $t(96) = 4.76$, $p < .001$, $Cohen's d = 0.97$, indicating that the manipulation was effective.

5.3.2. Attitude change

Participants in the depletion condition reported more positive general attitudes towards veganism ($M = 6.36$, $SD = 1.98$) than participants in the non-depletion condition ($M = 5.51$, $SD = 1.83$), $t(96) = 2.19$, $p = .03$, $d = 0.45$. Consistent with Hypothesis 1, this result suggests that the persuasive message was more effective on the depleted than the non-depleted participants. Participants also rated each of the four restaurants based on the reviews they read. Participants in both conditions did not differ in their evaluation of the meat restaurants ($M_s = 6.65, 6.41$, $SD_s = 1.03, 1.01$), $t(96) = 1.18$, $p = .24$, $d = 0.24$. However, participants in the depletion condition evaluated the vegan restaurants marginally more positively ($M = 7.01$, $SD = 1.06$) than participants in the non-depletion condition ($M = 6.54$, $SD = 1.34$), $t(96) = 1.90$, $p = .06$, $d = 0.39$. This again suggests that depleted participants were more persuaded than non-depleted participants in favor of veganism. Note that prior to conducting the study, independent judges rated the quality of each restaurant review and no differences were found.

There was no significant difference in extremity between participants in the depletion ($M = 1.93$, $SD = 1.42$), and non-depletion conditions ($M = 2.23$, $SD = 1.20$), $t(96) = -1.13$, $p = .26$, $d = -0.23$.

5.3.3. Behavior change

There was no difference between conditions with regard to the measure of behavior. In the depletion and non-depletion conditions, 48% and 52% (respectively) of participants chose a free meal at one of the vegan restaurants, $\chi^2(1) = 0.04$, $p = .84$.

5.3.3.1. Attitude-behavior association. Hypothesis 2 dealt with the association between attitudes towards veganism and behavior (see Fig. 1). Because the behavioral measure was dichotomous, we employed a binary

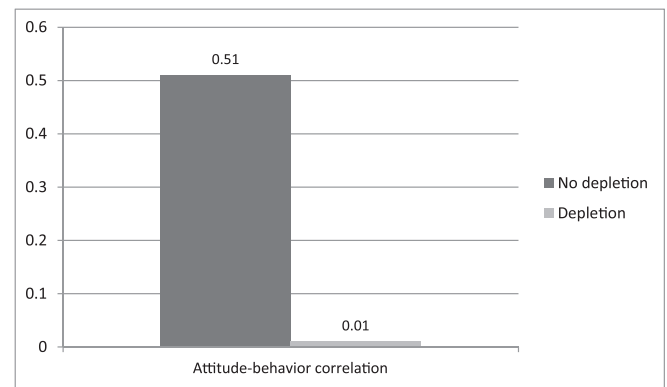


Fig. 1. Study 1: correlations between attitude and behavior towards veganism by depletion condition.

logistic regression to assess whether the association between attitude and behavior varied with depletion condition. Specifically, depletion condition (0 = no depletion, 1 = depletion), attitude, and the Condition \times Attitude interaction were entered into a binary logistic regression model to predict the likelihood of choosing a vegan restaurant (0 = meat, 1 = vegan). There was no main effect for the experimental condition on choice likelihood, $b(SE) = -0.22(0.45)$, $Wald's \chi^2(1) = 0.24$, $p = .63$, $EXP(B) = 0.80$. A main effect of attitude on choice, $b(SE) = 0.83(0.28)$, $Wald's \chi^2(1) = 8.86$, $p = .003$, $EXP(B) = 2.29$, indicated that more favorable attitudes towards veganism predicted a higher likelihood of choosing a vegan restaurant. Importantly, there was a significant Condition \times Attitude interaction on behavior, $b(SE) = -0.81(0.31)$, $Wald's \chi^2(1) = 6.78$, $p = .009$, $EXP(B) = 0.43$. The simple slope in the depletion condition was not significant, $b = 0.01$, $t(94) = 0.03$, $p = .97$. In the non-depletion condition the simple slope was positive and significant: $b = 0.83$, $t(94) = 2.21$, $p = .03$. That is, for depleted participants, a more positive attitude towards veganism was less likely to predict choosing a vegan restaurant in comparison to non-depleted participants. Finally, to test whether attitude strength played a role in the attitude-behavior relationship, we added extremity and the interaction terms Condition \times Extremity, and Condition \times Attitude \times Extremity to the regression. None of the new predictors was significant, $b_s(SE) = 0.38(0.33)$, $0.13(0.17)$, $-0.08(0.09)$, $Wald's \chi^2(1) = 0.07$, 0.65 , 0.70 , $p_s = 0.25$, 0.42 , 0.40 $EXP(B)s = 1.48$, 1.14 , 0.92 . The main effect of attitude on choice and the Condition \times Attitude interaction on behavior remained significant. This result suggests that habit, rather than attitude extremity, played a role in the moderation of ego-depletion on the attitude-behavior association.

In conclusion, Study 1 showed that depletion caused more change in attitude consecutive to a persuasion attempt (Hypothesis 1). However, the change in attitude was not followed by a change in behavior. Thus, depleted participants had a lower correlation between attitudes and behavior (Hypothesis 2). Nevertheless Study 1 did not manipulate persuasion in that all participants were exposed to a persuasive message. Thus, the findings cannot refute the possibility that depletion in and of itself elicited attitude change.

6. Study 2

This study was aimed at increasing the generalizability of Study 1 by using a different attitude topic, persuasion attempt, and behavioral measure. In addition, we manipulated persuasion to test whether depletion itself would elicit attitude change.

6.1. Method

6.1.1. Participants

One-hundred and four undergraduate students ($M_{age} = 24.1$, $SD = 2.95$, 63% female) participated in a study about decision making

in exchange for monetary compensation (15 New Israeli Shekels,¹¹ equivalent to \$4.00). No participants or measures were excluded. We computed power based on the Z score of Study 1 converted to *Cohen's d*. This sample size has a power of 0.80 to detect a medium effect size; *Cohen's d* = 0.55.

6.1.2. Procedure

As in Study 1, a laboratory experiment was conducted in which participants were tested individually on a computer. The study was a 2 × 2 between-subject design in which participants were randomly assigned to depletion (depletion/no depletion) and persuasion (persuasion/no persuasion) conditions. Depletion was manipulated first by using the same manipulation as in Study 1. Then half of the participants watched a six-minute video clip advocating pro-social behavior entitled "Inspirational: Be Kind to Others, It Will Pay Off". It showed a help chain in which one person helps another person, who then helps a third person and so on. This particular video-clip has been found to be very emotional and has received over 350,000 views on Youtube.¹² The other half of the participants watched a video-clip irrelevant to pro-social behavior (the most beautiful sites in the world). Afterward, the participants answered filler items to separate the persuasion manipulation from behavior. After answering the filler items, the computer screen presented following question (back translated from Hebrew):

"In the lab where this study is taking place, graduate students do research for their Masters' degrees. However, not all students can afford to cover the expenses related to their research (e.g., payment of participants and research assistants). In order to support these students, the lab raises money to help them finance their research."

Participants indicated whether they would be willing to donate part of their monetary compensation to support these graduate students. If they agreed to donate, they were instructed to place their donation in an envelope and hand it to the research assistant (all the money collected was donated to fund the research projects of the students in the lab). Participants typically hold onto the money they earn in an experiment, and this is a type of habitual, default baseline response. However, we had no direct measure of habit strength.

6.2. Measures

6.2.1. Manipulation check on depletion

The manipulation check was measured in the same way as in Study 1 ($\alpha = 0.90$).

6.2.2. Attitude

Five items measured attitude towards helping others¹³ ("providing assistance to other people is desirable", "helping others makes the helper proud", "helping others is usually a waste of time" [reverse scored], "Helping another person is rewarding", "children should be taught about the importance of helping others"). The items were rated on a 9-point Likert-type scale anchored at 1 = *strongly disagree* to 9 = *strongly agree*.

6.2.3. Behavior

Behavior was measured by the actual amount of money that participants donated.

6.3. Results and discussion

Table 2 presents the means, standard deviations, and correlations between the variables.

Table 2

Descriptive statistics and correlations for Study 2.

	<i>M</i>	<i>SD</i>	1	2
1. Depletion manipulation check	3.55	1.91		
2. Attitude towards helping others	7.56	1.37	.19	
3. Behavior (amount of donation)	3.15	3.16	<i>.17</i>	<i>.16</i>

Note: Values in **bold** differ from 0 at $p < .05$; values in *italics* differ from 0 at $p < .10$.

6.3.1. Manipulation check

As in Study 1, participants in the depletion condition reported feeling more depleted, ($M = 4.79$, $SD = 1.47$), than participants in the non-depletion condition, ($M = 2.41$, $SD = 1.54$), $t(102) = 8.02$, $p < .001$, $d = 1.58$, indicating that the manipulation was effective.

6.3.2. Attitude change

We analyzed that data using a two-way ANOVA, with depletion (depletion/no depletion) and persuasion (persuasive attempt/no persuasive attempt) as between-participants factors.

The analysis did not yield a main effect of depletion on attitude, $F(1, 100) = 0.15$, $p = .70$. That is, depletion by itself did not induce attitude change. However, the analysis yielded a main effect of persuasion on attitude change, $F(1, 100) = 4.03$, $p = .05$. That is, participants in the persuasion condition reported a more favorable attitude towards helping others than participants in the no-persuasion condition. Importantly, the interaction between the experimental manipulations on attitude change was significant (see Fig. 2), $F(1, 100) = 6.31$, $p = .01$, $\eta_p^2 = 0.04$. Simple effect analyses indicated that the interaction was driven by differences in the persuasion condition between depleted and non-depleted participants. Specifically, following a persuasive message, participants in the depletion condition reported more favorable attitudes towards helping others ($M = 8.14$, $SD = 0.70$) than non-depleted participants ($M = 7.31$, $SD = 1.64$), $t(50) = 2.37$, $p = .02$, 95% CI [0.13, 1.53]. With no message, there was no difference between depleted ($M = 6.88$, $SD = 1.74$) and non-depleted participants ($M = 7.45$, $SD = 1.49$), $t(50) = -1.27$, $p = .21$, 95% CI [-1.47, 0.33].

6.3.3. Behavior change

The analysis did not yield a main effect of depletion on behavior, $F(1, 100) = 1.34$, $p = .25$. However, a main effect of persuasion on behavior, $F(1, 100) = 3.95$, $p = .05$, $\eta_p^2 = 0.04$, revealed that participants who were presented with the persuasive message donated more money than participants who were not presented with a persuasive attempt.

The interaction between the experimental manipulations on behavior change was significant, $F(1, 100) = 4.23$, $p = .04$, $\eta_p^2 = 0.04$. Simple effects analysis indicated that given a persuasion attempt, participants in the depletion condition did not donate more money but actually donated less ($M = 2.86$,¹⁴ $SD = 2.77$) than non-depleted participants ($M = 4.83$, $SD = 3.70$), $p = .024$, 95% CI [-3.67, -0.26]. When the persuasion attempt was not present, there was no difference between depleted ($M = 2.90$, $SD = 3.70$) and non-depleted participants ($M = 2.35$, $SD = 2.27$), $p = .53$, 95% CI [-1.17, 2.27].

6.3.4. Attitude-behavior association

Hypothesis 2 predicted an association between the attitude towards pro-social help and behavior (amount of donation). To test H3, the experimental conditions, attitude, Depletion × Persuasion, Depletion × Attitude, Persuasion × Attitude, and Depletion × Persuasion × Attitude were submitted to a linear regression on the behavior measure. There were no main effects of the depletion and persuasion

¹¹ Each participant received the money as 15 single units of NIS.

¹² <https://www.youtube.com/watch?v=ufQpgYSDRdU>

¹³ All five items loaded on a single factor which explained 60.34% of the variance.

¹⁴ Means represent New Israeli Shekels.

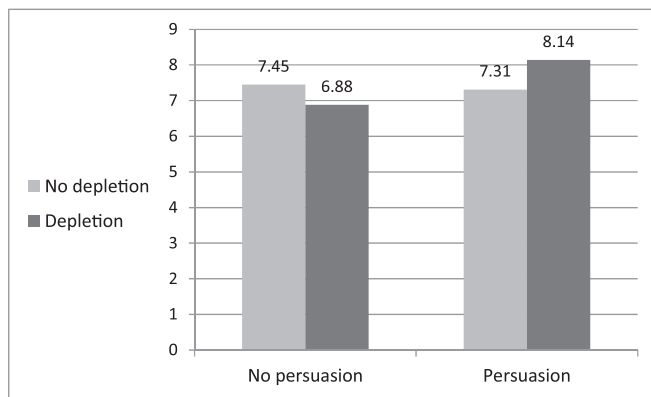


Fig. 2. Study 2: Pro-social attitudes by depletion and persuasion conditions.

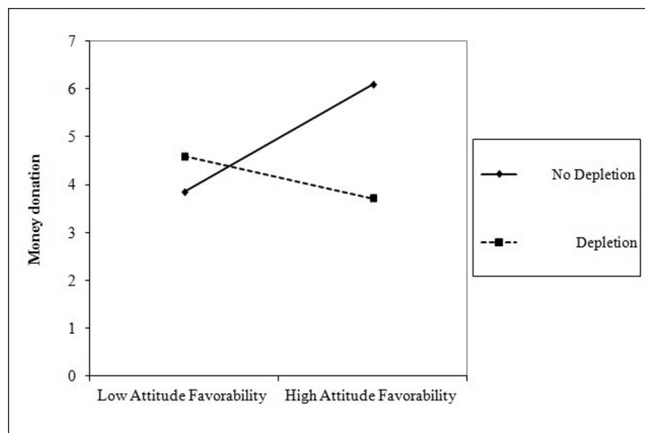


Fig. 3. Study 2: The effect of prosocial attitudes on monetary donation by depletion condition.

conditions on behavior, $\beta_s = 0.04, 0.36, t(98) = 0.93, 0.36, p_s = 0.93, 0.43$, nor was there a significant interaction between them, $\beta = 0.17, t(98) = 0.96, p = .34$. There was a main effect of attitude, as well as a significant Depletion \times Attitude interaction on behavior, $\beta_s = 0.37, -0.32, t(98) = 2.59, -2.40, p_s = 0.01, 0.02$. That is, attitude was less predictive of behavior under depletion, in comparison to no depletion (Fig. 3). The Persuasion \times Attitude interaction term was not significant, $\beta = 0.09, t(98) = 0.58, p = .56$. Critically, the three-way interaction term was significant, $\beta = -0.31, t(98) = -2.32, p = .02$. Specifically, under persuasion, pro-social attitude significantly predicted money donation for non-depleted participants, $b = 0.85, t(48) = 2.06, p = .04$, but not for depleted participants, $b = -0.24, t(48) = -0.76, p = .45, \beta = -0.15, t(48) = -2.17, p = .03$. When persuasion was not present, there was no difference between non-depleted, $b = 0.60, t(48) = 1.92, p = .06$, and depleted participants, $b = 0.32, t(48) = 1.18, p = .24$, in the prediction of behavior from attitude, $\beta = -0.03, t(48) = -0.49, p = .63$.

Thus overall, Study 2 replicated and extended the results of Study 1 when using a different persuasion message and a different behavior measure. Depleted participants who faced a persuasion attempt reported greater attitude change than non-depleted participants. The attitude change was not followed by a corresponding behavior change. That is, depleted participants who faced a persuasion attempt did not donate more money than depleted participants who were not faced with persuasion attempt. That is, persuasion affected the attitudes of depleted participants but not their behavior. It could be that participants' behavior was guided by their default response of not donating their monetary compensation.

Interestingly, contrary to present findings, previous work has reported that depleted participants were *more* likely to comply with

requests (such as donating to charity) relative to non-depleted participants (Fennis et al., 2009; Fennis & Janssen, 2010; Janssen et al., 2008). The difference with the current study is that previous work used a live agent who exerted significant compliance pressure (e.g., Janssen et al., 2008). Here, the invitation to donate was only presented on a computer screen without a human agent. For this reason, participants in the present study may have fallen back on their habit to keep their earnings.

Although Studies 1 and 2 provided supportive evidence for the hypotheses, they did not demonstrate that habits are the mechanism underlying the depletion-reduced attitude-behavior-change association. Hence, Study 3 was designed to test whether people fall back on strong habits when depleted and thereby act in ways inconsistent with their attitudes (under persuasion).

7. Study 3

7.1. Participants

One hundred and thirty-seven undergraduates ($M_{age} = 22.56, SD_{age} = 2.40, 67\%$ female) participated in studies about decision making and culinary preferences, in exchange for course credit. No participants or measures were excluded. This sample size has a 0.89 power to detect a medium effect size; *Cohen's d* = 0.55.

7.2. Procedure

As in Study 1, we used a between-participant design. Participants came to the laboratory and were tested individually on a computer. As in the previous studies, participants expected to do two unrelated studies, to disconnect the measurement of attitude from that of behavior. Participants were randomly assigned to the depletion (depletion/no depletion) conditions as in Study 1.

As in the previous studies, depletion was manipulated by using a task that has been used in previous work (Uziel & Baumeister, 2017). After the depletion manipulation, all participants read a one-page article written by a certified dietitian about the dangers of consuming sugar, such as memory deficiencies, learning disorders, depression, heart diseases, and obesity. After reading the article, participants reported their attitude towards consuming sugar. Afterward, a message appeared that the first study had ended and instructing participants to ask the research assistant about the second study.

The second (ostensibly unrelated) study was presented as a taste test and was held in a nearby room. On the table in the corner of the room, we placed ten 1.5 l bottles of drinks made up of five sugared drinks (Coca-Cola, Pepsi, Sprite, grape juice, and mango juice), and five non-sugared drinks (Diet Cola, Pepsi Max, diet Sprite, sparkling water, and still mineral water). Participants were told that the purpose of the new study was to learn about culinary preferences. Participants were instructed to choose one drink and consume as much as they wanted. The rationale for letting participants choose only one drink is that habit should play a more vital role when people are allowed to make a single choice rather than multiple choices. After drinking, participants answered a taste questionnaire. Specifically, we asked them to evaluate the taste and how healthy they thought it was. For each drink, we also measured participants' habit strength (see below). Finally, participants answered demographic questions, were debriefed, compensated, and thanked. After each session, a research assistant weighed the bottles to measure the amount consumed.

7.3. Measures

7.3.1. Depletion manipulation check

We used the same manipulation check measure as in Studies 1 and 2 ($\alpha = 0.80$).

7.3.2. Comprehension of persuasion message

In order to verify that participants read the article, we asked them to summarize the message. All participants understood the message. We then asked participants two additional questions, on a 9-point Likert type scale, to assess their effort: (a) “I made an effort to understand the message conveyed by the article” ($M = 7.20$, $SD = 2.00$), and (b) “I paid attention to the message conveyed by the article” ($M = 7.76$, $SD = 1.40$), $\alpha = 0.62$.

7.3.3. Attitude towards sugar

Six items were used to measure attitude towards sugar (“sugar is desired”, “sugar is harmful”, “sugar is healthy”, “sugar is beneficial”, “sugar is negative”, “I’m in favor of consuming sugar”); $\alpha = 0.92$.¹⁵ The items were rated on a 9-point Likert-type scale anchored at 1 = *strongly disagree* to 9 = *strongly agree*. Higher scores indicated a more positive attitude towards sugar.

7.3.4. Behavior

The two measures of behavior were: (1) choice of drink (0-not sugared, 1-sugared), and (2) the amount of beverage consumed in grams.

7.3.5. Control variables

Participants indicated: (a) if they had medical problems that obligated them to reduce (or avoid) sugar consumption; (b) if they avoided carbonated drinks, and (c) how often they consumed sugar substitutes (1 = *not at all*, 5 = *consistently*). One participant indicated a medical problem related to sugar consumption and was excluded from the analysis. Fourteen participants indicated avoiding carbonated drinks. Six participants indicated consistently consuming sugar substitutes. We obtained significant results in the hypothesized direction when those (20) participants were omitted from the analysis. Hence, we report the results on the entire sample.

7.3.6. Taste test

As part of the taste test, participants rated (a) how tasty each drink was, and (b) how healthy it was on a 9-point Likert type scale ($\alpha = 0.71$).

7.3.7. Habit strength

Habit strength for the drink participants chose was assessed by four items from the Self-Report Index of Habit Strength (drinking X is something I (a) do frequently, (b) would find hard not to do, (c) belongs to my daily routine, (d) that’s typically ‘me’; Verplanken & Orbell, 2003). Scale items were highly reliable ($\alpha = 0.97$).

7.4. Results and discussion

Table 3 presents the means, standard deviations, and correlations between the variables.

7.4.1. Manipulation check

As in Studies 1 and 2, participants in the depletion condition reported feeling more depleted ($M = 5.00$, $SD = 1.35$) than participants in the non-depletion condition ($M = 3.99$, $SD = 1.01$), $t(135) = 4.76$, $p < .001$, $d = 0.82$, indicating that the manipulation was effective.

7.4.2. Attitude change

Participants in both conditions did not differ in their understanding of the persuasive message $t(135) = 0.17$, $p = .87$. Participants in the depletion condition reported less positive attitudes towards sugar, ($M = 3.67$, $SD = 1.75$), than participants in the non-depletion condition, ($M = 4.57$, $SD = 1.93$), $t(135) = -2.87$, $p = .005$, $d = -0.49$. Attitude was predicted from the depletion condition (0 = no depletion,

Table 3
Descriptive statistics and correlations for Study 3.

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. Depletion manipulation check	4.51	1.33						
2. Attitude towards sugar	4.11	1.89	.14					
3. Drink choice	.620	.490	.26	.26				
4. Grams of sugar	30.63	32.25	.12	.25	.52			
5. Tastiness	6.47	2.75	.15	.09	.50	.20		
6. Healthiness	4.48	3.23	-.19	.02	-.61	-.09	-.31	
7. Habit strength	5.28	2.99	.23	-.05	-.12	.08	.02	.07

Note: Values in **bold** differ from 0 at $p < .05$; values in *italics* differ from 0 at $p < .10$.

1 = depletion), habit strength, and the Condition \times Habit Strength interaction. The main effect of depletion condition remained significant, when controlling for habit strength and the interaction, $\beta = 0.25$, $t(133) = 2.95$, $p = .004$. The other variables were not significant, $\beta_s < 0.13$, $t_s(133) \leq 1.60$, $p_s > 0.10$. These results provide support for H1.

7.4.3. Behavior change

There was no difference between participants in either condition regarding the choice of a sugared drink. Specifically, 67% of the participants in the depletion condition and 58% of the participants in the non-depletion condition chose a sugared drink, $\chi^2(1) = 1.04$, $p = .31$. Participants in the depletion condition ($M = 35.12$, $SD = 25.57$) did not differ from participants in the non-depletion condition ($M = 29.43$, $SD = 30.43$) in the quantity in grams they consumed, $t(135) = 1.18$, $p = .24$, $d = 0.20$.

As anticipated by Hypothesis 2, ego-depletion moderated the correlations between attitude towards sugar and each of the two behavioral measures. A logistic regression was employed to examine the role of ego depletion on the dichotomous measure (drink choice) and a linear regression was employed to test the role of depletion on the continuous measure (grams of sugar consumed). First, depletion condition (0 = no depletion, 1 = depletion), attitude, and a condition \times attitude interaction were entered into a binary logistic regression model to predict the likelihood of choosing a sugared drink (0 = sugared drink, 1 = non-sugared drink). There was no main effect of the experimental condition on choice of sugared drink, $b(SE) = 0.10$ (0.11), *Wald's* $\chi^2(1) = 0.95$, $p = .33$, $EXP(B) = 1.11$. A main effect of attitude on choice of sugared drink, $b(SE) = 0.44$ (0.15), *Wald's* $\chi^2(1) = 8.31$, $p = .004$, $EXP(B) = 1.55$, revealed that a more positive attitude towards sugar was related to choosing a sugared drink. Importantly, there was a significant Condition \times Attitude interaction on behavior (see Fig. 4), $b(SE) = -0.38$ (0.15), *Wald's* $\chi^2(1) = 6.11$, $p = 0.01$, $EXP(B) = 0.68$. That is, depleted participants' attitude towards sugar was less predictive of drink choice than the attitude of non-depleted participants. The simple slope in the depletion condition was not significant, $b = -0.10$ $t(133) = -0.08$, $p = 0.94$, but was significant in the non-depletion condition, $b = 0.44$, $t(133) = 2.54$, $p = 0.01$.

The depletion condition, attitude, and Condition \times Attitude interaction were then regressed on the continuous behavior measure - grams of sugar consumed. Only the interaction term was significant, $\beta = -0.43$, $t(133) = -2.10$, $p = 0.04$. The simple slope for participants in the depletion condition was not significant, $b = -0.50$, $t(133) = -0.26$, $p = 0.79$, whereas the simple slope for participants in the non-depletion condition was significant, $b = 2.00$, $t(133) = 2.39$, $p = 0.02$. That is, attitudes towards sugared drinks predicted subsequent behavior in the non-depletion condition but not in the depletion condition.

¹⁵ All six items loaded on a single factor, which explained 53.72% of the variance.

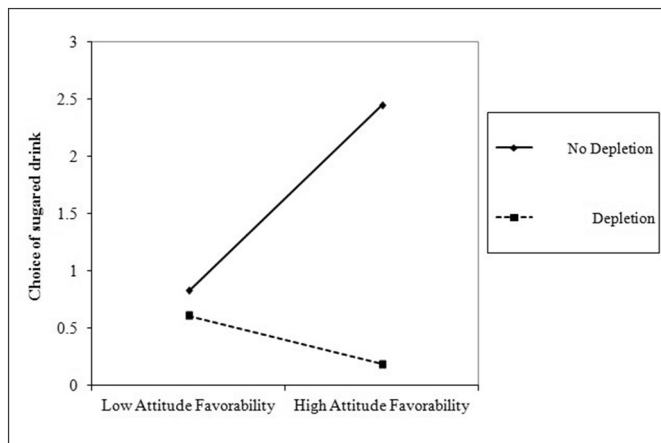


Fig. 4. Study 3: The effect of attitude towards sugar on sugar consumption by experimental condition.

7.4.4. Taste test

Participants in the depletion condition, ($M = 6.47$, $SD = 2.76$) did not differ from participants in the non-depletion condition ($M = 6.52$, $SD = 2.75$) in their evaluation of the level of tastiness of the drink, $t(135) = -0.09$, $p = .93$, $d = -0.02$. Participants in both conditions ($M_s = 4.45, 4.57$, $SD_s = 3.27, 3.20$) also did not differ in their evaluations of the level of healthiness of the drinks, $t(135) = -0.21$, $p = .83$. Hence, the attitude change for depleted participants did not make them choose drinks that they perceived to be healthier than non-depleted participants.

7.4.5. Behavioral measure: beverage choice

Participants in the depletion condition chose drinks that they rated as more habitual ($M = 5.88$, $SD = 2.94$) than participants in the non-depletion condition ($M = 4.73$, $SD = 2.93$), $t(135) = 2.30$, $p = .02$, $d = 0.40$.

7.4.6. The role of habit in shaping behavior

In order to test Hypothesis 3 that participants in the depletion condition relied more on their sugared drink habit when making the beverage choice than participants in the non-depletion condition, we conducted a moderation analysis. This analysis was limited to participants who chose a sugared drink ($n = 85$), because these were the only participants for whom we could test the connection between habit strength and the amount that they consumed.

We regressed the interaction term between the depletion condition and habit strength on the amount of sugared drink consumed (the continuous dependent measure), controlling for the following variables: (a) experimental condition, (b) habit strength, (c) attitude towards sugar, (d) Habit Strength \times Attitude towards sugar, (e) Experimental condition \times Attitude towards sugar, (f) experimental condition \times habit strength, and (g) Condition \times Habit strength \times Attitude towards sugar. Only the main effect¹⁶ of habit strength, $\beta = 0.34$, $t(78) = 1.97$, $p = .05$, and the interaction between the experimental condition and habit strength were significant, $\beta = 0.53$, $t(77) = 2.03$, $p = .04$. Specifically, the simple slope for participants in the depletion condition was significantly greater than zero, $b = 4.91$, $t(77) = 2.10$, $p = .04$, whereas the simple slope for participants in the non-depletion condition was not different from zero, $b = -0.71$, $t(77) = -0.42$, $p = .68$. That is, depleted participants relied more on their habits to guide their consumption behavior of sugared drinks than non-depleted participants (see Fig. 5). The interaction between depletion condition and habit strength explained a significant proportion of the variance in sugar consumption, $R_{\text{change}}^2 = 0.04$, $F_{\text{change}}(1, 77) = 4.33$, $p = .04$.

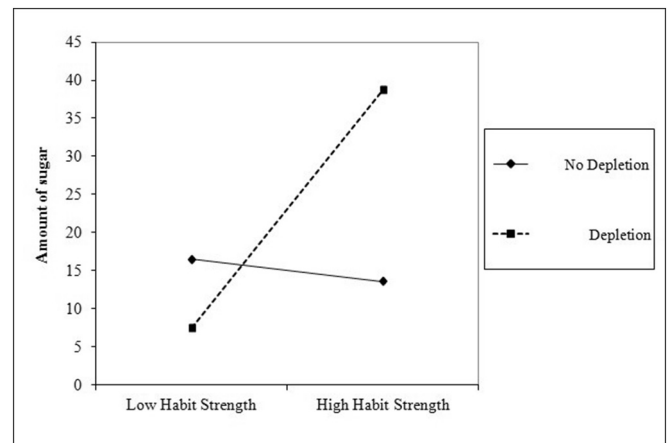


Fig. 5. Study 3: The effect of habit strength on sugar consumption by experimental condition.

None of the other regression coefficients was significant, $\beta_s \leq 0.12$, $t_s(77) \leq 1.20$, $p_s \geq 0.23$.

In sum, Study 3 provided additional support for Hypotheses 1 and 2 and increased their generalizability with a replication using a different attitude object and a different behavioral measure. Importantly, the results of this study provide additional insights into the mechanism underlying these effects. Consistent with Hypothesis 3, although depleted individuals were more easily persuaded, they were less likely to initiate new behaviors that corresponded to their new attitude. Instead, they tended to rely on their habitual drink choices.

A possible limitation of Study 3 is that the dependent variable of glucose consumption has been found to be positively associated with ego-depletion (Gailliot et al., 2007; Xu, Bègue, & Bushman, 2012). However, it is not likely that the effect obtained in Study 3 was a by-product of participants' need for sugar. First, both Study 1 and Study 2 observed the hypothesized effect using different behavioral measures. Furthermore, the link between ego-depletion and sugar consumption currently appears controversial due to several failed replications (Chatzisarantis & Hagger, 2015; Lange & Eggert, 2014; Vadillo, Gold, & Osman, 2016). Our results support the findings of these replication studies, as indicated by the null main effects of the depletion manipulation on both measures of sugar consumption.

7.5. Mini meta-analysis

To assess the effect size of the depletion manipulation as a moderator of the association between the new attitude and behavior, we conducted a random-effects meta-analysis using the data from the three studies (for the need to conduct a meta-analysis of one's own studies, see Goh, Hall, & Rosenthal, 2016). For each study, we converted the Z score for the difference between correlations¹⁷ to Cohen's d using the formula recommended by Borenstein, Hedges, Higgins, and Rothstein (2009). The meta-analytic effect, was $k = 3$, $N = 339$, $\bar{d} = -0.51$, 95% CI $[-0.72, -0.29]$, $p < .001$. There was no evidence for heterogeneity across the studies, $Q_{(2)} = 0.53$, $p = .77$. Note that this effect size is considered moderate (Cohen, 1988), although recent evidence suggests that is should be considered large in the field of psychology (Aguinis, Pierce, & Culpepper, 2009; Gignac & Szodorai, 2016).

8. General discussion

The current study identified a condition under which attitude change fails to translate into corresponding behavior change. Three

¹⁶ Marginally significant.

¹⁷ The correlations are reported in the Supplementary material.

experiments showed that the manifestation of a newly-formed attitude into a corresponding behavior depends on self-regulatory resources. Ego depletion rendered individuals' attitudes more susceptible to persuasion attempts (*Hypothesis 1*) but also prevented them from carrying out new corresponding behaviors. The outcome was that attitudes and behaviors corresponded less closely under depletion following a persuasive appeal (*Hypothesis 2*), because participants fell back on their habits (*Hypothesis 3*).

Specifically, Study 1 found that depleted participants reported a more favorable attitude towards veganism than non-depleted participants after watching a video clip advocating veganism. However, this attitude change was not reflected in behavior change. Studies 2 and 3 conceptually replicated this finding using different attitude objects and different behavioral measures. Finally, Study 3 showed that depleted participants reverted to their old habits.

The current findings have a number of empirical, theoretical, and practical implications. Theoretically, given that all three studies employed an ego depletion manipulation, the results could be construed as restricted to this self-control paradigm. However, it seems feasible that the results can be extrapolated to any motivational (e.g., personal relevance) or ability (e.g., distraction) variables that have been shown to influence message processing. Hence, the findings contribute to the literature beyond merely shedding light on ego depletion and can serve as a new moderator for the attitude-behavior relationship following persuasion.

Empirically, although dual-process theories such as the ELM have predicted the pattern obtained in the current research, and previous studies support these predictions (e.g., Barden & Petty, 2008; Petty, Cacioppo, & Schumann, 1983), the current studies employed actual behavioral measures (rather than the more commonly employed behavioral intentions). Furthermore, by measuring the habit strength of the behavior (Study 3), we were able to identify the underlying mechanism of the attitude-behavior inconsistency following persuasion.

The current results support the role of habits, rather than attitude strength, in explaining the attitude-behavior discrepancy. However, this discrepancy might be due to weak attitudes in many circumstances. Although we found no evidence for an attitude strength analysis using a measure of attitude extremity, it is highly possible that attitude certainty, importance, or accessibility might have worked in addition to habits to derail the attitude-behavior correspondence. For example, depletion might make people believe that they did not think about the message sufficiently, thus reducing attitude certainty, and by extension the likelihood of acting in accordance with that attitude. Previous work has shown that when people are unable to engage in deliberate processing, attitude certainty decreased, and participants indicated lesser intentions to act on their attitude (Barden & Petty, 2008).

The current work provides the first experimental evidence that habit can explain the differential effects of persuasion on attitudes and actual behavior. This role could not be assessed in previous studies that only measured behavioral intentions or that did not employ persuasion attempts.

The results clearly highlight the need for further research about behavior. Research in social psychology has built up a strong empirical basis for understanding attitude change, but much less is known about behavior change. Such empirical investigation will increase knowledge of the similarities and differences between attitude change and behavior change. These insights are important for applications for example, to health communication. Specifically, disentangling the mechanisms underlying attitude change from behavior change could explain why interventions that successfully changed attitudes failed to change corresponding behavior. For example, the Five-A-Day intervention program employed in 1991 by the National Cancer Institute successfully persuaded the public to consume more fruits and vegetables (Wood, 2017). However, this intervention had little impact on food consumption, which is mostly habitual behavior (Khare & Inman, 2006).

The current work has implications for consumer research as well.

Previous work has shown that persuasion is more effective when the customer is depleted (e.g., Fennis et al., 2009). The rationale behind this assumption is that the vulnerability of the customer to persuasion is higher at that time. Nevertheless, the present findings suggest that this attitude change would not be consequential. That is, if a depleted customer is persuaded to buy a new product that is different from the product the customer usually purchases (e.g., a new brand of coffee, switching to a new mobile phone) the persuasion attempt, successful as it might be, would probably not result in product purchase.

A limitation of the current work is that although our hypotheses regarding depletion and attitude change drew on the ELM (Petty & Cacioppo, 1986), under certain conditions, the same model suggests opposite effects to the ones reported in the current work. Specifically, according to the ELM, under low-message processing (as in the case of ego depletion), people rely more on simple cues. Simple cues could lead to reduced attitude change after persuasion if the message primarily includes negative cues (such as an unattractive message source, or a source that lacks expertise and credibility). Although the persuasive message used in this work did not contain these features, our work cannot be firmly generalized to all types of persuasive messages. Future research can address this issue by manipulating positive and negative peripheral cues to the persuasive messages.

Another topic for future investigation should be the long-term implications of the attitude-behavior discrepancy among depleted individuals. Specifically, once resources have been restored, previously depleted individuals may be inclined to act in line with their newly-acquired (as opposed to their habitual) attitudes. Alternatively, once their resources are restored, they may revert to their previous attitudes. That is, exploring the temporal implications of the persuasion processes applied to depleted individuals would be highly informative both practically and theoretically.

9. Conclusion

The assumption that an attitude change will result in a corresponding behavior change is not as robust as is often assumed. This study lends weight to the notion that changing attitudes does not necessarily involve the same psychological processes as changing behavior. Impairments in executive control resources that occur under ego depletion render attitudes vulnerable to persuasion and behavior vulnerable to existing habits. The findings imply that addressing individuals' habits and level of executive control resources are important factors in creating lasting influential changes.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jesp.2017.10.011>.

References

- Aguinis, H., Pierce, C. A., & Culpepper, S. A. (2009). Scale coarseness as a methodological artifact: Correcting correlation coefficients attenuated from using coarse scales. *Organizational Research Methods*, 12(4), 623–652. <http://dx.doi.org/10.1177/1094428108318065>.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Amodio, D. M., & Ratner, K. G. (2011). A memory systems model of implicit social cognition. *Current Directions in Psychological Science*, 20(3), 143–148.
- Barden, J., & Petty, R. E. (2008). The mere perception of elaboration creates attitude certainty: Exploring the thoughtfulness heuristic. *Journal of Personality and Social Psychology*, 95(3), 489.
- Baumeister, R. F., Muraven, M., & Tice, D. M. (2000). Ego depletion: A resource model of volition, self-regulation, and controlled processing. *Social Cognition*, 18(2), 130–150.
- Baumeister, R. F., Vohs, K. D., & Funder, D. C. (2007). Psychology as the science of self-reports and finger movements: Whatever happened to actual behavior? *Perspectives on Psychological Science*, 2(4), 396–403.
- Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2009). *Introduction to meta-analysis*. Chichester, UK: John Wiley & Sons. Ltd.
- Burkley, E. (2008). The role of self-control in resistance to persuasion. *Personality and*

- Social Psychology Bulletin*, 34(3), 419–431.
- Chatzisarantis, N. L., & Hagger, M. S. (2015). Unsuccessful attempts to replicate effects of self control operations and glucose on ego-depletion pose an interesting research question that demands explanation. *Appetite*, 84, 328–329.
- Clarkson, J. J., Hirt, E. R., Jia, L., & Alexander, M. B. (2010). When perception is more than reality: The effects of perceived versus actual resource depletion on self-regulatory behavior. *Journal of Personality and Social Psychology*, 98(1), 29.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Downing, J. W., Judd, C. M., & Brauer, M. (1992). Effects of repeated expressions on attitude extremity. *Journal of Personality and Social Psychology*, 63(1), 17.
- Englert, C., Bertrams, A., Furley, P., & Oudejans, R. R. (2015). Is ego depletion associated with increased distractibility? Results from a basketball free throw task. *Psychology of Sport and Exercise*, 18, 26–31.
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175–191.
- Fennis, B. M., & Janssen, L. (2010). Mindlessness revisited: Sequential request techniques foster compliance by draining self-control resources. *Current Psychology*, 29(3), 235–246.
- Fennis, B. M., Janssen, L., & Vohs, K. D. (2009). Acts of benevolence: A limited-resource account of compliance with charitable requests. *Journal of Consumer Research*, 35(6), 906–924.
- Fife-Schaw, C., Sheeran, P., & Norman, P. (2007). Simulating behaviour change interventions based on the theory of planned behaviour: Impacts on intention and action. *British Journal of Social Psychology*, 46(1), 43–68.
- Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., ... Schmeichel, B. J. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology*, 92(2), 325.
- Gignac, G. E., & Szodorai, E. T. (2016). Effect size guidelines for individual differences researchers. *Personality and Individual Differences*, 102, 74–78.
- Gillespie, B., Joireman, J., & Muehling, D. D. (2012). The moderating effect of ego depletion on viewer brand recognition and brand attitudes following exposure to subtle versus blatant product placements in television programs. *Journal of Advertising*, 41(2), 55–66.
- Goh, J. X., Hall, J. A., & Rosenthal, R. (2016). Mini meta-analysis of your own studies: Some arguments on why and a primer on how. *Social and Personality Psychology Compass*, 10(10), 535–549.
- Haddock, G., Rothman, A. J., Reber, R., & Schwarz, N. (1999). Forming judgments of attitude certainty, intensity, and importance: The role of subjective experiences. *Personality and Social Psychology Bulletin*, 25(7), 771–782.
- Haugtvedt, C. P., & Petty, R. E. (1992). Personality and persuasion: Need for cognition moderates the persistence and resistance of attitude changes. *Journal of Personality and Social Psychology*, 63(2), 308.
- Inzlicht, M., & Schmeichel, B. J. (2012). What is ego depletion? Toward a mechanistic revision of the resource model of self-control. *Perspectives on Psychological Science*, 7(5), 450–463.
- Janssen, L., & Fennis, B. M. (2017). Mindless resistance to persuasion: Low self-control fosters the use of resistance-promoting heuristics. *Journal of Consumer Behaviour*. <http://dx.doi.org/10.1002/cb.1646>.
- Janssen, L., Fennis, B. M., Pruy, A. T. H., & Vohs, K. D. (2008). The path of least resistance: Regulatory resource depletion and the effectiveness of social influence techniques. *Journal of Business Research*, 61(10), 1041–1045.
- Johnson, I. M., Siegel, J. T., & Crano, W. D. (2014). Expanding the reach of vested interest in predicting attitude-consistent behavior. *Social Influence*, 9(1), 20–36.
- Kahan, D., Polivy, J., & Herman, C. P. (2003). Conformity and dietary disinhibition: A test of the ego-strength model of self-regulation. *International Journal of Eating Disorders*, 33(2), 165–171.
- Khare, A., & Inman, J. J. (2006). Habitual behavior in American eating patterns: The role of meal occasions. *Journal of Consumer Research*, 32(4), 567–575.
- Krosnick, J. A., & Petty, R. E. (1995). Attitude strength: An overview. In R. E. Petty, & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. 1–24). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Lange, F., & Eggert, F. (2014). Sweet delusion. Glucose drinks fail to counteract ego depletion. *Appetite*, 75, 54–63.
- Linder, J. A., Doctor, J. N., Friedberg, M. W., Nieva, H. R., Birks, C., Meeker, D., & Fox, C. R. (2014). Time of day and the decision to prescribe antibiotics. *JAMA Internal Medicine*, 174(12), 2029–2031.
- Mancha, R. M., & Yoder, C. Y. (2015). Cultural antecedents of green behavioral intent: An environmental theory of planned behavior. *Journal of Environmental Psychology*, 43, 145–154.
- McEachan, R., Taylor, N., Harrison, R., Lawton, R., Gardner, P., & Conner, M. (2016). Meta-analysis of the reasoned action approach (RAA) to understanding health behaviors. *Annals of Behavioral Medicine*, 50(4), 592–612.
- Muraven, M., Collins, R. L., & Neuhaus, K. (2002). Self-control and alcohol restraint: An initial application of the self-control strength model. *Psychology of Addictive Behaviors*, 16(2), 113.
- Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology*, 74(3), 774.
- Neal, D. T., Wood, W., & Drolet, A. (2013). How do people adhere to goals when willpower is low? The profits (and pitfalls) of strong habits. *Journal of Personality and Social Psychology*, 104(6), 959.
- Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Communication and persuasion* (pp. 1–24). Springer.
- Petty, R. E., Cacioppo, J. T., & Schumann, D. (1983). Central and peripheral routes to advertising effectiveness: The moderating role of involvement. *Journal of Consumer Research*, 10(2), 135–146.
- Petty, R. E., Wells, G. L., & Brock, T. C. (1976). Distraction can enhance or reduce yielding to propaganda: Thought disruption versus effort justification. *Journal of Personality and Social Psychology*, 34(5), 874.
- Rhodes, R. E., & Dickau, L. (2012). Experimental evidence for the intention-behavior relationship in the physical activity domain: A meta-analysis. *Health Psychology*, 31(6), 724–727.
- Schmeichel, B. J. (2007). Attention control, memory updating, and emotion regulation temporarily reduce the capacity for executive control. *Journal of Experimental Psychology: General*, 136(2), 241.
- Uziel, L., & Baumeister, R. F. (2017). The self-control irony: Desire for self-control limits exertion of self-control in demanding settings. *Personality and Social Psychology Bulletin*, 43(5), 693–705.
- Vadillo, M. A., Gold, N., & Osman, M. (2016). The bitter truth about sugar and willpower: The limited evidential value of the glucose model of ego depletion. *Psychological Science*, 27(9), 1207–1214.
- Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A self-report index of habit strength. *Journal of Applied Social Psychology*, 33(6), 1313–1330.
- Vohs, K. D., Baumeister, R. F., & Giarocco, N. J. (2005). Self-regulation and self-presentation: Regulatory resource depletion impairs impression management and effortful self-presentation depletes regulatory resources. *Journal of Personality and Social Psychology*, 88(4), 632.
- Wan, E. W., Rucker, D. D., Tormala, Z. L., & Clarkson, J. J. (2010). The effect of regulatory depletion on attitude certainty. *Journal of Marketing Research*, 47(3), 531–541.
- 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.
- Wheeler, S. C., Briñol, P., & Hermann, A. D. (2007). Resistance to persuasion as self-regulation: Ego-depletion and its effects on attitude change processes. *Journal of Experimental Social Psychology*, 43(1), 150–156.
- Wood, W. (2017). Habit in personality and social psychology. *Personality and Social Psychology Review*, 21(4), 389–403.
- Wood, W., & Rünger, D. (2016). Psychology of habit. *Annual Review of Psychology*, 67, 289–314.
- Wurtele, S. K., & Maddux, J. E. (1987). Relative contributions of protection motivation theory components in predicting exercise intentions and behavior. *Health Psychology*, 6(5), 453.
- Xu, H., Bègue, L., & Bushman, B. J. (2012). Too fatigued to care: Ego depletion, guilt, and prosocial behavior. *Journal of Experimental Social Psychology*, 48(5), 1183–1186.