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Communicating Trends in Sustainability Transitions: Minority Beliefs and Dynamic Norms about Plant-Based Food Consumption

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ABSTRACT

An emerging line of research has been exploring how changes in social norms can lay the ground for shifts toward sustainability. This pre-registered study investigated the influence of communicating *static* and *dynamic* norms (2 Static x 2 Dynamic, between-subjects design) on respondents' beliefs, intentions, information-seeking behavior, and policy support regarding plant-based food. Here, *static* norms referred to a minority of consumers who believed that plant-based food has a crucial role in sustainability transitions. *Dynamic* norms referred to how the number of people endorsing this belief had been increasing. The findings ($N = 492$) revealed that communicating the dynamic aspect of the minority belief increased participants' endorsement of that same belief. Moreover, exposure to dynamic norms (alone or with static norms) had a small positive effect on policy support. These findings add to the growing body of knowledge on dynamic-norm communication.

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KEYWORDS
Dynamic norms; second-order beliefs; plant-based food; minority influence

1. Introduction

Shifting from meat-centric to increasingly plant-based food practices can help promote healthier and more sustainable food systems (Bryant, 2022; Godfray et al., 2018; WHO, 2021). In the last decade, young consumers in particular have been showing a growing concern for the environmental impact of the meat industry and have developed an increased interest in alternative sources of protein (Faber et al., 2020). However, there is still an excessive consumption of animal products in Europe and other industrialized Western societies (Guyomard et al., 2021). Decades of research on social norms have shown that communicating what the majority of others are doing can be an effective strategy for promoting the adoption of pro-environmental behaviors (Cialdini & Jacobson, 2021). But how can we foster more sustainable food consumption when unsustainable behavior *is* the norm?

1.1. Static and dynamic norms

According to Social Norms Theory, individuals are influenced by their perception of what others are doing, especially when those behaviors are widely adopted and salient (Perkins, 2003). The extent to

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which a behavior is widely spread, however, does not always seem to be a prerequisite for norm conformity: according to Moscovici (1980), minorities can also influence majorities by challenging the status quo and providing alternative norms. Furthermore, by focusing on the saliency aspect of normative influence, Sparkman and Walton (2017, 2019) argued that emphasizing the changing aspect of a norm can stimulate conformity, even when the norm is not widely established. This new perspective on normative change is part of an emerging line of research on social norms exploring how minority groups can lay the ground for shifts toward sustainability (Bolderdijk & Jans, 2021).

Communicating that a growing minority of people are performing a certain behavior (defined as *dynamic* or *trending* norms) appears to be more effective in stimulating change than communicating information on how prevalent the minority behavior is in the present (i.e. *static* norms) (Mortensen et al., 2019; Sparkman & Walton, 2017; Sparkman, Weitz, Robinson, Malhotra, & Walton, 2020). For example, Sparkman and Walton (2017) showed that a dynamic-norm message emphasizing how many people changed their behavior to limit meat consumption in recent years was more effective in motivating conformity with the target behavior than the equivalent static-norm messages stating that how many people were limiting their meat consumption at the moment. Exposure to dynamic-norm messages may arguably influence people via anticipation of future norms, compatibility of the new norms with one's identity, or the perception that other people find the new behavior important and are making an effort to engage in said behavior (Sparkman & Walton, 2017; 2019).

This novel approach to social norms has shown initial promising results (Loschelder et al., 2019; Mortensen et al., 2019), however, there is a lack of evidence about how different combinations of information conveying dynamic and static norms might influence environment-relevant variables. Some studies investigated the effectiveness of static-only messages compared to dynamic-only messages (e.g. Loschelder et al., 2019; Sparkman & Walton, 2017). For example, a static-only message might state that "30% of Americans make an effort to limit their meat consumption," compared to a dynamic-only message stating that "in the last five years, 30% of Americans started making an effort to limit meat consumption." Other studies tested if adding dynamic-norm information on top of static-norm information boosted conformity (e.g. Mortensen et al., 2019). Such a message might state for example that "30% of Americans make an effort to limit their meat consumption, and this number has increased in the last five years." However, as no studies have compared all the conditions against each other, it is still unknown if it is more effective to mention dynamic norms alone or together with static norms. This is particularly relevant due to conflicting findings and concerns that communicating minority norms can have a backfire effect (Richter et al., 2018). Some studies found marginal negative effects (Mortensen et al., 2019), and others have found no effects (Sparkman & Walton, 2019) or even positive effects (Demarque et al., 2015) when compared to a control condition. By considering the four combinations theoretically possible (i.e. control, only static, only dynamic, and static plus dynamic), we can observe not only the main effects of exposure to static and dynamic norms but also their interaction. This will allow us to test whether there is an "inhibitory effect" of minority static norms on dynamic norms, i.e. whether making the minority aspect of a norm salient hinders the positive effect of making its trending aspect salient.

Furthermore, research on dynamic norms has often focused on dynamic *behaviors* (e.g. changes in what others are doing), with little attention to how exposure to dynamic *mental states* (e.g. changes in what others believe) may also impact individuals' perceptions and behavior (e.g. see Sabherwal et al., 2021). However, people are not only motivated by their perception of what others do but also of what others think (Geiger & Swim, 2016). Many scholars have called for more research on the perception of others' beliefs, as they have the potential to influence a wide range of variables such as one's own environmental beliefs, intention, behavior, and support for climate policies (Jachimowicz et al., 2018; Mildenberger & Tingley, 2019; Nolan, 2021; Schuldt et al., 2019). This makes it worthwhile to examine the role of dynamic beliefs in environmental communication and test their effect on a variety of cognitive and behavioral outcomes.

1.2 The current study

The current study adds to the growing field of inquiry into dynamic norms and environmental communication by (a) testing different combinations of dynamic and static norms, which allows us to investigate if communicating static minority norms may inhibit expected positive effects of communicating trends; and (b) focusing on beliefs and their possible influence on a range of socio-psychological variables. More specifically, the study aimed to explore the effect of communicating trends and the prevalence of others' beliefs about the role of plant-based food consumption in reducing human impact on the natural environment. We focused on sustainable food transitions and plant-based food consumption, as meat eating is a harmful but culturally cherished and widespread behavior that can be very challenging to change (Graça et al., 2019).

To achieve the aim of the study, we tested whether communication materials highlighting different combinations of dynamic beliefs (present vs. absent) and static minority beliefs (present vs. absent) influence to a different extent of one's own belief, intention, policy support, and information-seeking behavior with plant-based food consumption. These variables (i.e. personal beliefs, intention, policy support) have all been previously studied in relation to people's perception of others' beliefs (Mildenberger & Tingley, 2019; Nolan, 2021; Schuldt et al., 2019) and sustainable food transitions (Fesenfeld et al., 2023; Graça et al., 2019, 2020), and we added a measure of information-seeking behavior (i.e. clicking on a link to a webpage about the topic during the study) as a proxy for real-life behavior. This combination of dependent variables, including both individual (personal beliefs, intentions, information seeking) and systemic-related (policy support) outcomes, allowed for a nuanced and comprehensive view of the impact of communicating social norms. We investigated dynamic norms and context-specific policies in a higher education setting, as young educated adults are a relevant target group for this specific domain and for sustainability-related lifestyle changes in general (Carvalho et al., 2022).

Our first research question focused on the main effect of dynamic norms. Specifically, we wanted to test whether reading information on dynamic positive beliefs about plant-based meal consumption would affect one's own beliefs, intention, policy support, and behavior related to plant-based meal consumption. Considering the previous findings on dynamic-norm communication (Loschelder et al., 2019; Mortensen et al., 2019; Sparkman & Walton, 2019), we expected that exposure to dynamic-norm information would have a positive effect on these dependent variables.

Our second research question focused on the main effect of static norms. We wanted to test whether reading information on static minority beliefs about plant-based meal consumption would affect one's own beliefs, intention, support, and behavior related to plant-based meal consumption. As previous research on minority norm communication has shown inconsistent results (i.e. backfire effects, positive effects, and null effects; e.g. Demarque et al., 2015; Mortensen et al., 2019; Richter et al., 2018; Sparkman & Walton, 2019), we refrained from advancing directional hypotheses on how exposure to information about static minority norms would influence our dependent variables.

The third research question focused on the interaction effect between dynamic and static norms. We wanted to investigate the "boosting effect" of dynamic norms on static norms (by comparing static and static *plus* dynamic), but also a potential "inhibiting effect" of minority static norms on dynamic norms (by comparing dynamic and static *plus* dynamic). Considering the lack of conclusive empirical findings about a possible backfire effect of communicating minority norms (e.g. Demarque et al., 2015; Richter et al., 2018), we refrained from advancing directional hypotheses on how the interaction between exposure to static and dynamic norms would influence our dependent variables.

In sum, we used an experimental 2×2 between-subjects design (Static Norm (present versus absent) x Dynamic Norm (present versus absent)) to investigate the main and interaction effects of static and dynamic norms on beliefs, intention, policy support, and information seeking behavior. We also conducted sensitivity analyses to test the robustness of the main findings when

considering potentially relevant sociodemographic and consumption variables (i.e. gender and eating habits). The study (including all main analyses and sensitivity analyses) was pre-registered before data collection. As exploratory analyses, we investigated respondents' *forecasted norms*, such as the estimation of the prevalence of this belief in the future, to follow up on previous studies that considered the role of *preconformity* (i.e. tendency to conform in anticipation of future norms) when communicating trends (Mortensen et al., 2019; Sparkman & Walton, 2017). The pre-registration can be found in the Supplementary Materials (Appendix A).

2. Methods

2.1 Participants

Participants were students from the University of Groningen (the Netherlands) and they were recruited via ads on digital screens on campus, social media channels, and networks in the university ecosystem (e.g. student online groups, program, and faculty groups). To estimate the required sample size, we considered the ηp^2 of previous studies on dynamic norms (i.e. $\eta p^2 = .04$ in Mortensen et al., 2019 and $\eta p^2 = .035$ Cheng, Hao, Xiao, & Wang, 2022). To achieve an effect size of ~ 0.2, we determined via G*Power 3.1 (Faul et al., 2007) that a sample of 416 participants was required, considering two-way ANOVAs with 4 conditions, and 80% power (1 - β) at a 0.05 alpha level. A total of 640 participants took part in the study. Eleven participants were not University of Groningen students (therefore were automatically excluded from continuing the survey), 48 participants stopped before reaching the materials section and one participant skipped all questions until the end of the survey. The sample of valid participants therefore consisted of 580 students. In this sample 26 participants were vegan (4.5%), 61 were vegetarian (10.5%). As stated in the pre-registration form, given the focal topic of the current study (i.e. transition toward plant-based eating), we considered meat-eating participants as the target sample for our main analyses ($N = 492$, 66.1% female, $M_{age} = 21.7$). One participant provided incomplete responses to their eating habits and was therefore not included in the target sample. For the sensitivity analyses, we considered the entire sample ($N = 580$, 67.2% female, $M_{age} = 21.7$).

2.2 Procedure and design

The study was approved by the Faculty of Arts Research Ethics Review Committee (CETO) of the University of Groningen (Code 81795200). To minimize self-selection biases and increase the credibility of the study materials, the study was presented as aiming to collect information about students' food preferences, habits, and opinions, as well as testing communication materials that were developed based on existing data. Participants were asked about demographic information and eating habits, and they were subsequently randomly assigned to one of four conditions: Static (how the belief is held among a minority of fellow students), Dynamic (how the number of fellow students holding the belief is increasing), Static + Dynamic (information about both belief prevalence and trend), Control (no norm information). Participants in the experimental conditions were presented with a fictitious communication product which included the following statement: "increasing plant-based meal consumption is the single biggest way to reduce our environmental impact" (Figure 1), which was adapted from a real newspaper article (Petter, 2020) to boost the ecological validity of the stimulus. Participants in the control condition were presented with a poster that did not contain any information. The materials are presented in Figure 1. Participants were subsequently asked questions about the communication product (i.e. text and/or design of the poster), dependent variables, and exploratory variables. At the end of the survey, participants could click on a link to read additional information on plant-based food, read the debriefing with the aim of the study, and participate in a lottery to win a restaurant voucher (100€, restaurant not disclosed neither in the recruitment procedures nor in the debriefing).

Figure 1. Material for the four conditions.

Note. The figures were used in the following conditions: static condition, dynamic condition, static + dynamic condition, control condition. To explain the lack of text in the control condition, participants were asked to focus on the design of this new poster where a text about plant-based food will be added.

2.3 Measures

Main dependent variables

Participants indicated how strongly they agreed or disagreed on a 7-point scale with four statements focused on plant-based food. One statement represented the *specific belief* that was used in the materials, i.e. "increasing plant-based meal consumption is the single biggest way to reduce our environmental impact." Three statements were adapted from the Vegetarian Motives Inventory (Hopwood et al., 2020), e.g. "plant-based meals are environmentally friendly" and used to calculate a composite score of *general beliefs* ($\alpha = .77$ for meat-eating participants; $\alpha = .79$ for entire sample). For *intention* to increase plant-based meal consumption, participants indicated how strongly they agreed or disagreed on a 7-point scale with 3 statements, e.g. "I intend to eat more plant-based meals in my daily life" ($\alpha = .91$ for meat-eating participants and the entire sample). *Policy support* was measured on a 7-point scale (1 = *strongly against*, 7 = *strongly in favor*) with four items adapted from De Groeve and Bleys (2017) focusing on support for plant-based food policies at the university level, e.g. "The proportion of plant-based meals in all canteens will be increased to 50%" ($\alpha = .71$ for meat-eating participants and the entire sample). As a behavioral measure, *link click*, we recorded whether participants clicked on a link to read additional information on plant-based food. All the measures are reported in the Supplementary Material (Appendix A).

Covariates (sensitivity analysis)

Participants were asked to indicate their gender (i.e. man, woman, non-binary, other and prefer not to disclose), and to report their eating habits regarding animal product consumption (i.e. eggs, dairy, meat, and fish) with a 7-point scale from (1 = *two or more times per day*, 7 = *never*) adapted from Lea and colleagues (2006). The scores were used to calculate a composite score of Animal Product Consumption (APC) to use as a covariate in the sensitivity analyses ($\alpha = .71$).

Forecasted norms (exploratory analysis)

Participants estimated how common the presented belief is and will be among their fellow students at four different time points (now, in 1.5, 3, and 10 years from now) using a slider for 0% to 100% (adapted from Mortensen et al., 2019).

3. Results

3.1 Main analyses

To investigate the effect of our norm manipulation on our target sample (i.e. meat-eating participants), we conducted two-way ANOVAs, with Static (present vs absent) and Dynamic (present vs absent) as between-participants factors, on the dependent variables *specific belief*, *general beliefs*, *intention*, and *policy support*.

First, the two-way ANOVA on *specific belief* revealed a significant interaction effect between Dynamic and Static, $F(1, 462) = 3.90$, $p = .049$, $\eta p^2 = .008$. Follow-up t-tests showed that participants in the Static + Dynamic condition ($M = 4.19$; $SD = 1.57$) endorsed the specific belief more than participants in the Static-only condition ($M = 3.59$; $SD = 1.76$), $t(229) = -2.79$, $p = .006$; no other significant differences between conditions were found. The main effect of Dynamic on *specific belief* was marginally significant ($F(1, 462) = 3.66$, $p = .056$) and there was no main effect of Static ($p = .946$). Regarding *general beliefs*, there were no significant differences between the conditions (all p-values > .104). As for *intention,* there was a marginally significant main effect of Dynamic norm ($F(1, 458) = 3.21$, $p = .074$), no significant effect of Static and no interaction between Static and Dynamic (both $p > .400$). For *policy support*, we observed a significant main effect of Dynamic ($F(1, 455) = 4.85$, $p = .028$, $\eta p^2 = .011$): participants exposed to Dynamic norm information had slightly stronger *support for policies* about plant-based food ($M = 4.77$;

SD = 1.47) compared to participants not exposed to Dynamic norms (*M* = 4.46; *SD* = 1.60; *F*(1, 455) = 4.85, *p* = .028, ηp^2 = .011). No other significant effects were found for *policy support* (all *p*-values > .635). Means and standard deviations are shown in Figure 2 and Table 1. Regarding the *link clicks*, we conducted a logistic regression and the results showed no significant relationship between a number of clicks and conditions, $X^2(2) = 0.00$, *p* = 1.00 (for an overview, see Table 2).

3.2 Sensitivity analyses

The analyses were also conducted on the entire sample (i.e. including vegetarian and vegan participants) and controlling for Animal Product Consumption (APC) and Gender. The interaction effect between Static and Dynamic on *specific beliefs* and the main effect of Dynamic on *policy support* was marginally significant when considering the entire sample (*p* > .056) and significant when controlling for APC and Gender (*p* < .013). APC was significantly related with *specific belief*, *general beliefs*, *intention*, and *policy support* (*p-values* < .001). All results are shown in the Supplementary Material, (Appendix B).

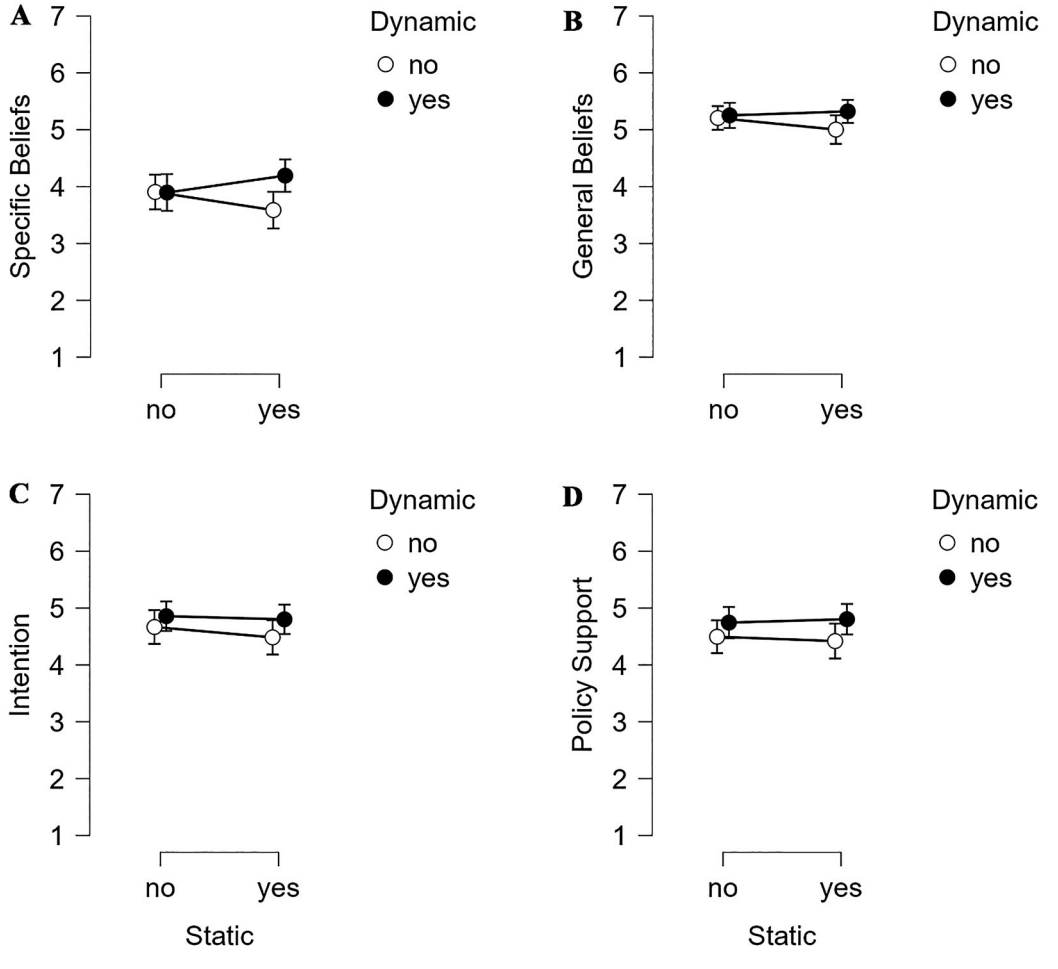

Figure 2. Means and confidence intervals of *specific beliefs*, *general beliefs*, *intention*, and *policy support* for all conditions.

Note. Graph 2A shows the significant small interaction between Dynamic and Static on *specific beliefs*. No significant main effect and interactions were observed for *general beliefs* and *intention*; these graphs (2B and 2C) are represented here to show the patterns. Graph 2D shows the significant main effect of Dynamic on *policy support*.

Table 1. Means and Standard Deviations for *specific beliefs*, *general beliefs*, *intention*, and *policy support* with meat-eating participants.

	Control		Static only		Dynamic only		Static + Dynamic		All conditions	
Measures	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Specific Beliefs	3.91	1.66	3.59	1.76	3.90	1.75	4.19	1.57	3.90	1.69
General Beliefs	5.21	1.13	5.00	1.37	5.25	1.20	5.32	1.12	5.20	1.21
Intention	4.67	1.62	4.48	1.64	4.86	1.38	4.80	1.43	4.70	1.52
Policy Support	4.50	1.56	4.42	1.64	4.74	1.47	4.80	1.48	4.62	1.54

3.3 Exploratory analysis on forecasted norms

We explored how meat-eating participants expected others' beliefs would evolve over time, (i.e. *forecasted norms*). A repeated measures ANOVA was conducted with Time as a within-subjects factor (with the levels: "now," "in 1.5 years," "in 3 years," "in 10 years"), and Static and Dynamic as between-subjects factors. Results showed a significant effect of Time ($F(1, 623) = 464.03$, $p < .001$, $\eta p^2 = .509$; see Figure 3), indicating that participants expected this belief to become more widespread in the future. No other significant effects were found. All results are shown in the Supplementary Material (Appendix B).

4. Discussion

This study investigated how information regarding others' beliefs about plant-based food would impact respondents' beliefs, intentions, information-seeking behavior, and policy support related to plant-based food consumption. With a focus on the *specific belief* that eating plant-based meals is a key action at the individual level to fight climate change, we presented communication materials in four conditions: (1) a message emphasizing how this belief is currently held by a minority (i.e. Static Norm), (2) a message emphasizing how this belief is trending (i.e. Dynamic Norm), (3) a message emphasizing both minority and trending aspects of this belief (i.e. Static *plus* Dynamic Norms), and (4) a control condition without norm information. Consistent with previous findings (Mortensen et al., 2019; Sparkman & Walton, 2017), our results showed that exposure to dynamic norms may both increase conformity with the target belief and increase support for issue-relevant policies.

Meat-eating participants (i.e. our target sample) were more likely to endorse the target belief about the importance of plant-based food when exposed to a combination of dynamic and static norms rather than when exposed to static norms alone. Interestingly, although previous research suggested a possible backfire effect of minority-norm exposure (e.g. Richter et al., 2018), the current findings showed that adding the static minority norm information did not have an adverse effect: participants in the static *plus* dynamic condition did not hold significantly less positive beliefs about the crucial role of plant-based food in the sustainable transitions than those in the dynamic-only condition. Furthermore, meat-eating participants were slightly more likely to support policies promoting plant-based food consumption when dynamic-norm information was shown, regardless of whether it was presented alone or together with static norms. Sensitivity analyses showed that these effects on beliefs and policy support did not reach significance when considering the entire sample

Table 2. Number of clicks per condition with meat-eating participants.

Condition	Control	Static only	Dynamic only	Static + Dynamic	All conditions
Total (N)	111	110	116	110	447
Clicked (N)	4	5	5	9	23
Clicked (%)	4	5	4	8	5

Note. Total *N* = number of participants who reached the survey page with the link; Clicked *N* = number of participants who clicked on the link.

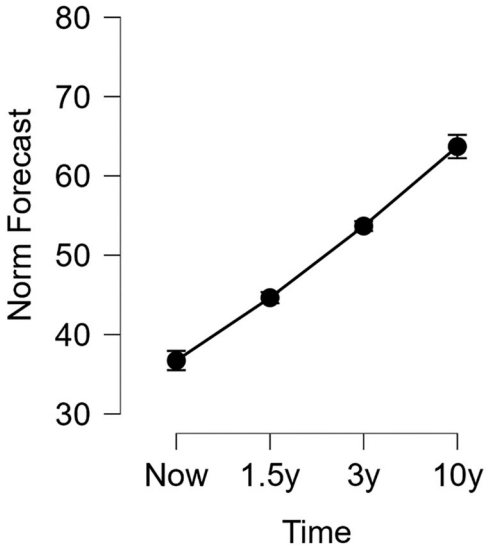

Figure 3. Means and confidence intervals of forecasted norms for target sample.

Note. The graph shows participants' estimation of other students holding the belief that "increasing plant-based meal consumption is the single biggest way to reduce our environmental impact" at four points in time.

(i.e. including vegetarian and vegan participants), but became significant when controlling for eating habits, which might indicate that diet is linked with how audiences react to messages conveying beliefs about plant-based food consumption. As for the norm forecast, exploratory analyses showed that participants expected a very marked future increase in the endorsement that plant-based eating is critical for sustainability transitions.

Overall, our research adds to the growing body of evidence showing promising effects of communicating trends: we found that exposure to dynamic beliefs increased the endorsement of these target beliefs and support for context-relevant pro-environmental policies, although this effect was small and dependent on participants' consumption of animal products. This suggests that dynamic-belief communication may be considered as an operationally feasible strategy that could be combined with other behavior change strategies as part of multi-component interventions to enable sustainable food transitions, rather than a sufficient and stand-alone approach. The results also showed that our participants envisioned an increase in favorable beliefs about plant-based diets in the future. If this expectation is shown to be consistent in other studies, policymakers and market actors could take this expected shift into account when developing their strategies and activities.

4.1 Limitations and future directions

As our sample size was relatively small and the scope was limited to the topic of plant-based eating, more research is needed to investigate dynamic beliefs with larger samples, other environment-relevant topics, and diverse settings. Another limitation of the present study is that the dependent variable we used as a proxy for behavior (i.e. recording whether participants clicked on the link to read additional information on plant-based food) showed a floor effect and cannot be considered a sensitive outcome measure. More research is also warranted to explore dynamic-norm exposure with other types of mental states (e.g. attitudes, values) and to investigate which factors – personal and/or situational – may moderate the impact of exposure to dynamic norms on environment-relevant variables such as pro-environmental attitudes and behavior.

Future studies could also investigate different ways of conveying trends. In our current study, we tried to align our operationalization of dynamic norms with formulations that have been used previously in the field (e.g. Loschelder et al., 2019; Mortensen et al., 2019). However, in our materials, the dynamic *plus* static condition displayed more detailed information (i.e. percentages) than the dynamic-only condition, which may have increased the perceived quality and credibility of the communication materials. Furthermore, being exposed to information about static and/or dynamic norms might have activated desirability biases, as the messages could convey that endorsing the target belief was the "right thing to do." Nevertheless, it is conceivable that there are other reasons for the effects of the dynamic plus static minority message. For example, future studies could examine processes borrowed from the emotional nonconformity literature, such as the concept of "emotional burden," i.e. feeling responsible for expressing certain emotions that are deemed (morally) appropriate especially when the majority of others are not expressing them (Goldenberg et al., 2014; Smith & Mackie, 2015). A dynamic plus static minority message might communicate that a morally appropriate alternative to the current norm is emerging but is not yet supported by the rest of the population, and therefore instill a sense of responsibility to contribute to the norm's advancement.

4.2 Conclusions

People are influenced by their perception of the social environment. This raises challenges to changing environmentally harmful behaviors that are widespread and culturally cherished, such as shifting from meat-centric to more plant-based diets. The current study investigated the influence of communicating information regarding others' beliefs about plant-based food. Taken as a whole, our findings indicate that communicating trends in others' beliefs may influence the audiences' own beliefs and policy support. Nevertheless, this effect is probably contingent on other variables at the social and individual level, such as consumption habits. Furthermore, our results suggest that emphasizing the minority aspect of dynamic norms does not necessarily lead to a backfire effect.

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Disclosure statement

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Data availability statement

The data used in this study are openly available in Figshare at https://doi.org/10.6084/m9.figshare.21207764.

Contributor details

All authors contributed to the formulation of research questions and hypotheses, to the methodological approaches, and approved the final manuscript before submission. Irene Malta oversaw the data collection, conducted statistical analyses, and wrote the first draft of the manuscript. João Graça and John Hoeks gave feedback and critical input on the study design, analyses, and manuscript text.

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