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Dynamic Norms Promote Sustainable Behavior, Even if It Is Counternormative

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Abstract

It is well known that people conform to normative information about other people's current attitudes and behaviors. Do they also conform to *dynamic norms*—information about how other people's behavior is changing over time? We investigated this question in three online and two field experiments. Experiments 1 through 4 examined high levels of meat consumption, a normative and salient behavior that is decreasing in the United States. Dynamic norms motivated change despite prevailing static norms, increasing interest in eating less meat (Experiments 1–3) and doubling meatless orders at a café (Experiment 4). Mediators included the anticipation of less meat eating in the future (*preconformity*) and the inference that reducing meat consumption mattered to other people (Experiments 2 and 3). In Experiment 5, we took advantage of a natural comparison to provide evidence that dynamic norms can also strengthen social-norm interventions when the static norm is positive; a positive dynamic norm resulted in reduced laundry loads and water use over 3 weeks during a drought.

Keywords

social influences, motivation, intervention, sustainability, health, open materials

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Many seemingly intractable problems are difficult to solve in part because their solution would require large numbers of people to abandon contemporary norms. Highlighting social norms can encourage positive behavior (e.g., Goldstein, Cialdini, & Griskevicius, 2008); however, some behaviors that have a negative effect (e.g., the effect on climate change of driving frequently, eating meat often, and discarding functioning products) are normal, well-accepted parts of people's day-to-day lives. In such cases, the accurate perception of societal norms may forestall needed change. In the face of such norms, how is social change possible? In the present research, we explored the hypothesis that drawing attention to the change of a norm over time (a *dynamic norm*) instead of its current state (a *static norm*) can motivate counternormative behavior as well as further motivate normative but not yet adequate behavior.

Our research is inspired by and extends the focus theory of norms, which posits that norms must be salient to cause conformity and that if two aspects of a norm conflict, such as the descriptive aspect (what other people do) and the prescriptive aspect (what is valued or appropriate), people will conform to whichever aspect is most salient (Cialdini, Reno, & Kallgren, 1990). Do people also conform to the dynamic aspect of norms? Many sustainable behaviors are nonnormative but increasing in prevalence. If this increase is salient, will people conform to this change even in violation of the current norm?

In this article, we examine these questions primarily in the context of a problematic and well-entrenched social norm—high levels of meat consumption—as well as in the context of an already normative behavior, water conservation. Livestock produce 14.5% to 18% of the total global warming effect, an amount larger than all of transportation (Gerber et al., 2013). Moreover, many people consume far more meat than physicians recommend (Westhoek et al., 2014). Frequent meat

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eating is a salient and well-reinforced norm: People eat meat in social and public settings, and default options at most restaurants include meat. Shifting attention to the prescriptive aspect of the norm, one way to remedy a negative descriptive norm (Cialdini et al., 1990), may only remind observers that most people see little wrong with eating meat. Another approach is to correct a shared misrepresentation of the norm. Conveying that many college students drink more than they actually want to can reduce pressure to drink (Schroeder & Prentice, 1998). But with meat consumption, there is often no divergence (to our knowledge) between attitudes and behavior—many people just like eating meat. These characteristics of meat eating—its ubiquity, salience, acceptance, and enjoyment—describe many unsustainable behaviors. Yet current theory does not provide clear insight into ways to change them.

How might dynamic norms promote behavior change? Given that static descriptive norms can incite diverse processes (e.g., perceptions of what is true, effective, appropriate; Cialdini & Goldstein, 2004; Deutsch & Gerard, 1955), we hypothesized that dynamic norms—representations of change in other people en masse—will also give rise to multiple processes. In the present research, we examined two processes relevant to sustainable behavior.

First, when a behavior increases in prevalence, people may anticipate ongoing change and a future world in which that behavior is normative and then conform to the emerging norm as if it were current reality. We call this *preconformity*. Prior research has found that people's impressions of norms are sensitive to information beyond the here and now, including imagined and fictitious worlds (Shrum, 2002). Works of fiction can affect impressions of reality so much that they can be harnessed to motivate positive behavior change (Paluck, 2009). Given the potency of imagined social worlds, do dynamic norms lead people to envision ongoing change and an altered future world to which they conform in the present?

Second, seeing others change may lead people to reconsider specific barriers that they had assumed would prevent change. Dynamic norms may thus inspire different inferences in different contexts: People may see a change as, among other things, more important, more possible, or more appropriate than they had thought. Because eating less meat involves changing a major aspect of one's diet in violation of prevalent norms and personal habit, change may appear difficult. If people learn that other people are making this change, they may attribute this effort to the importance others place on that behavior (Kelley, 1967). When this change is made en masse, observers may infer that others in general consider the change important. Given the impact of perceived prescriptive norms on behavior, this may raise interest in reducing meat consumption (Cialdini & Goldstein, 2004).

We expect preconformity (a future descriptive norm) and the perceived importance to other people (a current prescriptive norm) to be unique contributors to dynamic-norm effects on meat consumption. Later, we discuss a broader range of processes that may issue from dynamic norms. Notably, these processes may also apply even when a static norm is positive but not yet universal and thus could strengthen static-norm interventions. For instance, would learning that a growing majority conserves water be more motivating than learning simply that a majority does (see Brent, Cook, & Olsen, 2015)?

In Experiment 1, we tested whether a dynamic-norm message would increase people's interest in reducing their meat consumption relative to a static norm. In Experiment 2 (and two supplemental studies), we sought to replicate Experiment 1 and explore mediating processes. In Experiment 3, we manipulated preconformity directly to better assess its causal role. In Experiment 4, a field experiment, we tested whether dynamic norms increased meatless orders at a café. In Experiment 5, a field study featuring a natural comparison, we tested whether dynamic norms could increase water conservation during a drought (for a summary of all studies, see Table S1 in the Supplemental Material available online).

Experiment 1: Interest in Counternormative Behavior

Would a dynamic descriptive norm about meat consumption, compared with a static descriptive norm, increase interest in eating less meat?

Method

Participants. In exchange for $0.25, 122 U.S. adults took part through Amazon's Mechanical Turk (MTurk) in a "2–3 minute Psychology Study." We were unsure what effect size to predict, but we arrived at this number using our best guess of the sample size needed to detect an effect of interest. Sixty participants per condition yields 80% power to detect a medium-sized effect.

Procedure and dependent measure. We designed the norm statements to draw participants' attention to one aspect of the norm or the other, not to present new information. A pilot sample drawn from the same population as Experiment 1 ($N = 99$; see Experiment S1 in the Supplemental Material) was asked to estimate either the percentage of Americans who make an effort to eat less meat or the percentage who have changed to make this effort in the past 5 years. Both groups estimated this number at just under 30%

(M = 27.8% and M = 25.2%, respectively) and did not differ from one another, $t < 1$ (see the Supplemental Material). Therefore, the norm statement in each condition used this 30% number. (Although this number is less than half, we do not conceptualize norms as requiring a statistical majority but instead conceptualize them as involving the representation of a psychologically meaningful number of people; e.g., see Keizer, Lindenberg, & Steg, 2008.)

In the static-norm condition, participants read,

> Recent research has shown that 30% of Americans make an effort to limit their meat consumption. That means that 3 in 10 people eat less meat than they otherwise would.

In the dynamic-norm condition, they read,

> Recent research has shown that, in the last 5 years, 30% of Americans have now started to make an effort to limit their meat consumption. That means that, in recent years, 3 in 10 people have *changed their behavior* and begun to eat less meat than they otherwise would.

Both statements draw attention to a portion of Americans who make an effort to reduce their meat consumption, but differ in their emphasis. They emphasize either the current status of the norm (some people try to eat less meat) or change in the norm (some people are changing and now eat less meat). Next, participants completed the primary dependent measure: "How interested are you in eating less meat?" (1 = *not at all*, 4 = *somewhat*, 7 = *extremely*).

Would perceptions of the static norm vary across conditions? If people infer a higher static norm in the dynamic-norm condition this could pose an alternative explanation. To address this question in Experiment 1, we assessed perceptions of the static norm: "What percent of people do you think make an effort to limit their meat consumption?" Participants could also construe the behavior in question (limiting meat consumption) differently by conditions. To address this possibility, we asked participants to estimate the number of meatless meals eaten each week by people who limited their meat consumption.

Finally, we asked participants to report their political ideology (1 = *very liberal*, 7 = *very conservative*) and gender and whether or not they were vegan or vegetarian. No other individual difference or demographic variables were assessed.

Results

Population-level meat consumption. Only 4 participants (3.28%) reported being vegan or vegetarian, which reflects prevailing meat-eating norms. Analyses were focused a priori on those participants who ate meat and could thus reduce their meat consumption (N = 118; 43 female, 75 male).

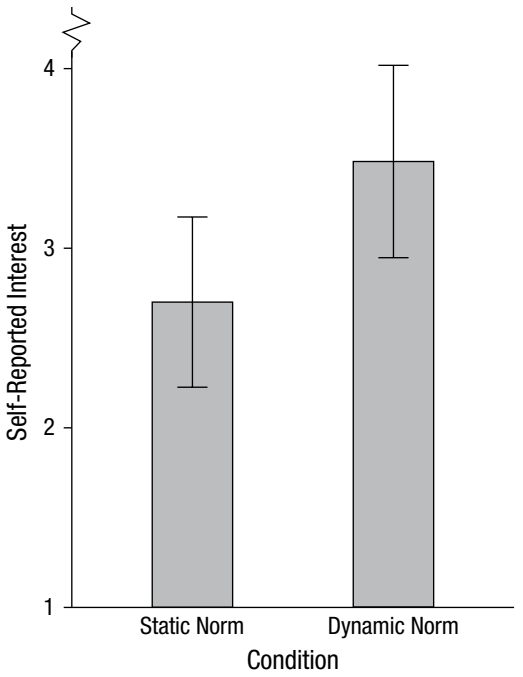

Fig. 1. Results from Experiment 1: participants' self-reported interest in reducing meat consumption in the static-norm and dynamic-norm conditions. Error bars represent 95% confidence intervals.

Interest in eating less meat. As hypothesized, participants expressed more interest in reducing their meat consumption in the dynamic-norm condition (M = 3.48, SD = 2.04) than in the static-norm condition (M = 2.70, SD = 1.83), $t(116) = 2.20$, $p = .030$, $d = 0.41$, 95% confidence interval (CI) for the difference in means = [0.08, 1.49] (Fig. 1). Liberals were more likely than conservatives to be interested in eating less meat, $b = 0.27$, 95% CI = [0.01, 0.52], $t(116) = 2.06$, $p = .041$, and women were more likely than men to be interested in eating less meat, $t(116) = 2.73$, $p < .01$, $d = 0.51$, 95% CI for the difference in means = [0.28, 1.73]. Using a multiple regression and dummy coding condition (0 = static, 1 = dynamic) and gender (0 = male, 1 = female), we found that the effect of condition on interest in eating less meat remained significant when we controlled for gender and political orientation, $t(114) = 2.01$, $p = .047$, $d = 0.38$, 95% CI for the difference in means = [0.01, 1.38]. There was no interaction with condition and either gender or political orientation, ts < 1.20.

Alternative explanations. There was no evidence of a shift in the perceived static norm. There was no between-condition difference in participants' estimates of the percentage of people who limit their meat consumption

(static-norm condition: $M = 30.7$, $SD = 10.5$; dynamic-norm condition: $M = 31.5$, $SD = 11.73$), $t < 1$, or of the number of meatless meals eaten each week by people who limited their meat consumption (static-norm condition: $M = 8.95$, $SD = 4.03$; dynamic-norm condition: $M = 8.36$, $SD = 4.75$), $t < 1$.

Experiment 2: Exploring Mechanisms for Conformity to Dynamic Norms

In Experiment 2, we tested whether we could replicate the effects of dynamic norms on interest in reducing meat consumption and investigated the mediating roles of preconformity and the perceived importance to other people.

Experiment 2 also included a no-norm control condition. The focus theory emphasizes that norms affect people as a function of their salience (Cialdini et al., 1990). The static-norm conditions in Experiments 1 and 2, as well as most real-world food selection contexts, strongly evoke meat-eating norms. In these contexts, we hypothesized that dynamic norms would increase interest in reducing meat consumption. By contrast, Experiment 2 was an online survey without strong contextual cues. It was not clear what aspect of the norm would be salient to participants who were not given a norm statement (i.e., in the control condition). When asked about their interest in eating less meat, people might think of the static meat-eating norm, of news stories or encounters with individuals that suggest that meat consumption is on the decline, or neither. Accordingly, we did not make strong predictions about the control group in this study.

Method

Participants. In exchange for $0.25, 306 U.S. adults took part through MTurk in a survey described as a "2–3 minute Psychology Study." We chose the sample size of 100 participants per condition because it yields more than 80% power to detect medium indirect-effect sizes in a mediation analysis (Fritz & MacKinnon, 2007).

Procedure. The manipulation was very similar to that in Experiment 1 except that (a) after exposure to the norm statements, participants were asked, "Why do you think this is?" and were given space to respond and (b) we included a control group that was provided with no normative information about meat consumption. The free-response question was added primarily to ensure that participants read the norm statement. Participants then completed the same outcome measure as in Experiment 1. In addition, they responded to the following three items assessing potential mediators, using a scale from 1 to 7 (1 = *not at all*, 4 = *somewhat*, 7 = *extremely*): "In the foreseeable future, to what extent do you think that many people will make an effort to eat less meat?" (preconformity); "How much are people making an effort to limit their meat consumption?" (effort); and "How important do people think it is to limit their meat consumption?" (importance). As in Experiment 1, we assessed perceptions of the static norm using the percentage-estimate measure of people who make an effort to limit their meat consumption. We also included a Likert-scale measure ("Roughly, how many people make an effort to limit their meat consumption?"; 1 = *none*, 5 = *a lot*) because participants could simply repeat the number they were given (30%) on the percentage-estimate measure. The order of the process items (preconformity, effort, and importance) was counterbalanced. As in Experiment 1, we also asked participants to estimate the number of meatless meals eaten each week by people who limited their meat consumption, and we assessed participants' political orientation and gender.

Results

Population-level meat consumption. Fourteen participants (4.58%) reported being vegan or vegetarian. The analyses focused on participants who reported eating meat ($N = 292$; 101 female, 187 male, 3 nonbinary).

Interest in eating less meat. As in Experiment 1, participants expressed more interest in reducing their meat consumption in the dynamic-norm condition ($M = 3.37$, $SD = 2.11$) than in the static-norm condition ($M = 2.77$, $SD = 1.72$), $t(289) = 2.29$, $p = .023$, $d = 0.31$, 95% CI for the difference in means = [0.06, 1.14]. Results for the no-norm control condition fell between those for the two norm conditions ($M = 3.06$, $SD = 1.70$) and did not differ significantly from those of either norm condition, $ts < 1.15$. There was also a significant difference between the dynamic-norm condition and a combination of the control and static-norm conditions ($M = 2.91$, $SD = 1.71$), $t(290) = 2.00$, $p = .046$, $d = 0.25$, 95% CI for the difference in means = [0.01, 0.91].

Five participants did not report either their political orientation or their gender as male or female and were excluded from analyses that included these factors. The patterns of interest in eating less meat mirrored those in Experiment 1; political liberals were more interested than were conservatives, $b = 0.12$, 95% CI = [−0.02, 0.26], $t(289) = 1.69$, $p = .092$, and women were more interested than were men, $t(286) = 2.47$, $p = .014$, $d = 0.29$, 95% CI for the difference in means = [0.11, 1.01]. When we controlled for these factors, the effect of the dynamic-norm condition (compared with that of the static-norm condition) on interest in eating less meat

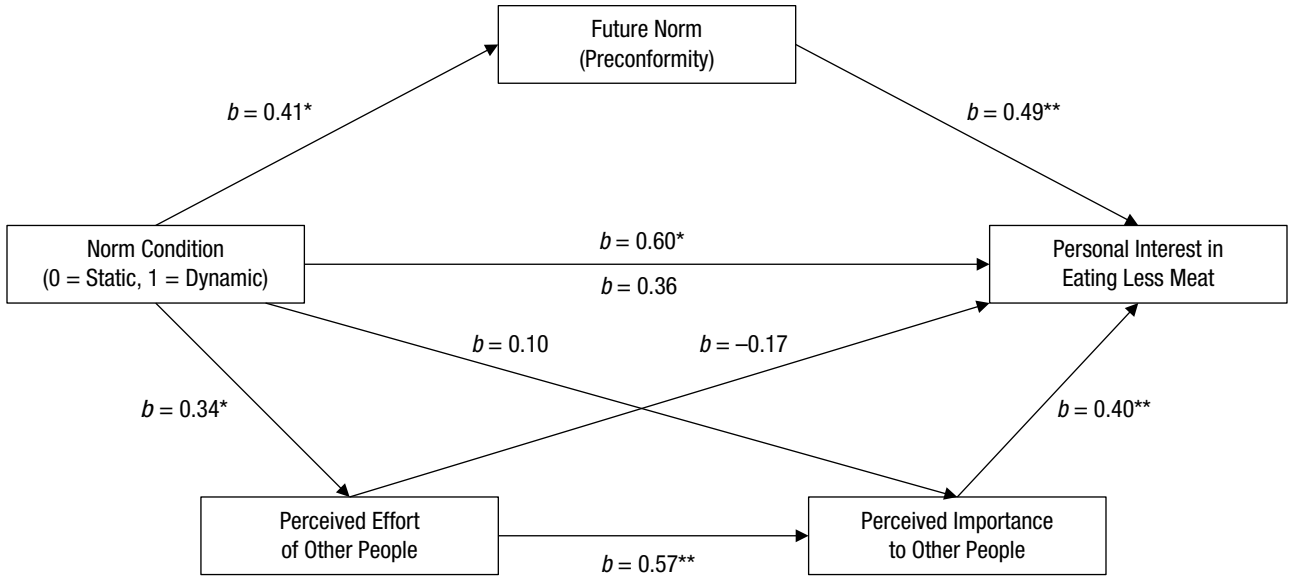

Fig. 2. Multiple sequential mediation analysis from Experiment 2: the effect of the dynamic-norm condition on interest in eating less meat, as mediated by perceptions of the future norm and perceptions of the effort of and importance to others of eating less meat. On the path from condition to interest in eating less meat, the value above the arrow is for the direct effect, and the value under the arrow is for the effect of condition after controlling for the mediators. All other values reflect the effects after controlling for the effects of all other paths present. Asterisks indicate significant paths (*$p < .05$, **$p < .001$).

remained significant, $t(282) = 2.57$, $p = .011$, $d = 0.36$, 95% CI for the difference in means = [0.14, 1.21]. There was no interaction between condition and either political orientation or gender, ts < 1.35.

Process measures. Our theory about psychological process focused on the contrast of dynamic and static norms; therefore, analyses of the process measures excluded the no-norm condition. One participant did not complete the item assessing anticipated future norms and was excluded from analyses of that measure.

Preconformity. Participants in the dynamic-norm condition had a greater level of anticipation that many people would make an effort to reduce their meat consumption in the future ($M = 4.27$, $SD = 1.06$) compared with those in the static-norm condition ($M = 3.87$, $SD = 1.14$), $t(195) = 2.59$, $p = .010$, $d = 0.37$, 95% CI for the difference in means = [0.10, 0.71].

Perceived effort of and importance to other people. Although participants in both conditions were told that some people "make an effort" to limit their meat consumption, this effort was perceived to be greater when it represented a change (dynamic-norm condition: $M = 3.77$, $SD = 1.04$) than when it did not (static-norm condition: $M = 3.44$, $SD = 0.87$), $t(196) = 2.42$, $p = .017$, $d = 0.35$, 95% CI for the difference in means = [0.06, 0.60]. The belief that it was important to other people to reduce meat consumption was marginally greater among participants in the dynamic-norm condition ($M = 3.99$, $SD = 1.23$) than among participants in the static-norm condition ($M = 3.68$, $SD = 1.38$), $t(196) = 1.65$, $p = .10$, $d = 0.24$, 95% CI for the difference in means = [–0.06, 0.67].

Mediation. We predicted that the increased salience of the dynamic norm would increase interest in reducing meat consumption because such salience would (a) lead to the belief that this behavior would increase in prevalence in the future and (b) lead people to believe that other people are putting in effort to change, which signals the importance of the behavior to them. When we regressed interest in eating less meat on the effect of norm condition (coded as static = 0, dynamic = 1), perceived future norm, perceived effort by others, and perceived importance to others, the main effect of norm condition was reduced to nonsignificance (from $b = 0.60$ to $b = 0.36$), $t(192) = 1.40$, $p = .16$.

We then performed a sequential mediational analysis with multiple mediators (Fig. 2). The results, including 5,000-sample bootstrap analysis of the confidence intervals, supported our hypothesis: Future norm perceptions had a significant indirect effect, $z = 2.24$, $p = .025$, indirect effect = 0.20, 95% CI = [0.04, 0.43]. Perceived effort did not have an indirect effect, $z < 1.10$, indirect effect = –0.06, 95% CI = [–0.18, 0.04]. Perceived importance also had no indirect effect, $z < 1$, indirect effect = 0.04, 95% CI = [–0.10, 0.21]. However, the sequential

indirect effect of perceived effort and importance did have a significant indirect effect, $z = 1.98$, $p = .048$, indirect effect = 0.08, 95% CI = [0.01, 0.16]. Finally, the total mediation of the model had a significant indirect effect, $z = 2.84$, $p = .005$, indirect effect = 0.28, 95% CI = [0.08, 0.53]. The results are consistent with the hypothesis that the dynamic norm increased personal interest in eating less meat because it led participants to two influential beliefs: (a) that in the future many people will eat less meat and (b) that other people are putting forth effort to eat less meat, which indicates the importance they attach to this behavior.

Alternative explanations. As in Experiment 1, there was no evidence of a shift in the perceived static norm about people who make an effort to limit their meat consumption along either the percentage-estimate measure (i.e., of people who make an effort to limit their meat consumption) (static-norm condition: $M = 28.4$, $SD = 7.49$; dynamic-norm condition: $M = 30.7$, $SD = 12.09$), $t(289) = 1.33$, $p = .184$, or the Likert-scale measure (i.e., of how many people make an effort to limit their meat consumption; static-norm condition: $M = 2.43$, $SD = 0.67$; dynamic-norm condition: $M = 2.47$, $SD = 0.67$), $t < 1$. There was also no effect on the perceived number of meatless meals eaten each week by people who limited their meat consumption (static-norm condition: $M = 9.95$, $SD = 4.54$; dynamic-norm condition: $M = 10.58$, $SD = 4.38$), $t = 1.01$, $p = .314$.

Experiments S2 and S3

To further confirm the reliability of the effects observed in Experiments 1 and 2 and the mediation findings from Experiment 2, we conducted two follow-up experiments (see the Supplemental Material). First, Experiment S2 ($N = 160$), a direct replication of Experiment 1, yielded the same effect on interest in reducing meat consumption. Second, although multiple measures revealed no between-conditions difference in the perceived static norm in Experiments 1 and 2, Experiment S3 ($N = 600$) further addressed the possibility that change in the perceived static norm contributed to the effect. In this experiment, we held constant the explicit representation of the static norm but, in the dynamic-norm condition, added to this a statement describing the norm as having increased over time. Although this comparison was not ideal from a theoretical standpoint because the key condition raised the salience of the two messages that we were seeking to contrast (i.e., it was a conservative test of the dynamic norm effect), the comparison produced a similar albeit smaller increase in interest in reducing meat consumption. The results provide further evidence that the perceived level of the static norm did not drive the effect. Experiment S3 also replicated the mediation pattern found in Experiment 2 (see Fig. S1 in the Supplemental Material).

Experiment 3: Preconformity in Dynamic-Norm Effects

In Experiment 3, we further examined the role of the perceived future descriptive norm. Given that self-perception can readily affect social perception (i.e., social projection; Krueger & Clement, 1997; Ross, Greene, & House, 1977), it is possible that increased interest in reducing meat consumption leads people to anticipate that other people would change as well and thus that the future norm would shift. To directly test the causal role of preconformity, in Experiment 3 we manipulated the representation of the future descriptive norm within dynamic-norm statements (Spencer, Zanna, & Fong, 2005).

Method

Participants. In exchange for $0.35, 600 U.S. adults took part through MTurk in a survey described as a "2–3 minute Psychology Study." We doubled the sample size from Experiment 2 because we expected smaller differences between variations in the dynamic-norm conditions than between static-norm and dynamic-norm conditions. Two hundred participants per condition provides 80% power to detect a small to medium-sized effect.

Procedure. Participants were randomized into three conditions: (a) a static-norm condition, (b) a dynamic-norm condition with an altered future norm (i.e., future growth), and (c) a dynamic-norm condition without an altered future norm (i.e., no future growth). In both dynamic-norm conditions, participants read a prompt similar to those used for the dynamic-norm conditions in Experiments 1 and 2. In the future-growth dynamic-norm condition, the text continued, "This trend is expected to continue in the near future." Participants then saw a line graph, which represented a rise over the preceding 5 years in a solid line and the expected continued growth over the next 4 years in a dotted line.

In the no-future-growth dynamic-norm condition, the text continued "However, this trend is not expected to continue—instead it's expected to slow and possibly reverse in the future." Participants then saw a line graph with the same solid line indicating the rise over the preceding 5 years, but the dotted line showed a leveling off and reversal over the next 4 years. Participants in the static-norm condition read a prompt similar to those used in Experiments 1 and 2 and also saw a pie

chart depicting the static norm. As in Experiment 2, participants were asked to reflect on these data (for full materials for all conditions, see Experiment 3: Condition Materials and Fig. S2 in the Supplemental Material). The dependent measure for all participants was the same as in Experiment 1 and 2.

Results

Population-level meat consumption. Forty-three (7.17%) participants reported being vegan or vegetarian. The analyses focused on participants who reported eating meat ($N = 557$; 313 female, 236 male, 8 nonbinary).

Interest in eating less meat. As predicted, interest in reducing meat consumption was greater in the future-growth dynamic-norm condition ($M = 3.63$, $SD = 1.92$) than in the static-norm condition ($M = 3.19$, $SD = 1.82$), $t(544) = 2.26$, $p = .024$, $d = 0.23$, 95% CI for the difference in means = [0.06, 0.82], and was marginally greater in the future-growth dynamic-norm condition than in the no-future-growth dynamic-norm condition ($M = 3.26$, $SD = 1.86$), $t(544) = 1.92$, $p = .055$ (two-tailed; one-tailed: $p = .027$, $d = 0.20$, 95% CI for the difference in means = [−0.01, 0.75]). The static-norm condition and the no-future-growth dynamic-norm condition did not differ, $t < 1$. Only when the dynamic-norm condition included a representation of a greater future norm did people show greater interest in eating less meat.

Experiment 4: A Meatless Lunch

Can dynamic norms change not only interest in reducing meat consumption but also food selection? Café patrons waiting in line for lunch completed a survey-based intervention and, unbeknownst to them, had their orders tracked. Given the salience of meat-eating norms in this typical food-consumption environment, we predicted that the dynamic-norm condition would reduce meat consumption relative to both a static-norm condition and a control condition.

Method

Participants. Three hundred twenty-two customers waiting in line at a café on the Stanford campus took part in this experiment. All were over the age of 18, and most were faculty, staff, and graduate students (undergraduates typically eat at dining halls). The mean age of customers in a pilot study ($N = 166$) was 29.4 years old. A sample size of 100 participants per condition provides more than 80% power to detect an effect size similar to the small-to-medium-size effects found in Experiments 1 and 2 (ds = 0.31–0.41).

We ran the study over 2 weekdays during peak lunch hours until we surpassed our target of 100 people per condition. Eleven participants were excluded because they were recognized as affiliates of the Department of Psychology or personally knew the experimenter and may have been aware of the aim of the study. An additional 7 participants were excluded because their receipts indicated that they did not order a personal lunch. One ordered more than two entrees and was thus presumably buying food for other people; 6 did not buy lunch (i.e., they spent less than $2.50 on food; most bought coffee). The final sample thus included 304 participants.

Procedure and manipulation. The café met two basic criteria: a reliably long line during lunch, which allowed the delivery of randomized materials to patrons waiting to order, and the availability of multiple meatless lunch options. Observations found that patrons generally waited in line for about 5 min before passing a stand with copies of the menu. After the menu stand, they waited another 1 to 2 min before reaching the counter to order. A gap of about 8 feet separated the front of the line and the counter; a wall also obstructed the counter from the back of the line. Thus patrons were not directly observed by other patrons or by the experimenter while ordering, reducing any demand processes.

During peak lunch times on weekdays (between 11:30 a.m. and 1:00 p.m.), a sign placed before the menu stand invited patrons in line to complete a survey on "consumer preferences" in exchange for a $5 discount on lunch. Approximately 70% of patrons agreed to participate. They completed materials on a clipboard and returned them to the experimenter, but kept a coupon from the survey. The survey was sufficiently brief that participants completed it before reaching the menu stand. Thus, participants were exposed to the study materials immediately before selecting what to order. Unbeknownst to participants, each coupon included a code that enabled us to link the order with an experimental condition. After taking an order, the cashier stapled the coupon to a copy of the patron's receipt and then stored it for later retrieval by the experimenter.

Before the study, survey materials from the three conditions were shuffled so that, as the experimenter drew from the top of the stack, participants were randomized into one of three conditions. The materials for the static- and dynamic-norm conditions about meat consumption were very similar to the materials from Experiments 1 and 2. Participants in these conditions first read the following:

> We're interested in food and people's attitudes towards different kinds of foods. Right now we're focusing on meat. By meat, we mean fish, pork, chicken, beef, etc. On the next page, we'll give

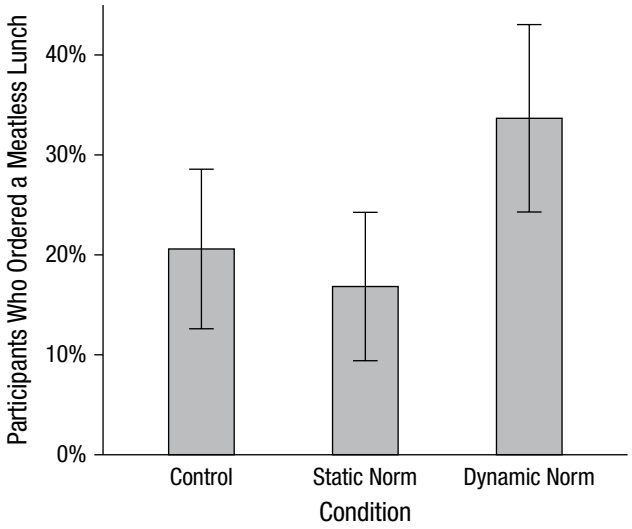

Fig. 3. Results from Experiment 4: the percentage of patrons who ordered a lunch without meat in each condition. Error bars represent 95% confidence intervals.

> you some information. Then we'll ask you for your thoughts.

This neutral representation of the study, together with the privacy of participants' orders, was designed to reduce any demand effects. In the static-norm condition, the materials continued as follows:

> Some people limit how much meat they eat. This is true both nationally and here at Stanford. Specifically, recent research has shown that 30% of Americans make an effort to limit their meat consumption. That means that 3 in 10 people eat less meat than they otherwise would.

In the dynamic-norm condition, the materials continued as follows:

> Some people are starting to limit how much meat they eat. This is true both nationally and here at Stanford. Specifically, recent research has shown that, over the last 5 years, 30% of Americans have started to make an effort to limit their meat consumption. That means that, in recent years, 3 in 10 people have changed their behavior and begun to eat less meat than they otherwise would.

We designed the control condition to address another possible alternative explanation for dynamic-norm effects: Perhaps imagining any social change causes people to take a greater future time perspective, motivating behavior congruent with long-term goals such as health. Thus, the control condition represented a dynamic norm unrelated to food. The materials paralleled the dynamic-norm materials but addressed social media use. The text read as follows:

> We're interested in people's hobbies and people's attitudes towards different kinds of hobbies. Right now we're focusing on time spent online. Some people are starting to limit how much time they spend on Facebook. This is true both nationally and here at Stanford. Specifically, recent research has shown that, over the last 5 years, 30% of Americans have started to make an effort to limit the time they spend on Facebook. That means that, in recent years, 3 in 10 people have changed their behavior and begun to spend less time on Facebook than they otherwise would.

After reading the normative information, participants in each condition were asked, "Why do you think this is?" and were given space to respond. As in Experiment 2, this question was designed to ensure that participants had read and reflected on the norm statement. It also maintained the cover story and distracted attention from the primary outcome of interest, participants' orders.

Outcome measure. Participants' receipts were collected at the end of each lunch period and coded for the presence of meat.

Results

Analysis revealed a significant effect of condition on participants' likelihood of ordering meat, $\chi^2(2, N = 304) = 8.73$, $p = .013$. As hypothesized, participants in the dynamic-norm condition were more likely to order a meatless lunch (34%) than were participants in either the static-norm condition (17%), $\chi^2(1, N = 202) = 6.72$, $p < .01$, or the control condition (21%), $\chi^2(1, N = 203) = 3.76$, $p = .053$. The latter two conditions did not differ, $\chi^2(1, N = 203) < 1$. The a priori test comparing the dynamic-norm condition with the combined static-norm and control conditions was significant, $\chi^2(1, N = 304) = 7.53$, $p = .006$ (Fig. 3). Exploratory fine-grained analyses showed that the reduction in meat consumption was driven largely by an increase in orders of salad, a paradigmatic meatless meal (see Table S2 in the Supplemental Material).

Experiment 5: Water Conservation in a Residential Laundry Facility

In Experiment 4, we found that dynamic norms can shift behavior that is counternormative but increasing.

Can dynamic norms also strengthen social-norm messages when a majority is growing?

While conducting this research, we learned of a campaign to encourage residents of three large high-rise residences to do fuller and thus fewer loads of laundry during a drought. We took advantage of this opportunity to conduct a field experiment. This context allowed us to test effects in a context in which the norm was positive, to deliver dynamic-norm messages in a more scalable form (on signs), and to assess behavior over several weeks rather than with a one-off choice.

Method

Participants. For 3 weeks before and 3 weeks during a social-norm intervention, we collected daily data from 30 washing machines used by approximately 1,200 graduate students living in three nearly identical couples' housing facilities on the Stanford campus. Given the effect sizes found in Experiments 1 and 2 (*d*s = 0.31 to 0.41), this design had more than 80% power to detect an effect size similar to those in Experiments 1 and 2. The study was conducted in the summer during a drought in California.

The layout of each building was identical, including identical basement laundry rooms. Each housed graduate-student couples who were effectively randomly assigned by the campus housing office to live in one of the three buildings. Specifically, incoming graduate couples were placed on a list to access couples' housing. Each year, when couples' housing units became available, a lottery system was used to assign wait-listed couples to a specific building (preferences for buildings were not solicited or recognized). Each building was randomly assigned to the dynamic-norm, static-norm, or the control condition. Laundry facilities were free to building residents, and residents did not have access to laundry facilities in the other buildings, thus ensuring that most residents did laundry only in their building's facility.

Procedure and manipulation. We tracked the number of times each laundry machine was used each day over the 3 weeks before the intervention (preintervention) and the 3 weeks of the intervention using automated logs digitally stored by each machine. On the day the intervention began, signs placed in the laundry room in both norm conditions asked residents to save water by using full loads. The signs differed only in their titles. The static-norm sign read, "Most Stanford Residents Use Full Loads! Help Stanford Conserve Water!" The dynamic-norm sign read, "Stanford Residents Are Changing: Now Most Use Full Loads! Help Stanford Conserve Water!" (see Fig. S3 in the Supplemental Material). In addition, stickers placed on the front of each front-loading machine in both norm conditions marked a full versus not full load. As clothes were loaded into each machine, the stickers were visible on the left edge of the machine. In the control condition, no signs or stickers were added to the laundry room. Pilot surveys suggested that most residents did laundry weekly and thus were likely to see the signs multiple times during this 3-week period (for more information, see Study S5 in the Supplemental Material).

Design. The presence of just three buildings in Experiment 5 raises some inferential questions; thus, it should be considered a preliminary field test. However, potential alternative explanations are mitigated by structural features of the study. Couples were effectively randomized to live in one of the three high-rise buildings, the buildings were identical in layout and in laundry facilities, the buildings were randomly assigned to condition, and we included an extended baseline assessment period against which we assessed change after the introduction of the intervention.

Results

Mixed-model analysis. To examine change in the average number of loads per machine per day during the intervention, we dummy-coded preintervention and intervention dates (preintervention = 0, intervention = 1) and tested the interaction between condition and time (preintervention vs. intervention). To maximize statistical power, we fit usage to a mixed-effects model examining all 1,260 observations (10 machines at each of three sites over 42 days, excluding the day the intervention started), controlling for random variance from each machine and each day.

Given that the outcome, loads per machine per day, was overdispersed count data, we used a negative binomial mixed-model regression with random effects for each machine and date. We used the *glmmADMB* package (Fournier et al., 2012) for the R software environment (R Core Team, 2017) to implement nonparametric mixed-effects models, and we used the R function confint to implement Wald tests to calculate 95% CIs.

As predicted, the reduction in usage was larger in the dynamic-norm condition (28.5%) than in the control condition (2.5%), $z = 3.58$, $p < .001$, 95% CI for the difference in means = [0.14, 0.49]; the static-norm condition (9.73%), $z = 2.85$, $p = .004$, 95% CI for the difference in means = [0.08, 0.42]; and the static-norm and control conditions combined, $z = 3.65$, $p < .001$, 95% CI for the difference in means = [0.13, 0.44]. The reduction in usage in the static-norm condition did not differ significantly from that in the control condition ($p > .40$). Examining change relative to the baseline within each condition revealed that the reduction in use was significant in the dynamic-norm condition, $z = 3.98$, $p <$

.001, 95% CI for the difference in means = [0.17, 0.51], but not in the static-norm condition, $z < 1.20$, or the control condition, $z < 0.35$. Parametric analyses produced equivalent results (see the Supplemental Material). The reduction in the total number of loads was 219 in the dynamic-norm condition, 85 in the static-norm condition, and 18 in the control condition over the 3-week intervention period.

These analyses used the data at its most granular level: loads per machine per day. This approach provided the highest degrees of freedom and the best estimate of error. Given that we assigned buildings to condition, however, an alternative and more conservative test was to count each building as one subject and analyze mean building usage per day. When analyzed this way in a mixed model with a random intercept for date, the greater reduction in usage in the dynamic-norm condition compared with the control condition remained significant, $z = 2.57$, $p = .01$, 95% CI for the difference in means = [0.08, 0.56], and the greater reduction in usage in the dynamic-norm condition compared with the static-norm condition was marginally significant, $z = 1.91$, $p = .056$, 95% CI for the difference in means = [–0.01, 0.47]. There was no difference between the static-norm and control conditions, $z < 1$.

Longitudinal analysis. An important question in water conservation and many other sustainability contexts involves the degree to which behavior change persists or tapers off with time (see Allcott, 2011; Kenthirarajah & Walton, 2015). In Experiment 5, unlike Experiments 1 through 4, we examined behavior over several weeks; thus Experiment 5 was an opportunity to begin to explore how people respond to repeated dynamic-norm messaging. To examine this question, we used the parameter estimates from mixed models (with the parameters described in the previous section), but we performed separate comparisons of the preintervention phase with the 1st, 2nd, and 3rd weeks of the intervention. We found no decrease in effectiveness over time. If anything, the reduction in usage from the baseline period in the dynamic-norm condition relative to the control condition grew in size over the 1st ($d = 0.30$), 2nd ($d = 0.33$), and 3rd ($d = 0.49$) weeks of the intervention. Although it will be important to examine outcomes over a longer period of time, this analysis suggests that the effect of seeing the dynamic norm did not wane after the first exposure and perhaps even grew over the 3-week intervention period.

Experiment S5: Process Measures in the Laundry Context

Because the field context of Experiment 5 did not permit the assessment of psychological measures, we examined psychological processes in a supplemental online experiment ($N = 204$). Although the perceived effort of other people may be less relevant in this context (if anything, it may be easier to do full laundry loads than to divide laundry across multiple machines), preconformity and the perceived importance of full loads to other people may be relevant. Indeed, using materials from Experiment 5, Experiment S5 found effects on participants' belief that the norm would increase in the future (i.e., preconformity) and, less strongly, for the perceived importance to other people of doing full loads.

General Discussion

In five experiments, we found that exposure to dynamic descriptive norms can inspire attitude and behavior change and can do so even in the face of a prominent, contrary static norm. Using the example of high levels of meat consumption—a desirable, widely accepted, and salient yet unhealthy and unsustainable behavior—dynamic norms increased interest in eating less meat (Experiments 1–3) and doubled the percentage of patrons who ordered a meatless lunch (Experiment 4). Further, we found evidence that dynamic norms can strengthen traditional static-norm interventions in which the norm is positive: A dynamic norm about water conservation reduced laundry loads by nearly 30% over 3 weeks, compared with a reduction of just under 10% from a static-norm message (Experiment 5).

Norms can be an obstacle to social change, a mechanism of stasis (e.g., Prentice & Miller, 1996). However, making change in collective behavior salient can motivate behavior change, reversing social influence from perpetuating the norm to overturning it.[1]

In the present research, we identified two novel mechanisms. Dynamic norms can lead people to anticipate a changed future world (preconformity) and increase the perceived importance of a behavior to other people, particularly if people see change in others' behavior as reflecting effort. These mechanisms arose uniquely in response to dynamic norms compared with static norms. They reveal in people a novel sensitivity to information about change in collective behavior.

Limitations and future directions

Beyond these processes, learning that other people are changing may challenge a wide range of perceived barriers to personal change. It may convey that there is new information or reason to change, or that change is possible or not too difficult. Witnessing others change may also imply that change is carried out by people

who, like oneself, did not do the behavior before, and thereby imply that the new behavior is compatible with one's identity (see Lockwood & Kunda, 1997). Dynamic norms may tap into convert-communicator effects, in which people who have changed are especially persuasive advocates (Levine & Valle, 1975). People may also show changes in beliefs, and come to see change as moral, attractive, healthy, or important. Given the possibility that dynamic norms set diverse processes in motion, a full account of mediation, and how different mediators contribute in different behavioral contexts, is an important direction for future research.

Our analysis also implies circumstances in which dynamic norms may be less likely to change behavior. If change in other people's behavior does not appear deliberate or reflect importance, or if it is anticipated that it will slow or reverse (i.e., that it is a passing fad), there may be no perception of importance to others or altered future norm. In fact, the rapid adaptation of some behaviors may be seen as a sign that the trend will soon pass (Berger & Le Mens, 2009). In these cases, attributions for and beliefs about why others have changed may detach from mechanisms that would encourage personal change.

Drawing attention to the static or dynamic aspect of a norm may not always be as straightforward as exposing people to a simple norm statement. Mentioning the rise of a very unfamiliar behavior (e.g., using composting toilets) may lead people to fixate on the counter-normative status of the behavior rather than the change. Conversely, if a behavior is strongly associated with a recent trend (e.g., avoiding gluten), even a static-norm statement may arouse thoughts about the change. This could become the case for limiting meat consumption if this trend continues to garner attention (Kluger, 2015). Researchers hoping to further study or apply dynamic-norm effects will need to ensure they successfully manipulate or induce the salience of the dynamic norm.

Conclusion

Margaret Mead famously said, "Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has" (Lutkehaus, 2008, p. 261). But how? Dynamic norms begin to provide a psychological account of how a small group can cause change. Many reforms struggle because of the need to change existing norms, but often a small, dedicated group changes quickly. If this change is visible, appears willful, reflects the importance of the issue, and is taken as a sign of what is to come, it may encourage broader change even in the face of a salient and socially entrenched current norm.

Action Editor

Leaf Van Boven served as action editor for this article.

Author Contributions

G. Sparkman and G. M. Walton developed the study concept, designed the studies, reviewed data analyses, and drafted the manuscript. Testing, data collection, and data analyses were performed by G. Sparkman. Both authors approved the final version of the manuscript.

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Note

1. The present research is not alone in suggesting that social influence regarding changes made by other people may help incite broader social change. After we submitted our manuscript for publication, we learned of other researchers who have independently pursued similar ideas and found consistent results (Mortensen, Neel, Cialdini, Jaeger, Jacobson, & Ringel, 2017).

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