Listen to others or yourself? The role of personal norms on the effectiveness of social norm interventions to change pro-environmental behavior

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ARTICLE INFO	ABSTRACT
	Social norm interventions are a cheap and convenient strategy to promote proenvironmental behavior change. However, the effectiveness of using them has been debated. The present study argues that the effectiveness depends on one's own internal moral compass, as presented by personal norms. We examined this main assumption across 3 studies focusing on pro-environmental behavior in a food and diets context. Study 1 shows in a cross-sectional design that people with stronger personal norms are more likely to reduce their meat consumption regardless of their perceptions of the static or dynamic social norms towards meat consumption. Furthermore, quasi-experimental findings show that dynamic (Study 2) and static (Study 3) social normative messages are more effective the weaker one's personal norms towards the pro-environmental behavior. Therefore, when evaluating the effectiveness of social norm interventions people's personal norms should be taken into consideration.

1. Introduction

Growing evidence demonstrates that human consumption patterns are moving beyond the carrying capacity of the earth (Thøgersen, 2014). As a consequence, governments and organizations are increasingly recognizing they have a responsibility to shape individual consumption patterns towards more pro-environmental behaviors. Pro-environmental behaviors, such as reducing one's meat consumption and reducing your electricity or water use, include those behaviors that benefit the environment by changing the availability of materials or energy from the environment or altering the structure and dynamics of ecosystems in a positive way (Steg & Vlek, 2009). A popular way to accomplish such change is by introducing behavior change interventions that make particular social norms salient. Social norms are perceptions about rules that are understood by members of a relevant reference group, such as your friends, family, or colleagues (Cialdini & Trost, 1998).

Social norm interventions are popular because social norms are shown to be strong predictors for pro-environmental behaviors (Farrow, Grolleau, & Ibanez, 2017), especially when made salient (Cialdini, Kallgren, & Reno, 1990). Regardless of the increased prevalence of

social norm interventions, the effectiveness of using them has been debated, and evidence of when and how they are effective is inconsistent (e.g., Abrahamse & Steg, 2013; Anderson, Song, Lee, Krupta, Lee, & Park, 2017; Reno, Cialdini, & Kallgren, 1993; Scheibehenne, Jamil, & Wagenmakers, 2016; Yeomans & Herberich, 2014). The present study argues that one's own internal moral compass, as presented by personal norms, impact the effectiveness of social norm interventions. Therefore, the present study examines to what extent social norm interventions (i. e., normative messages) are effective to encourage pro-environmental behavior, and, the moderating role of personal norms on this relationship.

2. Theoretical background

Social norm interventions are popular because they are deemed to be a convenient, cheap and easy way to administer behavior change interventions (Anderson et al., 2017). Such interventions often rely on making salient two specific types of social norms, injunctive and descriptive social norms (Cialdini, Reno, & Kallgren, 1990). The injunctive norm specifies what people (dis)approve within a reference group, while the descriptive norm specifies how the norm reference

group typically acts in a particular situation.

Studies have found that both injunctive and descriptive social norms are relevant in relation to a variety of pro-environmental intentions and behaviors (e.g., Allcott, 2011; Costa & Kahn, 2013; De Groot, Abrahamse, & Jones, 2013; De Groot & Schuitema, 2012). However, descriptive norms are often stronger to guide intention/behavior than injunctive norms (e.g., Bertoldo & Castro, 2016; Elgaaied-Gambier, Monnot, & Reniou, 2018; Helfinstein, Mumford, & Poldrack, 2015; Louis, McDonald, Smith, Staunton, & Terry, 2014; Pedersen, Grønhøj, & Thøgersen, 2015; Zou & Savani, 2019). Given the disproportionate influence of descriptive norms on pro-environmental behaviors, and food and diet related behaviors (e.g., Mollen, Rimal, Ruiter, & Kok, 2013, pp. 83–89), the present paper: one, focuses on pro-environmental behaviors in the food and diet context; and two, uses a conceptualization of social norms referring specifically to descriptive norms.

2.1. Listen to others: social normative messages and behavior change

Harnessing the power of social norms involves letting people know how others act, that is, they need to be salient (Cialdini et al., 1990). Due to ease and cost, a preferred method for making social norms salient is through normative messages (Schultz, Khazian, & Zaleski, 2008). When exposed to a majority normative message (e.g. "The majority of people like yourself are reducing their meat consumption"), people will be aware of the norm in question and consequently be more likely to perform in line with the majority behavior; and, vice versa, when people have been made aware that a minority of people like themselves are performing the behavior, they are less likely to perform the behavior. The present paper therefore focuses on social normative messages as the specific type of social norm intervention.

Social normative messages often rely on making salient a "static" social norm, which addresses the current state of the norm (Sparkman & Walton, 2017). However, a lot of pro-environmental behavior is followed by a minority group only, resulting in a minority rather than a majority social norm (Mortensen et al., 2019). Making salient a minority norm with normative messages can have the reverse effect on positive behavior change, because people are reminded that showing the desired behavior is not the normal thing to do (Cialdini, Demaine, & Sagarin, 2006). Therefore, more recently, a distinction has been made between static and dynamic descriptive norms when using social normative messages (Loschelder, Siepelmeyer, Fischer, & Rubel, 2019; Mortensen et al., 2019; Sparkman & Walton, 2017).

Rather than static norms which focus on perceptions of current behavior, dynamic norms are perceptions about the past and expected future developments in relation to the behavior. While research shows that making dynamic social norms salient seems to be relevant to promote pro-environmental behavior, especially when the majority of people do not yet perform the desired behavior (Loschelder et al., 2019; Mortensen et al., 2019; Sparkman & Walton, 2017), it is still likely that, in line with the research using static normative messages, the more people who show a change in their behavior, the more influential the dynamic norm will be to positively influence the behavior.

Normative messages have been used for promoting a variety of pro-environmental behaviors, such as re-using towels (Han, Kim, & Lee, 2018), reducing meat consumption (Sparkman & Walton, 2017), paying for carbon offsetting (Huber, Anderson, & Bernauer, 2018), and, energy conservation (Anderson et al., 2017; Horne & Huddart Kennedy, 2017). These studies show that making salient a static majority norm, or a dynamic minority norm, often results in more of the desired behavior, compared to making salient a (static) minority norm or no social norm intervention. For example, a recent meta-analysis including 91 field-experiments has shown that interventions making salient a social norm in favor of the desired behavior are more effective (i.e., with a medium effect size) in changing pro-environmental intention/behavior than not intervening at all (Bergquist, Nilsson, & Schultz, 2019).

Interestingly, the effectiveness of using social norm interventions has been debated, and, results in relation to their effectiveness are inconsistent (e.g., Abrahamse & Steg, 2013; Anderson et al., 2017; Reno et al., 1993; Scheibehenne et al., 2016; Yeomans & Herberich, 2014). For example, a meta-analysis comparing six different social influence behavior change interventions (i.e., block leader approach, public commitment, modeling, group feedback, comparable feedback, and, social normative interventions) showed that interventions based on making salient majority static social norms were less effective compared to any of the other interventions (Abrahamse & Steg, 2013). These results imply that social norm interventions can better be avoided, or, at least be combined with other behavior change strategies to achieve positive environmental behavior change. In the present study, we suggest an alternative explanation – compared to minority norms, the effectiveness of (static and dynamic) majority social norm interventions might be largely underestimated when stronger personal norms are present because they weaken the social norm-behavior relationship.

2.2. Listen to yourself: moderating role of personal norms

Personal norms are regarded as a strong motivator to encourage pro-environmental intention and behavior (Schultz et al., 2016). Personal norms are feelings of moral obligations to do "the right thing" (e.g., decrease meat consumption to preserve the earth) (Schwartz & Howard, 1981). That is, while social norms are perceptions of how important people in your social life think or act, providing guidelines of what is the "normal" thing to (Cialdini & Trost, 1998), personal norms are rules or standards for one's own behavior (Thøgersen, 2009). Therefore, personal norms act as an internal compass on how to act morally. Indeed, research indicates that the stronger one's personal norm towards a pro-environmental behavior, the stronger their intention/behavior related to this norm (e.g., Aertens, Mondaelers, Van Huylenbroek, & Verbeke, 2009; Joanes, 2019; Onwezen, Antonides, & Bartels, 2013).

Personal norms are not only relevant because they directly predict pro-environmental behavior(al intention). Schwartz (1973) argues that a personal norm is an internalized social norm. Consequently, personal norms can be triggered after a social norm intervention, as such interventions aim to make a social norm salient. In line with this reasoning, personal norms are often shown to partially mediate the relationship between social norms and pro-environmental intention/-behavior (e.g., Doran & Larsen, 2016; Han, Yu, Kim, & Kim, 2018; Harland, 2007; Kim & Seock, 2019). Although the mediating role of personal norms on the social norm-intention/behavior relationship has been widely validated, the present study argues for a more complex relationship. We argue that personal norms moderate the relationship between social norms and pro-environmental intention/behavior. That is, personal norms originate from individual conscious reasoning and contemplation, regardless of social expectations (Thøgersen, 2009). When an individual has stronger moral beliefs about a certain topic, the level of social validation they get from their surroundings should impact them less (Schultz et al., 2016). In situations where individuals might perceive that other people are not engaging with the desired behavior, stronger personal norms may even result in more of the desired behavior (Hornsey, Majkut, Terry, & McKimmie, 2003; Hornsey, Smith, & Begg, 2007).

The Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986) may help to understand the moderating effect of personal norms. It assumes that when people do not have strong pre-existing attitudes about a certain topic (i.e., people with weaker personal norms), they are more likely to be persuaded by easily accessible and peripheral cues. Perceptions about what other people think and do, as activated with social normative messages, might provide such cues. In contrast, people with stronger personal norms are more likely to set aside peripheral cues, because they can use their moral compass rather than peripheral cues. As this guiding system is in line with the normative behavior, people with stronger personal norms will show stronger pro-environmental intention and behavior regardless of whether they have been made

aware of a social norm (not) in favor of the desired behavior. People with weaker personal norms in pro-environmental behavior, lack such internal moral compass on environmental issues, which means that they are more likely to act in line with the social norms that have been made salient in a normative message.

Hence, normative messages are more likely to be effective to change pro-environmental intention and behavior when personal norms are weaker. This mitigating impact of personal norms on the relationship between social norms and behavior may explain findings demonstrating weaker effect sizes of social norm interventions compared to other behavior change interventions relying on social influence (cf., Abrahamse & Steg, 2013). That is, the effect sizes, and consequently the effectiveness, of such interventions might be underestimated because they do not need to target those people with stronger personal norms, while these people will always be targeted as well.

The limited research on the moderating role of personal norms in relation to the relationship between social norms or social normative interventions and pro-environmental behavior suggests that stronger personal norms decrease the impact of social norms on pro-environmental behavior (Göckeritz et al., 2010; Schultz et al., 2016). For example, Göckeritz et al. (2010) showed that the stronger one's personal norm towards energy conservation, the lower the correlation between the descriptive norm and conservation behavior. Similarly, in a field-experimental setting, Schultz et al. (2016) showed that people with stronger personal norms were less influenced by normative messages compared to people with weaker personal norms to reduce residential water consumption, although these results were not found for all types of normative messages that they included. Our paper extends these two studies in three important ways.

First, the studies above focused on the influence of static social norms (Göckeritz et al., 2010) and static and majority normative message framing (Schultz et al., 2016) on pro-environmental behavior. With the growing interest in dynamic social norms and dynamic message framing, especially in relation to pro-environmental behaviors that are performed by a minority only (Loschelder et al., 2019; Mortensen et al., 2019; Sparkman & Walton, 2017), the present study focuses on whether personal norms influence the relationship between dynamic social norms and dynamic majority versus minority normative messages and pro-environmental intentions in a similar way. In particular, this stream of research has not provided evidence on whether the same pattern of relationship occurs when emphasizing a majority versus a minority change in the desired behavior. This adds another question, are dynamic social normative messages even more effective when a majority rather than a minority of people show a change in the desired behavior? Hereby, this paper not only contributes towards further validating the findings of Göckeritz et al. (2010) and Schultz et al. (2016), but simultaneously contributes to the growing field of research in dynamic norms.

Second, the two studies described above included either cross-sectional (Göckeritz et al., 2010) or field-experimental data (Schultz et al., 2016). The present study includes a mix of cross-sectional (Study 1) and quasi-experimental data (Study 2 and 3), including varied samples, two specific types of pro-environmental intentions in the food and diet behavioral context (i.e., reducing meat consumption and reducing food waste), and, more controlled quasi-experimental settings (Study 2 and 3). Hereby, our paper aims to further generalize both studies' findings.

Third, there are no studies that have examined the extent to which personal norms moderate the relationship between social norms and the effectiveness of social normative messages in a pro-environmental food and diet related behavioral context. The present paper focuses on pro-environmental behaviors related to food and diet choices, because the food sector is one of the most problematic sectors creating negative pressures on the environment (European Environment Agency, 2010). These behaviors are often regarded as relatively unconstrained in relation to policies and legislation, and therefore largely in the realm of personal choice. These typical 'private sphere behaviors' include much

behavioral freedom, and therefore one's own moral standards as presented by personal norms might become even more important to guide behavior (cf., Gatersleben, Murtagh, & Abrahamse, 2014).

2.3. Aim and hypotheses

In the present study, we argue that the effectiveness of social norm interventions - specifically majority compared to minority normative message framing - is potentially underestimated because personal norms weaken the social norm-behavior relationship. We focus on pro-environmental behavior related to food and diets, and use pro-environmental intention as the best proxy to understand the underlying behavioral processes of actual behavior (Ajzen, 1991), of two different food and diet behavioral contexts (Coker & Van der Linden, 2020). Based on the literature above, we expect that people with stronger personal norms are more likely to perform desired behavior *regardless* of their perceptions of the social norms towards the desired behavior, hereby potentially inflating the potential effectiveness of social normative interventions emphasizing a majority rather than minority pro-environmental behavior. In a cross-sectional (Study 1) and two quasi-experimental studies (Study 2 and 3), we test this assumption.

In Study 1, we examine the extent to which personal norms weaken the relationship between social norms and pro-environmental intentions. As framing social norms dynamically has only recently received more attention in research (Loschelder et al., 2019; Mortensen et al., 2019; Sparkman & Walton, 2017), we validate whether this assumption holds true for perceptions of the dynamic and static social norm towards pro-environmental food and diet behavior. We hypothesize that (Hypothesis 1):

H1a. The stronger one's personal norm, the weaker the relationship between dynamic social norms and pro-environmental food and diet intentions.

H1b. The stronger one's personal norm, the weaker the relationship between static social norms and pro-environmental food and diet intentions.

If personal norms weaken the relationship between social norms and pro-environmental intentions, then social norm interventions using majority normative messages should also be less effective than using minority normative messages for those with stronger personal norms. Study 2 and 3 focus on this assumption by examining the effectiveness of *social normative messages* specifically. We investigate the extent to which personal norms moderate the relationship between dynamically (Study 2), and, statically (Study 3) majority versus minority framed normative messages and pro-environmental food and diet intentions. In line with our reasoning, we hypothesize that (Hypothesis 2):

H2a. A majority dynamically-framed normative message will be less effective to positively change pro-environmental food and diet intentions compared to a minority dynamically-framed normative message, the stronger one's personal norm towards the desired behavior.

H2b. A majority statically-framed normative message will be less effective to positively change pro-environmental food and diet intentions compared to a minority statically-framed normative message, the stronger one's personal norm towards the desired behavior.

3. General methods

Before reporting our studies, we briefly provide an overview of our general methodological considerations related to our sampling strategy, power and effect size, and data analysis.

3.1. Sampling strategy

Convenience sampling with a snowball sampling strategy was the method of data collection for all three studies. We used this strategy

because the purpose of our research was related to examining relationships and internal validity rather than external validity, and, this strategy gave us the opportunity to collect large and varied sets of data fulfilling this purpose (Etikan, Musa, & Alkassim, 2016). To ensure the quality of our final samples, we used strict inclusion criteria (e.g., Dutch speaking participants; including participants who do not participate in the desired behavior yet). Participants who did not fulfil the criteria were immediately guided to the end of the study. Using strict a-priori inclusion criteria increased the power of our studies, by increasing the observed effect size (Meyvis & Van Osselaer, 2018).

3.2. Power and effect size

Research in psychology often overestimates the size of the effect being investigated resulting in a replication crisis in which scholars are confronted with problems related to replicating previous findings (Simmons, Nelson, & Simonsohn, 2011), even more so in relation to finding moderating effects (Meyvis & Van Osselaer, 2018). Our studies accounted for the potential lack of power to find such moderating effect in different ways. First and foremost, we replicated the results in three studies, across varied convenience samples, different (cross-sectional and quasi-experimental) research designs and different operationalizations of our main concepts of interest. Second, we calculated the sample size needed for detecting our moderating effects a-priori by taking a small to medium effect size for Study 1 and 2. This effect size was based on a meta-analysis by Abrahamse and Steg (2013), which reports Hedges' *g* effect sizes of social influence interventions similar to ours (social norm information, Hedges' *g* ranges between 0.00 and 0.23; social norms feedback, Hedges' *g* = 0.29). Hedges' *g* represents here the number of standard deviation units by which the intervention group outperformed a control group (no intervention) on the outcome variable. The reported effects sizes are considered small to medium effects sizes. For study 3 we decided to use a medium to large effect size rather than a large effect size, to increase power (Meyvis & Van Osselaer, 2018). In addition, we increased our sample size after we had calculated the minimum sample size needed. Third, to further address potential power issues in our studies, we increased the observed effect size (see Meyvis & Van Osselaer, 2018). We increased this by (1) including exclusion criteria beforehand; (2) using a full (Study 1) and partial (Study 2 and 3) within-subjects design; (3) using multi-item validated scales for the main constructs of interest; (4) including and correcting for confounding variables; (5) reducing variability with a homogenous sample (especially Study 3), and (6) including a sensitive dependent variable (based on past literature).

3.3. Data analysis

Multiple regression analysis, with Hayes' (2012) moderation procedure (Model 1, bias-corrected, 5000 bootstrap samples) was used to test whether the relationship between social norms/normative messages and pro-environmental intentions were moderated by the level of personal norms. In all studies, the details of the moderator effect were further examined by looking at the conditional effects of the focal predictor at different values of the moderator. We reported R^2 and R^2-change values, *F*-values, the indirect unstandardized *B*-values and their confidence intervals to provide a full picture of effect sizes in relation to these moderating analyses (Preacher & Kelly, 2011).

Our multiple linear regression procedure included an interaction term in the regression equation. Using this approach has been a widely used standard for testing moderating effects in psychological sciences, including but not limited to the subfield of environmental psychology. However, several assumptions were checked in all studies prior conducting this analysis. We checked for: (1) linearity between the independent variables by checking the scatterplot, (2) independence of observations by checking the Durbin-Watson statistic, (2) a normal distribution of data by checking the Q-Q plots and checking the Shapiro-

Wilk statistic, (3) no multi-collinearity by checking the VIF score between the independent variables, and (4) homogeneity of variance by checking the Levene's test of homogeneity of variance (Field, 2017). Furthermore, in line with the minimum standard of performing a multiple regression analysis, the dependent variable in all studies was a Likert-type scale that could be considered as a continuous variable, and, the independent variables included at least two conditions. In all our studies, no assumptions were violated, and therefore we report the standard multiple (moderator) regression analysis.

To increase the power of our studies, we checked for confounding variables, including frequency of the desired behavior, and, socio-demographics (age, gender, income, and educational level). Only "frequency of the desired behavior" fulfilled the statistical assumptions of including covariates (i.e., a strong correlation with the dependent variable, no interaction with the manipulation variable, and, not affected by the manipulation; Meyvis & Van Osselaer, 2018). In Study 3, "gender" also fulfilled these criteria. Hence, we have done the moderating analyses including and excluding the potential confounding variables. As the conclusions of the results for the moderator effect did not change when including the confounding variables, we decided to report the results excluding the confounding variables only.

4. Study 1

A shift towards a more plant-based diet is an important aspect to aid the sustainability challenge we are faced with today (Godfray et al., 2018). Therefore, Study 1 and 2 focused on how we can encourage people to reduce their meat consumption as a type of pro-environmental behavior related to food and diets. More specifically, Study 1 focused on testing Hypothesis 1.

4.1. Method

4.1.1. Research design and participants

An online cross-sectional survey was distributed via social media (data collected in November–December 2019). As the manipulation of normative message framing was targeted towards Dutch consumers specifically, we aimed to target Dutch-speaking adults by advertising and compiling the study online in Dutch only. Furthermore, we only included adult participants who were not already actively engaged in the desired behavior, i.e., flexitarians and meat-eaters. Participants indicating that they were younger than 18 and/or they were vegetarian or vegan, were immediately thanked and guided to the end of the survey. Excluding participants a-priori based on these criteria was assumed to further increase the quality of the sample, and, consequently, the observed effect size of the study (Meyvis & Van Osselaer, 2018). The final sample included 332 participants, of which 55.4% females (males: 44.6%). Participants mean age was 27 years old (*SD* = 10.92). The majority of the sample was highly educated (80% had a Bachelor's or Master's degree) and was a student (59%). In line with the high percentage of students, most participants (65.4%) earned less than €20,000 a year, 11.2% earned €35,000 to €49,999, and approximately six percent earned more than €50,000. The socio-demographics show that the sample is biased towards younger Dutch students and therefore a convenience sample only.

An a-priori sample size analysis (Soper, 2020) revealed that for an anticipated effect of $f^2 = 0.10$, with a minimal desired statistical power of .80, using a probability level of 0.05, and including five predictors (static social norms (SSN), dynamic social norms (DSN), personal norms (PN), interaction terms SSN and DSN*personal norms), a minimum sample of 134 participants was required (Cohen, Cohen, West, & Aiken, 2003). The sample size of 332 was therefore sufficient for the aim of the study.

4.1.2. Procedure and measures

Participants were indirectly approached via social media (Facebook,

Table 1

Moderation effect of personal norms on the relationship between social norms and the intention to reduce meat consumption.

Intent to reduce meat consumption	B	p	t	95% CI	
DSN	0.65	<.001	3.78	0.31; 0.99	$R^2 = .50$, $F(3, 328) = 111.04$, $p < .001$
PN	1.50	<.001	5.53	0.97; 2.04	
DSN*PN	−0.12	.014	−2.47	−0.22;-0.02	$\Delta R^2 = .01$, $\Delta F(1, 330) = 6.10$, $p = .014$
SSN	0.52	.004	2.88	0.17; 0.88	$R^2 = .49$, $F(3, 328) = 103.90$, $p < .001$
PN	1.57	<.001	5.55	1.02; 2.13	
SSN*PN	−0.12	.013	−2.51	−0.22;-0.03	$\Delta R^2 = .01$, $\Delta F(1, 330) = 6.29$, $p = .013$

Note: DSN = dynamic social norms; PN = personal norms; SSN = static social norms.

WhatsApp, and LinkedIn) and directly contacted at the University of Groningen and University Library. After briefing about the purpose of the study, including ethical issues of anonymity, confidentiality and the right to withdraw at any time to the study, participants could provide their consent to participate in the study. They then answered questions related to the inclusion criteria and socio-demographics and frequency of meat consumption, followed by questions measuring the main constructs (i.e., intention, dynamic and static social norms, and, the moderating variable, personal norms). All these variables were measured on a 7-point Likert scale, ranging from 1 *strongly disagree* to 7 *strongly agree*.

Intention towards reducing meat consumption was used as a proxy for actual meat consumption. Based on Ajzen (1991), three items were used to measure intention, such as "I will try to add less meat to my meals in the coming week." Mean scores across the three items showed that participants had a medium strong willingness to reduce their meat consumption in the future ($M = 4.51$, $SD = 1.74$, $\alpha = 0.92$).

Two items to measure dynamic ("Compared to two years ago, more and more Dutch people eat vegetarian food" and "Eating less meat is a trend among Dutch people.") and two items to measure static descriptive social norms towards reducing meat consumption ("The minority of the Dutch population eats vegetarian"; "The majority of the Dutch population eats meat") were included, adopted from Pedersen et al. (2015). Mean scores revealed that in general participants agreed that both the static ($M = 5.72$, $SD = 1.08$, $\alpha = 0.59$) and dynamic ($M = 5.51$, $SD = 1.00$, $\alpha = 0.65$) descriptive norm was in favor of reducing meat consumption among Dutch people.

Seven items measured the participants' personal norm towards reducing meat consumption. The items were adopted from the scale of De Groot and Steg (2009) and included items such as "I feel morally obliged to reduce meat consumption, regardless of what others do." Mean scores revealed that participants held neither a favorable nor an unfavorable personal norm towards reducing meat consumption ($M = 3.58$, $SD = 1.35$, $\alpha = 0.90$).

4.2. Results

Regression analyses including dynamic social norms (DSN), personal norms (PN) and the interaction term (DSN*PN). The model in total explained 50% of variance in intention towards reducing meat consumption (Table 1). The main effects of DSN and PN were both significant, but they were qualified by a significant moderator effect ($B = −0.12$, $p = .014$). We analyzed the direction of the moderating effect by looking at the simple slope effects of the focal predictor at low (1 *SD* below the mean), medium (mean) and high (1 *SD* above the mean) values of the moderator (see Fig. 1a). Those with weak PN, DSN were a stronger predictor for intentions ($B = 0.39$, $p < .001$) than for those with a medium ($B = 0.22$, $p = .003$) or strong ($B = 0.05$, $p = .672$) PN.

Static social norms (SSN), PN and the interaction term (SSN*PN) explained 49% of variance in intention towards reducing meat consumption (Table 1). SSN and PN both contributed uniquely to this model, although these main effects were qualified by the moderator effect ($B = −0.12$, $p = .013$). The simple slope effects showed that for those with weak PN, SSN were a stronger predictor for intentions ($B = 0.27$, $p = .005$) than for those with a medium ($B = 0.09$, $p = .158$) or

strong ($B = −0.08$, $p = .442$) PN (see Fig. 1b).

4.3. Conclusion

The findings of Study 1 provide support for Hypothesis 1: personal norms moderate the relationship between social norms and intentions to behave pro-environmentally. Specifically, the stronger one's personal norm, the weaker the relationship between dynamic (H1a) and static (H1b) social norms and pro-environmental food and diet intentions. Social norms in the present study were measured as a continuous variable only rather than a manipulation variable, providing less clearance in relation to the causal relationships. Moreover, the results did not focus on a social norm intervention, hereby just implying that social norm interventions are less effective to change behavior because people with stronger personal norms are affected less by such interventions (Hypothesis 2). Therefore, Study 2 will experimentally investigate the effect of dynamic versus static social norm interventions on pro-environmental intentions, and the moderating role of personal norms.

5. Study 2

Normally, normative messages emphasizing a majority norm towards a desired behavior will be more effective to change such behavior than a minority norm (Oceja & Berenguer, 2009). Study 2 tests whether the effectiveness of using a dynamic majority over a dynamic minority normative message would diminish the stronger one's personal norms towards the normative behavior (Hypothesis 2a).

5.1. Method

5.1.1. Research design and participants

The study entailed a one-way between-subject quasi-experimental design, in which participants were either exposed to a minority or majority dynamic descriptive normative message. The target population (i. e., adult Dutch participants who ate meat) was anyone within the reach of the researcher's personal, social media and e-mail network. Data was collected in April 2020.

The final sample included 279 participants. Fifty percent of the participants were female, and the mean age was 39 years old. Seventy percent of the sample was highly educated and 51% earned between 20,000 and 50,000 Euro on a yearly basis. Although the sample was based on convenience sampling only, the socio-demographics of gender (50%), age ($M = 42$ years old), and yearly household income ($M = 32,800$ euro) showed a reasonable resemblance of the average Dutch person (CBS, 2019).

An a-priori sample size analysis (Soper, 2020) revealed that for an anticipated effect of $f^2 = 0.10$, with a minimal desired statistical power of .80, using a probability level of 0.05, and including three predictors (DSNM, PN, interaction term DSNM*PN), a minimum sample of 112 participants was required (Cohen et al., 2003). The sample size of 279 participants was therefore regarded as sufficient for the aim of the study.

5.1.2. Experimental manipulation

The independent variable, dynamic social normative message, was manipulated by presenting two dynamic descriptive normative
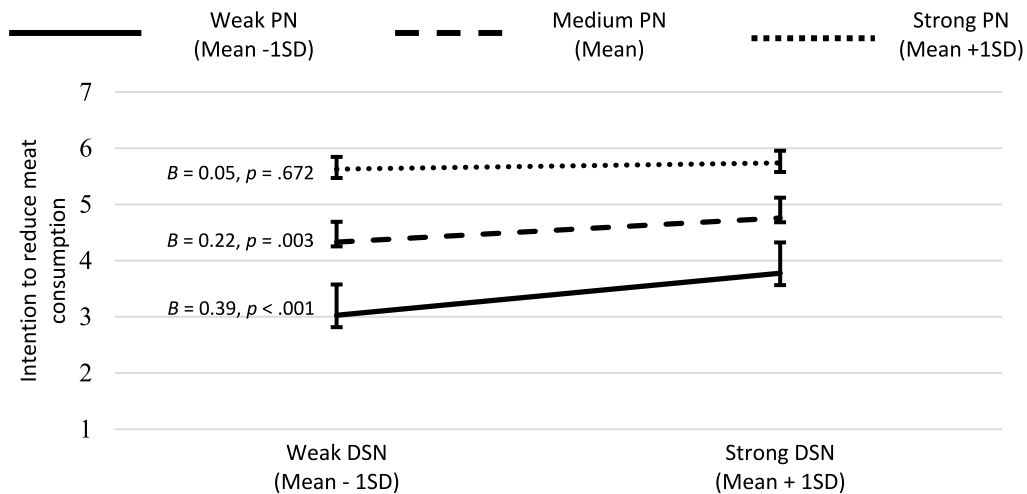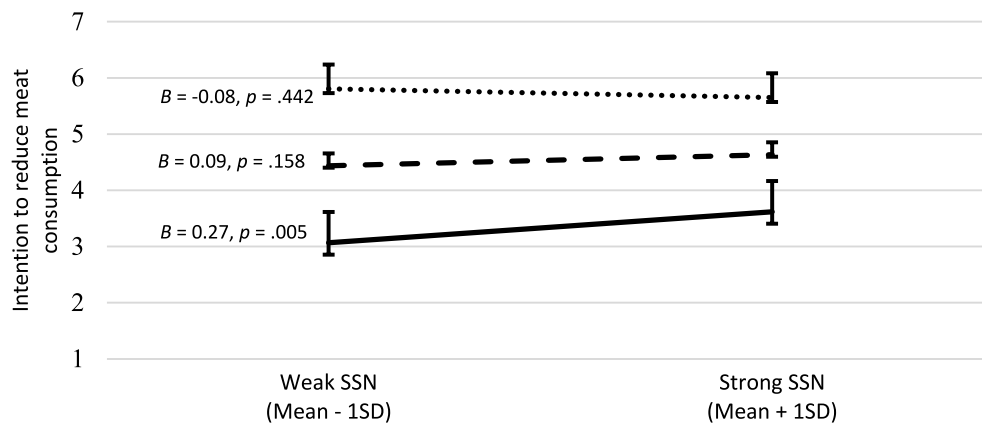
Fig. 1a.

Fig. 1b.

Fig. 1. Visualization of simple slope of dynamic social norms (DSN) (a) and static social norms (SSN) (b) for weak, medium and strong personal norms (PN) on intention to reduce meat consumption. Error bars represent 95% Confidence Intervals.

messages towards meat consumption based on Staunton, Louis, Smith, Terry, and McDonald (2014): a minority and majority dynamic normative message.[1] Participants were asked to read a part of an article, and were randomly assigned to either a majority ($n = 141$) or a minority ($n = 138$) dynamic normative message:

> *"Recent research by the Voedingscentrum (2019) has shown that around 80%* (majority)/*20%* (minority) *of the Dutch population is either trying, or considering to make an effort to limit the amount of meat they consumer. This means that over half* (majority) / *less than a quarter* (minority) *of people like you have started eating less meat than they otherwise would."*

The percentages in the experimental manipulation (80% versus 20%) were not based on actual data, as only 46% of Dutch people claim to be interested in reducing meat consumption (Voedingscentrum, 2018). It was chosen to create a condition where either a strong or a weak perceived dynamic descriptive norm between the two experimental conditions could be detected, while at the same time not deviating too

much from this average. Since these percentages were not based on actual evidence, we included a governmental source ("Voedingscentrum") that is deemed credible by most Dutch people. To check for the confounding effect of credibility, we included questions related to the credibility and trustworthiness of the message.

5.1.3. Procedure and measures

After briefing about the purpose of the study (i.e., to investigate what people's opinion was on a news article in relation to eating meat), including ethical issues of anonymity, confidentiality and the right to withdraw at any time to the study, participants could provide their consent to participate in the study. After giving their consent, they first answered questions in relation to the inclusion criteria and socio-demographics, followed by the exposure to one of the two experimental manipulations and main constructs (see below). All the variables were measured on a 7-point Likert scale, ranging from 1 *strongly disagree* to 7 *strongly agree*. Finally, they were thanked and debriefed.

Intention towards reducing meat consumption ($M = 3.71$, $SD = 1.64$, $\alpha = 0.89$) and personal norms ($M = 3.20$, $SD = 1.28$, $\alpha = 0.87$) were measured similarly to Study 1. The means and standard deviations of the dependent and moderator variable were somewhat lower than in Study 1, likely due to the more representative sample of the Dutch population in this study.

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[1] Minority and majority messages refer to the extent to which either a majority or minority show the desired behavior in the present study, and not refer to stating what others are not doing.

For the manipulation check, we asked items related to the dynamic social norm in relation to meat consumption in the Netherlands. Items included "meat consumption is a trend in the Netherlands," and, "the majority of Dutch people are trying to reduce their meat consumption." We dummy-coded the experimental manipulation (0 = minority message, 1 = majority message) and checked whether the two conditions differed on the dynamic social norm. A one-way ANOVA showed that the manipulation was successful as participants in the negative descriptive normative message condition believed the news article represented a weaker dynamic descriptive norm ($M = 4.27$, $SD = 1.10$) than the participants in the positive normative message condition ($M = 4.68$, $SD = 1.11$), $F(1, 277) = 9.40$, $p = .002$, $\eta2 = .03$.

5.2. Results

The overall model explained 47% of variance in intention towards reducing meat consumption (Table 2). The main effects for majority and minority dynamic social normative messages (DSNM) and PN on the intention to reduce meat consumption contributed significantly to this model. However, these main effects were qualified by a significant moderator effect of positive versus negative DSNM*PN ($B = -0.05$, $p = .031$). The simple slope effects of the focal predictor at low, medium and high values of the moderator showed that those with weak PN, majority DSNM resulted in stronger intentions to reduce meat consumption than minority DSNM, when participants had weak ($B = 0.53$, $p = .010$) PN. For those with medium ($B = 0.22$, $p = .131$) or strong PN ($B = -0.09$, $p = .644$), it did not matter whether the DSNM was framed as a majority or minority message (see Fig. 2).

5.3. Conclusion

The findings provide support for Hypothesis 2a: a majority dynamically-framed normative message is less effective to positively change pro-environmental food and diet intentions compared to a minority dynamically-framed normative message, the stronger one's personal norm towards the desired behavior. Study 2 manipulated dynamically framed social normative messages only. The results of Study 1 suggest that a similar effect holds true for statically framed normative messages as well. Furthermore, although reducing meat consumption seems to be partially motivated by moral reasons, non-morally-based motives might be important for changing such behaviors as well, such as the cultural barriers related to (not) eating meat, the taste, or health-related motives (e.g., Kahneman & Tversky, 1979; Vainio, 2019). Such alternative motives related to the behavioral context might confound the results we found in Study 1 and 2. Study 3 will therefore address these issues by validating the findings of Study 2 for statically rather than dynamically framed normative messages, and, by focusing on a different diet and food related pro-environmental context (i.e., food waste reduction).

6. Study 3

Food waste has a large impact on the environment in terms of large emission of greenhouse gases and wasteful use of resources (Haugaard, Lähteenmäki, & Stancu, 2016), and, is globally considered to be one of the biggest issues in the field of sustainable development (Amani, Aschemann-Witzel, Bech-Larsen, Hooge, & Oostindjer, 2015). Therefore, Study 3 focused on intentions to reduce food waste as another type of pro-environmental behavior. It presents a small follow-up study only,

Table 2
Moderation effect of personal norms on the relationship between social normative messages and the intention to reduce meat consumption.

Intent to reduce meat consumption	B	p	t	95% CI	
DSNM	1.00	.011	2.57	0.23; 1.76	$R^2 = .47$, $F(3, 273) = 82.22$, $p < .001$
PN	0.98	<.001	9.24	0.83; 1.42	
DSNM*PN	−0.24	.031	−2.17	−0.47;-0.02	$\Delta R^2 = .01$, $\Delta F(1, 273) = 4.69$, $p = .031$

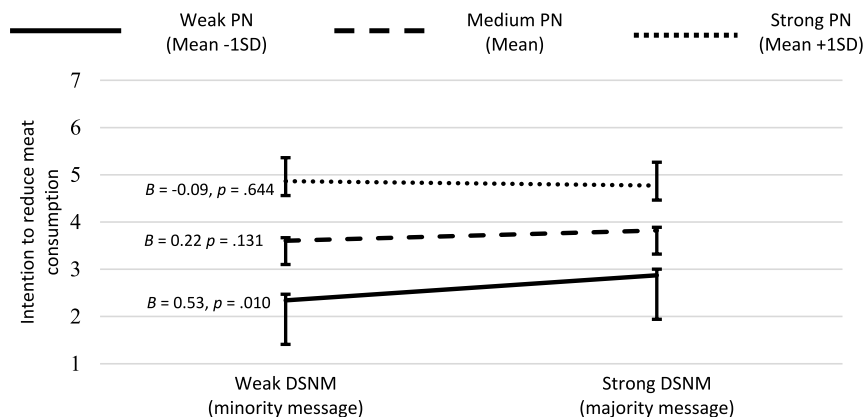Note: DSNM = dynamic social normative message; PN = personal norms.

Fig. 2. Visualization of simple slope of dynamic social normative messages (DSNM) for weak, medium, and strong personal norms (PN) on intention to reduce meat consumption. Error bars represent 95% Confidence Intervals.

which explores whether the effectiveness of using a static majority over a static minority normative message would diminish the stronger one's personal norms towards the normative behavior (Hypothesis 2b).

Table 3
Moderation effect of personal norms on the relationship between social normative messages and the intention to reduce food waste.

Intent to reduce waste	B	p	t	95% CI	
SSNM	1.80	.029	2.25	0.20; 3.80	$R^2 = .31$, $F(3, 50) = 7.61$, $p < .001$
PN	1.54	<.001	3.48	0.65; 2.42	
SSNM*PN	−0.66	.026	−2.29	−1.24;-0.08	$\Delta R^2 = .07$, $\Delta F(1, 50) = 5.24$, $p = .026$

Note: SSNM = static social normative message; PN = personal norms.

6.1. Method

6.1.1. Research design and participants

The study included a one-way between-subjects quasi-experimental design, in which we presented either a majority or minority static social normative message (SSNM). Personal norm towards reducing food waste was included as a continuous moderator variable, and, the dependent variable was the intention to reduce food waste.

The population included students from Groningen who were enrolled in either the Hanze University of Applied Sciences or the University of Groningen. By using a convenience sampling strategy, students were approached by a fellow-student via online channels[2] asking to participate in a brief study related to food waste of students in Groningen. Via a link in the post, the participants were directed to an online survey in Qualtrics. The final sample included 54 students, of which 81% was female (versus 19% male) and studied at the University of Groningen (85%, versus 15% at the University of Applied Sciences). Data was collected in May 2020.

For anticipated effect of $f^2 = 0.30$, with a minimal desired statistical power of .80, using a probability level of 0.05, and including three predictors (SSNM, PN, interaction term SSNM*PN, a minimum sample of 42 participants was required (Cohen et al., 2003). We estimated a larger effect size for Study 3 compared to Study 1 and 2 because Study 3 focused on a specific sub sample of the population (students at the University of Groningen). In particular, the experimental manipulation focused on a very specific reference group, and we were able to collect data from this specific subgroup only which is assumed to increase the observed effect size (Meyvis & Van Osselaer, 2018). However, we acknowledge that the sample size is small for detecting moderating effects. Hence, the results of this study should be interpreted in light of our theoretical framework and the other two studies reported in this paper only.

6.1.2. Experimental manipulation

The independent variable, the static descriptive normative message, was manipulated similarly to Study 2. After reading some general information in relation to food waste in the Netherlands, participants were randomly assigned to either a majority ($n = 27$) or a minority ($n = 27$) static social normative message:

"Most students in Groningen do not waste food. They do this by, for example, saving or freezing left-overs instead of throwing them away and checking the use-by dates of fresh food before purchasing it." (majority static normative message)

"Most students in Groningen waste a lot of food. They do not, for example, save or freeze left-over, they throw them away and they do not check the use-by dates of fresh food before purchasing it." (minority static normative message)

6.1.3. Procedure and measures

After briefing about the purpose of the study (i.e., to investigate what people's opinion was on food waste), including ethical issues of

anonymity, confidentiality and the right to withdraw, participants could provide their consent to participate in the study. After, they answered demographic questions, followed by questions related to their personal norms towards food waste reduction. Then, participants were randomly assigned to one of the two experimental conditions (i.e., majority or minority static descriptive normative message), followed by questions related to intentions, the manipulation check and socio-demographics. All these variables were measured on a 7-point Likert scale, ranging from 1 *strongly disagree* to 7 *strongly agree*, unless otherwise stated below. Before participants were informed about the actual purpose of the study, they were given the opportunity to express their ideas on study's purpose.

Intentions towards reducing food waste were measured with five items based on Ajzen (1991), including for example "I expect to reduce the amount of food that I waste in the future" (1 *very unlikely* to 7 *very likely*). Mean scores showed that participants' intention to reduce food waste was relatively strong ($M = 5.65$, $SD = 0.98$, $\alpha = 0.92$).

Personal norms towards reducing food waste were measured with the adapted scale of De Groot and Steg (2009). Mean scores revealed that participants held a relatively strong personal norm towards reducing food waste ($M = 5.37$, $SD = 0.82$, $\alpha = 0.80$).

For the manipulation check, we asked two static social norm items, measured on a 7-point Likert-scale ranging from 1 *very unlikely* to 7 *very likely,* related to how likely participants believed that students from Groningen were reducing their food waste. Mean scores were computed ($\alpha = 0.69$). We dummy-coded the experimental manipulation (0 = minority message, 1 = majority message) and checked whether the two conditions differed on the static social norm. A one-way ANOVA showed that the manipulation was successful as participants exposed to the minority descriptive normative message showed a significant weaker static descriptive norm ($M = 2.96$, $SD = 0.60$) than those exposed to the majority condition ($M = 3.91$, $SD = 1.09$), $F(1, 52) = 15.47$, $p < .001$, $\eta2 = .23$.

6.2. Results

The overall model explained 31% of variance in intention towards reducing food waste (Table 3). The main effects for majority and minority static social normative messages (SSNM) and PN on the intention to reduce food waste contributed significant to this model. Again, these main effects were qualified by a significant moderator effect of SSNM*PN ($B = -0.66$, $p = .026$). The simple slope effects, illustrated in Fig. 3, showed that a majority SSNM showed a trend towards stronger intentions to reduce food waste when participants had weak ($B = 0.60$, $p = .077$), rather than medium ($B = 0.06$, $p = .785$) or strong ($B = -0.48$, $p = .153$) PN.

6.3. Conclusion

The results of Study 3 support Hypothesis 2b: a majority statically-framed normative message is less effective to positively change pro-environmental food and diet intentions compared to a minority statically-framed normative message, the stronger one's personal norm towards the desired behavior.

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[2] During the corona lock-down no other ways were available to approach the specific target population anymore.
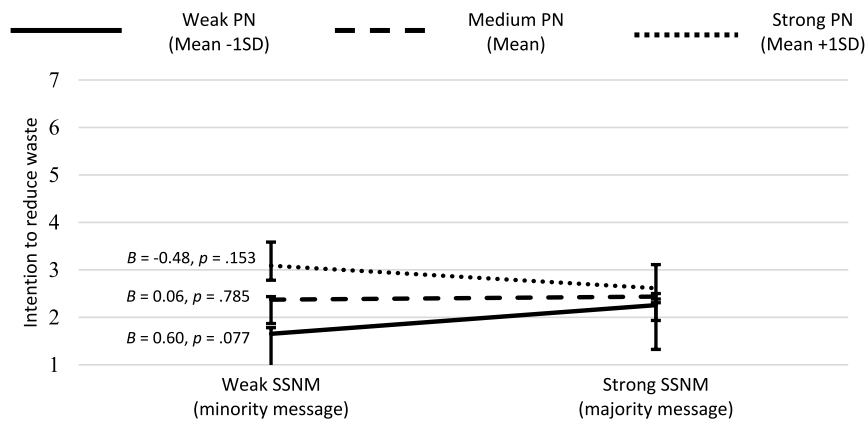
Fig. 3. Visualization of simple slope of static social normative messages (SSNM) for weak, medium, and strong personal norms (PN) on intention to reduce food waste. Error bars represent 95% Confidence Intervals.

7. Discussion

Social norms have been considered as important predictors for a variety of pro-environmental behaviors (Cialdini et al., 1990), including in the diet and food context (Staunton et al., 2014). As such, social norms have been a popular factor used in behavior change interventions to encourage positive environmental change (See Farrow et al., 2017 for a review). Despite an increase in the use of social norm interventions, debates continue due to the inconsistent findings of their effectiveness (e.g., Abrahamse & Steg, 2013; Anderson et al., 2017; Scheibehenne et al., 2016; Yeomans & Herberich, 2014). We examined whether the moderating role of personal norms could be a potential explanation for these inconsistent findings. More specifically, there will always be people who have developed stronger personal norms towards consuming pro-environmentally and these people are more likely to perform the normative (i.e., desired) behavior regardless of the social norms towards the behavior.

We found support for Hypothesis 1: social norms affect the intention to act pro-environmentally more strongly for those with weaker personal norms towards the desired pro-environmental behavior. This assumption was validated regardless of whether these social norms were perceptions about the trend or changes towards the desired behavior (H1a) or the current state of the desired behavior (H1b). These results seem to be consistent with the results from the cross-sectional study of Göckeritz et al. (2010), who found that when the strength of personal norms towards energy conservation increased, the correlations between social norms and conservation behavior among American households decreased.

Furthermore, and, in line with the results of Study 1, a normative message emphasizing that a majority of people like themselves was starting to perform (H2a) or performed (H2b) the desired behavior rather than a minority of people, was less effective to positively change pro-environmental intentions related to food and diet consumption, the stronger one's personal norm towards the desired behavior. Hereby providing support for Hypothesis 2. These results are in line with the field-experimental study performed by Schultz et al. (2016) showing that American residents with stronger personal norms were less influenced by normative messages compared to people with weaker personal norms in relation to reducing their household water consumption.

The results extend the existing literature because we examined the moderating effect of personal norms in a combination of cross-sectional and experimental studies, including two different pro-environmental behavioral contexts and two different types of pro-environmental behavioral intentions, conducted across varied Dutch (Study 1 and 2) and student (Study 3) consumer samples. Hereby, our findings further validate the studies of Göckeritz et al. (2010) and Schultz et al. (2016)

and show that the moderating effect of personal norms is robust.

Our findings provide support for the ELM (Petty & Cacioppo, 1986) by showing that social and personal norms, as described in the social and environmental psychological literature fit well within this model. That is, the strength of personal norms are likely to influence the extent to which people hold stronger "pre-existing attitudes" about the topic. Simultaneously, social norms might work as an "peripheral cue" for those with strong personal norms. Consequently, the weaker one's personal norms, the more likely people will be persuaded by easily accessible and peripheral cues such as (salient) social norms.

Finally, our findings show that the mitigating effect of personal norms work similarly for dynamic and static social norms. Past research has shown that making social norms salient dynamically seems to be especially relevant to promote pro-environmental behavior when the majority of people do not perform the desired behavior (Loschelder et al., 2019; Mortensen et al., 2019; Sparkman & Walton, 2017). However, our research suggests that (1) dynamic social norms work similarly to static norms in the sense that people with stronger personal norms are less affected by them, and, (2) majority dynamic social norms influence pro-environmental behavior more strongly than minority dynamic norms. Hence, we provide evidence that dynamic social norms and dynamically-framed normative messages, at least partly, work in a similar way than static social norms and statically-framed normative messages, hereby contributing to the growing field of research on dynamic social norms (Loschelder et al., 2019; Mortensen et al., 2019; Sparkman & Walton, 2017).

7.1. Limitations and future research directions

Our findings suggest that our convenience sampling strategy might have altered the strength of the moderator effect of personal norms. For example, our findings showed that the convenience student sample (Study 3) increased the effect size of personal norms as a moderator between social normative messages and the intention to reduce food waste compared to the two studies that relied on a more general "varied" convenience sample. Indeed, reliance on student samples has been criticized for overestimating effect sizes in experimental research (Wood et al., 2015). However, an alternative explanation for these larger effects are related to the more specific reference group that was used in Study 3 (Udall, De Groot, De Jong, & Shankar, 2021). Maybe it is more difficult to identify yourself as a Dutch person with a generic group of "Dutch consumers" than it is to identify yourself as a specific student from the university of Groningen. Although Study 3 only included a small sample size and a different pro-environmental behavioral intention, it seems that a student sample could have impacted the strength of the relationships All our studies included specific inclusion criteria and

measured potential confounding variables to decrease the potential bias caused by our convenience sampling strategy. As we found a similar moderating direction across these varied samples, the moderating effect seems to be robust. However, future research should critically reflect on the sample used as the sample characteristics seem to be able to interfere with the strength of the relationships.

Another limitation of the three studies regards the behavioral measure. Measuring intentions instead of actual behavior is a limitation, especially in a context involving moral behaviors. Although this study has given a strong indication of the process under which social normative message framing might be effective, the true impact of such interventions to encourage actual behavior might be overestimated. Past research has shown that measuring intentions is a correlated, but imperfect, prediction of actual pro-environmental behavior in the future (Ajzen, 1991). If future research is more interested in the actual impact of social normative messages on pro-environmental behavior, a (field-) experiment including actual behavior rather than intentions will be a more advisable approach.

Our results provide important practical implications. As normative messages are often targeted at people regardless of their personal norms, when evaluating their effectiveness, those people with stronger personal norms are included in this evaluation as well, hereby underestimating the effectiveness of such messages. Systematically underestimating the effectiveness of social normative interventions might result in the unnecessary focus on other, possibly more difficult or more expensive, alternatives to encourage positive behavior change. Therefore, practitioners should consider normative interventions as a valid option to change behavior, by estimating or investigating the personal norms within the target population.

Author statement

Judith de Groot conceived of the presented idea, developed the theory and performed the computations. Krista Bondy encouraged to refine the theoretical framework, discussion and implications. Geertje Schuitema supported the study design and data analysis. All authors discussed the theoretical model, results and contributed to the final manuscript.

Author note

We have no known conflict of interest to disclose.

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