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Witnessing change: Dynamic norms help resolve diverse barriers to personal change☆,☆☆

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ABSTRACT

Recent research has found that *dynamic norms*—information about collective change in behavior—can promote meaningful personal behavior change, even if that behavior is not currently the norm. Through what psychological processes do dynamic norms operate? We theorized that, when others change, it can lead observers to infer that whatever factors had loomed large as barriers to change do not, in fact, prevent change. If so, dynamic norms may alter diverse salient mechanisms of personal change, and encourage behavior change in diverse contexts. Investigating four domains—smokers' intention to quit, dietary choice, sleep-related behavior, and men's identification as feminist—Experiments 1–4 found that dynamic norms affected three well-established mechanisms of personal behavior change across contexts: the belief that personal change is possible (increased self-efficacy), the belief that change is important to others (injunctive norms), and the belief that change is compatible with one's social identity. In each case, change in the psychological process also statistically mediated change in personal interest and intentions to change. Experiment 5 tested our hypothesis that psychological barriers that loom large would be remedied most. Manipulating the salience of all three barriers within a single context, we found that dynamic norms had a larger impact on salient than less salient barriers. The results suggest that dynamic norms can help resolve diverse psychological barriers to encourage personal change, especially salient barriers. They may thus be a particularly robust source of social influence across contexts.

1. Introduction

Progress on social problems, including those related to health, the environment, and social justice, often requires people to make personal changes. However, a variety of psychological barriers can forestall change: change can seem impossible, insufficiently important, or incompatible with how we see ourselves. How can such barriers be overcome? We theorize that *dynamic norms*—information that other people are changing—can ease diverse concerns people can have about personal change across a wide-range of contexts.

Although social norms are a cornerstone of social psychology (e.g., Asch, 1952; Cialdini & Goldstein, 2004; Deutsch & Gerard, 1955; Milgram & Sabini, 1978; Newcomb, Koening, Flacks, & Warwick, 1967), there is much we do not understand about norms, the forms they can take, and the psychological processes they can instigate. For instance, past research has focused almost entirely on *static* norms, such as information about the prevalence of a behavior (descriptive norms) or the attitudes of others toward a behavior (injunctive norms) at a given point in time. The focus theory of norms holds that people are more likely to conform to whatever aspect of a norm is most salient, whether the descriptive or the injunctive aspect (Cialdini, Reno, & Kallgren, 1990). We suggest that change in collective behavior or attitudes is itself also an aspect of norms to which people may conform, if this aspect is salient (Sparkman & Walton, 2017). We refer to information involving widespread change in others' behavior or attitudes as *dynamic* norm information, or simply "dynamic norms." The particular focus of the present research is on dynamic norms that reflect the intentional, successful efforts at change of many other people.

Although relatively little research has examined dynamic norms, initial work suggests that people can conform to salient information about how a norm is changing. Moreover, they may do so even in the face of a contrary static norm, making them a potentially valuable

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approach to engrained social problems. One series of experiments examined high levels of meat consumption, a major cause of greenhouse gas emissions and ill health. Dynamic norms information—namely, that a growing minority of Americans were making an effort to eat less meat—increased participants' interest in limiting their own meat consumption. Moreover, in a field experiment, the dynamic norm doubled the percentage of lunch goers who ordered a meatless meal (Sparkman & Walton, 2017). In other studies, learning that norms of water conservation are growing to approach a majority reduced water use in the lab more than learning about norms about a near majority with no mention of growth (Mortensen et al., 2017). Dynamic norm effects are not limited to cases of a growing minority. In another field study, people reduced water use during a drought by doing fewer loads of laundry in response to a dynamic norm message about full laundry loads (i.e., a growing majority of residents are using full loads). In this case, while a static norm message (that a majority of residents used full loads, without a reference to growth or change) also produced a directional effect, this reduction was smaller in size and did not reach significance (Sparkman & Walton, 2017).

In the present research, we examine how people respond to dynamic norm information about the successful, intentional change of others, and ask whether processes relevant to personal change are instigated by this information. As static norms can facilitate a variety of important inferences (e.g., what behaviors are effective, Cialdini & Goldstein, 2004; what behaviors are approved, Schroeder & Prentice, 1998; Schultz, 1999; who does or endorses a behavior, such as those high in status, Davis & Rusbult, 2001; Goldstein, Cialdini, & Griskevicius, 2008; Paluck & Shepherd, 2012), so we theorized that learning about collective change can facilitate a variety of potentially important inferences about that change. Given that dynamic norms deal with information about change that others make, we anticipate they will influence how people think about the prospect of personal change. More specifically, we theorize that learning about others' changes can address specific factors that otherwise seem to stand in the way of personal change. People may perceive that change is not possible or beyond their capability; change may seem not important enough to carry out; or change may feel incompatible with important aspects of one's identity. Imagine you shared these concerns, but then witnessed many people changing: Would it still seem like change was not possible if many people were changing? Would change still appear unimportant if many people had begun putting in the effort to change? If those who are changing are people who, like you, did not behave in a certain way previously but now do, is that behavior still incompatible with the kind of person you are? In each case, dynamic norms may lead people to reconsider whatever barrier(s) loomed large when contemplating their own change.

This analysis implies not one primary process through which dynamic norm operate but many. Dynamic norms may cause change through diverse processes across contexts depending on which barriers are salient and present in a given context. Importantly, if dynamic norms work through diverse processes, especially salient ones, they may be relatively robust in their effects. Static norms, too, can cause change in a wide-variety of settings where the perceived static norm is aligned with positive change (Tankard & Paluck, 2016), presumably because they too can affect a variety of processes. Similarly, we theorized that dynamic norms can be effective in a wide-range of settings where the norm is improving, including where the static norm is currently positive (i.e., a growing majority do the behavior in question) and where it is currently negative (i.e., a growing minority do the behavior).

Initial research is consistent with our theorizing, yet important parts of this theory have not been tested. Learning that more people are making an effort to limit their meat consumption led people (1) to anticipate an altered future norm (conforming to which was termed "preconformity") and (2) to believe that others viewed reducing meat consumption as important (an altered injunctive norm). These processes simultaneously mediated greater interest in participants in limiting their own meat consumption (Sparkman & Walton, 2017).

We suggest that dynamic norms should be effective in a broader range of contexts beyond meat consumption and that, in other settings, they may address further barriers to change pertinent to those contexts. The present research explored three prominent psychological factors each of which is well-established in its importance for behavior change in general: (1) self-efficacy, the belief that one can change; (2) perceived injunctive norms, the belief that others regard a change as important; and (3) social-identity compatibility, the belief that the change is compatible with one's identity. These processes are not comprehensive of all mechanisms dynamic norms might address. But given their established importance for behavior change, they are a useful place to begin to explore the breadth of processes through which dynamic norms may facilitate personal change.

The contribution of the present research is not in identifying these factors as important to behavior change but in linking them to dynamic norms. Ample research shows their importance in diverse contexts. First, people are unlikely to attempt to change if they do not believe they can, even if they view the change as desirable or beneficial (Chambliss & Murray, 1979; Rotter, 1966; Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986). The Theory of Planned Behavior highlights how perceptions of how difficult a behavior is to enact, among other factors, govern the behaviors considered (Bandura, 1977). Self-efficacy—the belief that one can do something—is heavily shaped by social information. When people observe others like them fail at a task, they may infer that they too are unable to do it (Brown & Inouye, 1978). Role models—individual exemplars who have accomplished or succeed at something relevant to an observer—are thought to inspire motivation in part by showing people that they can achieve more than what they thought possible (Lockwood & Kunda, 1997). Consistent with our emphasis on change, research also finds that people are more inspired by individuals who have improved than by individuals who have always succeeded (Klein & O'Brien, 2017). Similarly, growth-mindset interventions use examples of others who have grown as social proof that intelligence can grow through hard work, good strategies, and help from others, inspiring people to overcome challenges in their own lives (Blackwell, Trzesniewski, & Dweck, 2007; Paunesku et al., 2015; Yeager et al., 2016). This past research has focused on exposure to the accomplishments of paradigmatic individuals; in some cases, the personal relevance of and social connection to these individuals is an important aspect of their effects (Lockwood & Kunda, 1997; Walton, Cohen, Cwir, & Spencer, 2012). Little research, however, has examined the impact of collective changes successfully made by others on self-efficacy. In a notable exception, Rimal, Lapinski, Cook, and Real (2005) found that learning about a collective increase in the popularity of yoga lead participants to have greater self-efficacy beliefs than learning about a decline in popularity. In this work, dynamic norms influenced self-efficacy in a context where people considered an unfamiliar behavior whose difficulty was not known to them. The absence of a control group also means we cannot tell whether dynamic norms increased or decreased self-efficacy beliefs (or both) to produce the difference. In the present work, by contrast, we assess whether successful collective changes made by others can convey that a change that had seemed impossible or very difficult is possible for oneself. Specifically, we assess whether information about the rates of successful change made by others increases self-efficacy in a context where people may doubt their ability to change: addiction to tobacco products and quitting smoking.

Second, people can see a behavior as possible but insufficiently important to undertake. Often, change is not trivial. To change, people may have to overcome a variety of psychological tendencies that encourage stasis such as automaticity and habit (Wood & Neal, 2007; Wood & Rünger, 2016), positive bias toward the familiar (Zajonc, 1968), or concern that change will violate one's existing attitudes, morals or values (Schwartz, 1977). Further, the Theory of Planned Behavior holds that people are significantly influenced by social norms,

Table 1
Perceived primary psychological barriers to change across contexts in Experiments 1–4.

Context	% identifying this belief as the primary barrier to change		
	Belief that change is not possible	Belief that change is not seen as important enough	Belief that change is not compatible with one's identity
Quitting smoking	66%[a]	7%	27%
Avoiding late night screen use	12%	80%[a]	9%
Men considering themselves feminist	12%	20%	68%[a]
Avoiding sugary drinks	22%	70%[a]	8%

[a] This option was selected more than at chance (33.3%) according to a chi-square analyses (all $ps < .001$, see Study S1 for full analyses).

including injunctive aspects such as how important or valuable others consider a behavior to be (Bandura, 1977). When a person believes that a behavior is not seen as important by others, it can reduce motivation for that behavior. Given that people often infer others' motivation from their behavior (Kelley, 1967, 1973), witnessing others' change may signal that others believe this change was important enough to overcome relevant hurdles, altering perceived injunctive norms and motivating personal change (Jacobson, Mortensen, & Cialdini, 2011; Reno, Cialdini, & Kallgren, 1993; Rimal & Real, 2005; Sparkman & Walton, 2017).

Third, change can feel inconsistent with one's personal and social identity. For instance, social identities such as affiliation with one's race, gender, or political identity are essential parts of our self-concept (Hogg & Abrams, 1988; Tajfel, 1978) and play a key role in shaping behavior (Markus & Nurius, 1986; Markus & Wurf, 1987). People are motivated to approach behaviors that feel consistent with valued personal and social identities and to avoid behaviors that feel inconsistent with those identities across a wide range of domains, including political behavior (Bryan, Walton, Rogers, & Dweck, 2011), health behavior (Berger & Rand, 2008; Oyserman, Fryberg, & Yoder, 2007), and consumer behavior (Oyserman, 2009), among others (Miller, Brickman, & Bolen, 1975; Oyserman, 2015). Therefore, if a behavior feels incompatible with one's identity—that is, asksif people think, "Someone like me does not do this" — the behavior may seem aversive. However, dynamic norms about people who were once like oneself in their prior behavior but changed may render both novel behaviors and the people who do them more similar and less incompatible with oneself. Absent a representation of change, people may even perceive that there are strict categories or groups of people who do, versus do not do, a behavior ("Some people are X-ers; others are not X-ers. Which am I?"). Collective change may erode these perceived categories, and imply that the kinds of people who do or do not behave in a certain way is malleable. Relatedly, observers may identify more with people who, like them, did not previously do a behavior but who changed than with people who have always behaved in a different way. Indeed, the theory of normative social behavior holds that normative information is more influential when it is seen as about people similar to oneself (Rimal & Real, 2005; see also Klein & O'Brien, 2017).

1.1. Which process(es) dynamic norms will operate through in a given context?

Although the primary goal of the present research was to establish that dynamic norms can remedy diverse psychological processes that dissuade people from attempting to change, secondarily we sought to understand which process should be impacted by dynamic norms most in a given context. We examine one factor that may shape this: the salience of a given belief(s) that functions as a significant barrier(s) to change in a given context. When asked to consider changing, salient barriers loom large and may prevent attempts to change. By conveying that many people have changed, dynamic norms may challenge assumptions about these salient factors. If so, dynamic norms may mitigate whatever psychological barrier(s) is or are salient in a context most.

1.2. Overview of studies

1.2.1. Experiments 1–4: effects on diverse psychological processes across behavioral contexts

1.2.1.1. Primary hypotheses. The present research examined four behavioral contexts in which past literature and survey data (described in the introduction to each study) and Supplemental Study 1 (described below) suggest that different primary psychological barriers to personal change would arise. Experiment 1 examined smoking-cessation, where we anticipated that perceived ability to change would be a focal barrier; Experiment 2 examined the use of electronic devices before bed (perceived importance to others); Experiment 3 examined men's endorsement of feminist politics (identity compatibility); and Experiment 4 examined consumption of sugary drinks (perceived importance to others). In each study, we assessed parallel measures of self-efficacy, perceived importance to others, and identity compatibility. Our primary hypothesis was that dynamic norms would improve participants' perceptions on each anticipated barrier of interest noted above.

To validate our expectations, grounded in prior research, about which psychological barrier would be prominent in each context, we conducted a pilot study on the salience of each barrier within each context. In each context, participants ($N = 334$) reported which of the three psychological factors they thought played "the largest role" in preventing change; additionally, they were asked to rate the prevalence of each barrier in preventing change. In each case, the hypothesized barrier of interest we identified (noted above) was selected by participants as being of greatest barrier to change in that context (see Table 1). Ratings made by the specific populations being asked to change showed the same pattern (see Study S1).

1.2.1.2. Further analyses. Effects on psychological process measures beyond the anticipated barrier in each context are exploratory.

We also assessed behavioral intentions and interest in change in each context. These measures are of secondary importance to our focus on psychological process measures, because (1) the assessed processes are established mediators of behavior change and (2) past research has already shown that dynamic norms can alter socially meaningful behavior (Mortensen et al., 2017; Sparkman & Walton, 2017). However, our theory presumes that change on process measures should mediate change on intentions and interest in personal behavior change. Therefore, we also tested for mediation of the process measures on these outcomes. This approach prioritizes our focus on understanding the link between dynamic norms and multiple process measures. Follow-up research that seeks to zero in on a specific mechanism within a given context may use complimentary designs, such as by manipulating the mediator (Bullock, Green, & Ha, 2010; Spencer, Zanna, & Fong, 2005). Such designs are less relevant to the present research question, however, as these processes are already known to affect behavior change. What is not known is whether and how dynamic norms impact these processes across diverse contexts.

1.2.1.3. Operationalizing dynamic norms across contexts. Real-world representations of social change are complex and multifaceted, and may convey information about the direction of change in the prevalence of behavior or attitudes, whether change reflects the intentional efforts of others or other factors, how fast change is occurring, who is changing, and whether attempts to change are successful, among others.[1] Across the four contexts studied, we focus on written dynamic norm statements that provide information about the direction of change (what is becoming more or less common) as well as, as noted, information that implies that these changes are the consequence of the successful, intentional attempts at change made by many individuals. They are not, for instance accidental changes, temporary changes that were short lived and ultimately discontinued, or population changes due to cohort shifts. These criteria were chosen because we theorized that dynamic norms representing such changes would be especially likely to challenge perceived barriers to personal change. In each study we relied on past survey research and/or pilot studies to construct accurate summary information about the norm.

Additionally, because it seemed possible that dynamic norms could impact perceptions of descriptive static norms (if a behavior is on the rise, people might infer that its current prevalence is higher), we included accurate static norm information in each dynamic norm condition. This mitigates an overly positive perception of the static norm. Therefore, we also included a separate static norm only condition. This allows us to test whether the dynamic norm conditions cause change relative to the control, and whether the representation of the same static norm without the dynamic element does as well. This approach reflects our primary focus on *understanding the effects of dynamic norms*, with the representation of the static norm constrained, rather than assessing the *effects of dynamic norm above and beyond static norm effects*, which is of secondary interest. Indeed, this design renders the contrast between the dynamic and static norm only conditions conservative, as the dynamic norm condition draws attention to both the static and dynamic aspects of the norm, not only the latter (cf. Sparkman & Walton, 2017, Experiment S3). However, as positive static norms can alter behavior, we expected that the static norm only condition would tend to increase behavioral intentions and interest in cases where the norm was positive (i.e., a majority did the behavior) more so than in cases where the norm was negative (i.e., a minority did the behavior). Correspondingly, the contrast between the dynamic and static norm only conditions should generally be stronger when the static norm is negative and weaker when the static norm is positive. While we did not have strong predictions about the effects of static norms on the process measures, we did not expect them to have comparable impacts to dynamic norms (see Experiment S2 in the Supplemental material). While static norms do not represent others changing or specifically imply that perceived barriers to change can be overcome, learning that many others do a behavior may, in some contexts, imply that the behavior is doable, important, and identity-compatible.

1.2.1.4. Experiment 5: which process(es) when?. Experiment 1–4 assess whether dynamic norms can impact three psychological barriers across diverse behavioral contexts. To test our theory that information about dynamic norms would remedy salient barriers most, Experiment 5 directly manipulated the salience of each psychological barrier within a single context and tests whether the dynamic norm effect would be greatest on whichever barrier had been made salient.

[1] This complexity is not unique to dynamic norm information; descriptive norm information, for instance, can also convey many implications, which may be more or less present, including the prevalence of a behavior, its frequency among those who partake, who does and does not do a behavior, etc.

2. Experiment 1: smoking cessation and the belief that change is possible

Can dynamic norms shape behavior-relevant inferences about self-efficacy and thereby increase the likelihood of personal behavior change? Experiment 1 examined a context where many people doubt their ability to change—smoking cessation. The vast majority of smokers in the US want to quit, have personally tried and failed, and consider themselves addicted (Newport, 2013). Some estimates suggest that successfully quitting smoking requires an average of 10 or more attempts (Chaiton et al., 2016). Having experienced repeated failures, smokers may reasonably question whether they can quit. Yet the belief that quitting is possible is a precursor to trying, and research suggests that increasing smokers' efficacy beliefs increases the likelihood of an attempt succeeding (Schnoll et al., 2011). Further, Study S1 found that the belief that change was not possible was the most prominent perceived barrier among the three beliefs assessed to quitting smoking (in both the general sample and among current smokers). Fortunately, smoking is on the decline in the US, driven in part by the fact that many smokers eventually do quit. In fact, just over half of all people who have smoked successfully quit (Newport, 2013; Saad, 2012). Could information about the rate of others successfully quitting increase smokers' belief that they can personally quit? And would this improve smokers' outlook on whether they will try to quit?

2.1. Method

2.1.1. Participants

Three hundred and thirty-five adults with a unique IP address in the United States took part through Amazon's Mechanical Turk in a "2–3 minute Psychology Study" for 35 cents. Participants had been prescreened in prior (unrelated) surveys where they indicated that they smoked tobacco products. They were asked in the present study to confirm that they smoked tobacco products. Twenty-seven said they did not, leaving a sample of 308 smokers (148 female, 160 male). One hundred participants per condition, with three conditions, yields 80% power to detect an effect size found in prior research on dynamic norms (d = 0.35–0.42; Sparkman & Walton, 2017).

2.1.2. Procedure and measures

All participants were told that we were conducting research on smoking tobacco products and were curious about their views and experiences.

To create the norm statements in Experiment 1, we relied on current national polling data indicating that 81% of people in the US do not smoke, that smoking is on the decline, and that a majority of those who have smoked report having quit (McCarthy, 2016; Newport, 2013). We also wrote the dynamic norm statement to convey that this change was the result of intentional and successful attempts at change made by individuals—not due to temporary or failed attempts at quitting smoking (given that many people who attempt to quit smoking fail), or cohort shifts in smoking (as younger cohorts have lower smoking rates than older cohorts, as smokers die younger than nonsmokers). In the dynamic norm condition, participants read, "Fewer and fewer people smoke. The number of people in the US who smoke continues to decrease. Now 81% of people do not smoke. Surveys find that most people who smoke change. Specifically, more than half of all people who smoke quit successfully."

Those in the static norm only condition read, "Few people smoke. Specifically, surveys find that 81% of people in the US do not smoke." In both norm conditions, to help ensure engagement with the condition material, participants were then asked, "Why do you think this is?" and given space to respond. Participants in the no-norm control condition proceeded directly to the outcome measures. No direct appeal to quit smoking was made in any condition.

Next participants were asked: "How likely are you to try to quit

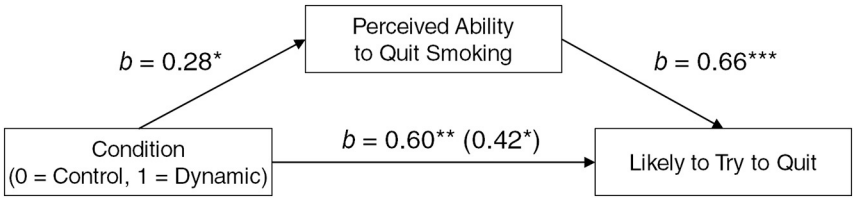

Fig. 1. Mediation analysis from Experiment 1: The results provide correlational evidence consistent with the hypothesis that the effect of the dynamic norm condition on self-reported likelihood of attempting to quit smoking in the near future was partially mediated by participants' beliefs that they would be able to quit smoking. Values inside the parentheses reflect the condition effect controlling for the mediator. Asterisks indicate significant paths: $*p < .05$, $**p < .01$, $***p < .001$.

smoking in the near future?" (*1 = not at all, 6 = certainly*). They then completed the battery of process measures. Four items assessed each of the three beliefs: *perceived ability to change* (see below); *perceived importance of the change to others* (e.g., "How important do people think it is to quit smoking?"; $\alpha = 0.75$); and *perceived compatibility of the change with one's identity* (e.g., "To what extent do you feel that… 'quitting smoking is compatible with who I am'?"; $\alpha = 0.73$). All process items used the same 5-point scale (*1 = not at all, 5 = very much*).

We assessed perceived ability to change in a manner following past research (McAuley, 1992). First, participants first wrote down three difficulties they thought they would face if they tried to quit. They then rated how likely they would be to overcome each difficulty (*1 = not at all, 5 = very much*). Finally, participants responded to a single item, "If you tried to quit, how likely would you be to succeed?" along the same scale. The scale was calculated as the average of participants' mean rating of their ability to overcome the difficulties they specified with their overall perceived likelihood of succeeding (α across the four items = 0.70; correlation across the two parts, $r(306) = 0.34$, $p < .001$). To further explore smokers' perceived ability to quit, participants' free responses were also coded for the specific types of difficulties mentioned (Kappa = 0.86). For the full description of coding, see the Supplemental material.

Items for the same beliefs were presented together in the same block. Their order within block was randomized, with the exception of process measures in the perceived ability to change block, which were shown in a consistent order of perceived difficulties first, then the general self-assessment of ability to change. The order of blocks was also randomized.

The process measures used in Experiments 1–4 were identical, except that each item referenced the behavior in question in each study (for the complete measures and correlations among measures, see the Supplemental material). We report all measures, manipulations, and exclusions in these studies.

2.2. Results

2.2.1. Psychological processes

2.2.1.1. Primary analysis: self-efficacy. As hypothesized, participants expressed a greater belief in their personal ability to quit smoking in the dynamic norm condition ($M = 3.38$ $SD = 0.90$) than in the control condition ($M = 3.10$ $SD = 0.83$), $t(305) = 2.32$, $p = .021$, $d = 0.32$, 95% CI of the difference = [0.04, 0.52]. Participants in the static norm only condition ($M = 3.24$ $SD = 0.85$) fell in between and did not differ significantly from either other condition, $ts < 1.30$, $ps > .20$.

Examining specific types of difficulties, participants in the dynamic norm condition rated themselves as being more capable of overcoming experiences of withdrawal in the dynamic norm condition ($M = 3.52$ $SD = 1.00$) than in the control condition ($M = 3.01$ $SD = 0.95$), $t(161) = 2.60$, $p = .010$, and, marginally than in the static norm only condition ($M = 3.17$ $SD = 1.02$), $t(161) = 1.87$, $p = .064$. They also expressed a marginally greater belief they could overcome triggers to smoking ($M = 3.45$ $SD = 1.11$) when compared to the control condition ($M = 3.13$ $SD = 0.95$), $t(252) = 1.91$, $p = .057$, and significantly so than those in the static norm only condition ($M = 3.13$ $SD = 1.13$), $t(252) = 2.01$, $p = .046$. The static norm only and control conditions did not differ significantly on either of these measures, $ts < 0.9$, $ps > .35$. For full analyses of anticipated difficulties, see the Supplemental material.

2.2.1.2. Exploratory analyses. There was no pair-wise condition difference on either perceived importance to others, $ts < 1.20$, $ps > .27$, or perceived identity compatibility $ts < 1.45$, $ps > .14$.

2.2.2. Intention to attempt to quit smoking

Participants reported that they were likely to try to quit smoking in the near future more in the dynamic norm condition ($M = 4.26$ $SD = 1.43$) than in the control condition ($M = 3.66$ $SD = 1.66$), $t(305) = 3.04$, $p = .003$, $d = 0.42$, 95% CI of the difference = [0.20, 1.00].

Consistent with the fact that the static norm in this case is positive (i.e., most people do not smoke), participants also reported being more likely to try to quit smoking in the static norm only condition ($M = 4.05$ $SD = 1.35$) than in the control condition, $t(305) = 1.98$, $p = .049$, $d = 0.28$, 95% CI of the difference = [0.00, 0.78]. While the effect of the static norm only condition was smaller than that of the dynamic norm condition ($ds = 0.28$ versus 0.42), the two norm conditions did not differ significantly, $t < 1.10$, $p > .28$.

2.2.3. Mediation

Consistent with the hypothesis that the dynamic norm condition increased smokers' likelihood of attempting to quit by increasing their perceived ability to quit successfully, mediational analysis (Fig. 1) found a significant partial mediation through perceived ability, $z = 2.17$, $p = .030$, indirect effect = 0.18, 95% CI from 5000 sample bootstrap = [0.03, 0.32]. A simultaneous mediation model with all process measures produced similar results (see Supplemental materials). As noted, statistical tests of mediation are consistent with a theorized meditational process but provide only correlational evidence (see Judd & Kenny, 2010).

3. Experiment 2: avoiding electronic screens before bed and perceived importance

When a behavior is not seen as important can seeing others change convey that they believe that this change is important? Would this encourage personal change? Experiment 2 examined the common behavior of looking at bright electronic screens (e.g., laptops, TVs, cell phones, tablets, etc.) soon before going to bed. Despite considerable evidence that this harms sleep (Fossum, Nordnes, Storemark, Bjorvatn, & Pallesen, 2014; Mesquita & Reimão, 2010; for a review see Hale & Guan, 2015), people may see this behavior as harmless and doubt the need to curb nighttime screen use. Further, in Study S1 participants identified the belief that change is not seen as important as the most prominent barrier to avoiding late night screen use among the three beliefs assessed. Would a dynamic norm about others' reduction in screen use before bed increase participants' perception that others consider this important? And would this increase participants' interest in reducing their own screen use before bed?

3.1. Method

3.1.1. Participants

Two hundred and ninety-eight adults (147 female, 150 male, 1 non-binary) with a unique IP address in the United States completed a "2–3 minute Psychology Study" for 35 cents posted on Amazon's Mechanical Turk. In a pilot survey (N = 140), over 98% of Amazon's Mechanical Turk users reported looking at electronic devices (TVs, cell phones, tablets, laptops, etc.) in the hour before going to bed. Therefore, we did not prescreen participants in this population for this behavior. One hundred participants per condition, with three conditions, yields 80% power to detect an effect size similar to that found in prior research and in Experiment 1 (ds = 0.35–0.42).

3.1.2. Procedure and measures

All participants were told that we were conducting research on people's use of electronics, and were curious about their views and experiences.

We surveyed adults in the US on Amazon's Mechanical Turk (N = 140) to create the norm statements used in Experiment 2. Roughly 20% of participants reported making some effort to avoid screen use before going to bed. Virtually all of these efforts had begun recently.

In introducing the study participants read "In the following questions, when we say 'using electronic screens,' we mean looking at electronic screens like a computer, TV, or cell phone for some duration (not just a glance)." The dynamic norm condition read, "Some people are beginning to not use or look at electronic screens before going to bed. Specifically, surveys find that many people are changing and now roughly 20% of people in the US do not look at their electronic screens in the hour before bed." We assumed that participants would assume that this change was intentional and successful and thus did not convey this explicitly. Those in the static norm only condition read, "Some people do not use or look at electronic screens before going to bed. Specifically, surveys find that roughly 20% of people in the US do not look at their electronic screens in the hour before bed." As in Experiment 1, in both norm conditions participants were asked, "Why do you think this is?" and given space to respond. Those in the control condition proceeded directly to the outcome measure. No other information (e.g., the impact of late-night screen use on sleep) was provided and no direct appeal to reduce screen use was made.

Next participants were asked: "How interested are you in avoiding electronic screens in the hour before bed?" (*1 = not at all, 5 = very much*). Participants then completed the same battery of process measures from Experiment 1 but referring to reducing electronic screen use before bed (e.g., "If you tried to avoid screens in the hour before bed, how likely would you be to succeed"; perceived ability to change: (α across the four items = 0.69; correlation across the two parts, r (296) = 0.44, $p < .001$); perceived importance to others: α = 0.81; perceived identity compatibility: α = 0.67). For full measures, see the Supplemental material.

3.2. Results

3.2.1. Psychological processes

3.2.1.1. Primary analysis: perceived importance to others. As predicted, participants expressed the belief that others considered it important to avoid screen use before bed more in the dynamic norm condition (M = 3.16 SD = 0.93) than in the control condition (M = 2.83 SD = 0.90), $t(294) = 2.48$, $p = .014$, $d = 0.36$, 95% CI of the difference = [0.07, 0.58]. The static norm only condition (M = 2.97 SD = 0.94) fell in between and did not differ from either of the other conditions, $ts < 1.50$, $ps > .14$.

3.2.1.2. Exploratory analyses. Interestingly, the dynamic norm also increased participants' perception of their ability to change and the compatibility of this change with their identity. Participants saw themselves as more able to avoid screen use before bed in the dynamic norm condition (M = 3.10 SD = 0.89) than in the control condition (M = 2.84 SD = 0.88), $t(295) = 2.14$, $p = .034$, $d = 0.29$, 95% CI of the difference = [0.01, 0.50]. And they reported greater identity compatibility with this change in the dynamic norm condition (M = 2.64 SD = 0.85) than in the control condition (M = 2.23 SD = 0.85), $t(294) = 3.30$, $p = .001$, $d = 0.48$, 95% CI of the difference = [0.17, 0.64]. In both cases, the static norm only condition fell in between (perceived ability to change: M = 2.97 SD = 0.78, identity compatibility: M = 2.46 SD = 0.91) and, with one exception, did not differ from either of the other conditions, $ts < 1.50$, $ps > .14$. The exception was a marginal difference for identity compatibility with the control condition, $t(294) = 1.82$, $p = .071$, $d = 0.26$, 95% CI of the difference = [−0.06, 0.43].

3.2.2. Interest in avoiding screen use before bed

As predicted, participants expressed greater interest in avoiding screen use before going to bed in the dynamic norm condition (M = 2.86 SD = 1.29) than in the control condition (M = 2.39 SD = 1.36), $t(295) = 2.53$, $p = .012$, $d = 0.35$, 95% CI of the difference = [0.10, 0.84]. Consistent with the fact that the static norm in this case is negative (most people in this population used electronic screens before bed), the static norm only (M = 2.43 SD = 1.25) and control conditions did not differ, $t < 1$, $p > .70$. The dynamic versus static norm condition comparison was also significant, $t(295) = 2.31$, $p = .022$, $d = 0.33$, 95% CI of the difference = [0.07, 0.78].

3.2.3. Mediation

Although we predicted that the dynamic norm would increase interest in avoiding screen use before bed by increasing their belief that others thought it important to do so, the dynamic norm affected all three process measures. Therefore, we conducted a simultaneous mediation analysis (Fig. 2) to investigate which process(es) statistically mediated the effect. The results provide correlational evidence consistent with the hypothesized role of the perceived importance to others, $z = 2.30$, $p = .022$, indirect effect = 0.16, 95% CI from 5000 sample bootstrap = [0.03, 0.31]. Perceived identity compatibility also statistically mediated the effect $z = 2.77$, $p = .006$, indirect effect = 0.187, 95% CI from 5000 sample bootstrap = [0.06, 0.35]. Perceived ability to change did not, $z = 0.054$, $p > .50$.

4. Experiment 3: feminist views among men and identity compatibility

People are exposed not only to the behaviors of others but to their social identification, such as their political party membership, religious affiliation, sports team allegiance and so forth. Experiment 3 examined men's identification as feminist and support for feminist legislation. In this context, we anticipated that perceived identity incompatibility would serve as a barrier to personal change. Men's motivation to be consistent with their gender identity can shape a broad set of beliefs and behaviors (Brough, Wilkie, Ma, Isaac, & Gal, 2016; Willer, Rogalin, Conlon, & Wojnowicz, 2013) and, specifically, can hinder men's endorsement of gender equity (Kosakowska-Berezecka et al., 2016; Toller, Suter, & Trautman, 2004). Further, Study S1 found that the belief that change was not compatible with one's identity was the most prominent perceived barrier to men identifying as feminist among the three beliefs assessed (both among the general sample and among men who did not currently consider themselves feminist). Would learning that other men are changing and beginning to identify as feminist increase men's sense that being feminist is compatible with who they are? Would this lead some men to then identify as feminist and increase their support for a relevant policy, pay equity legislation?[2]

[2] This study was conducted before the 2017 Me Too movement, so

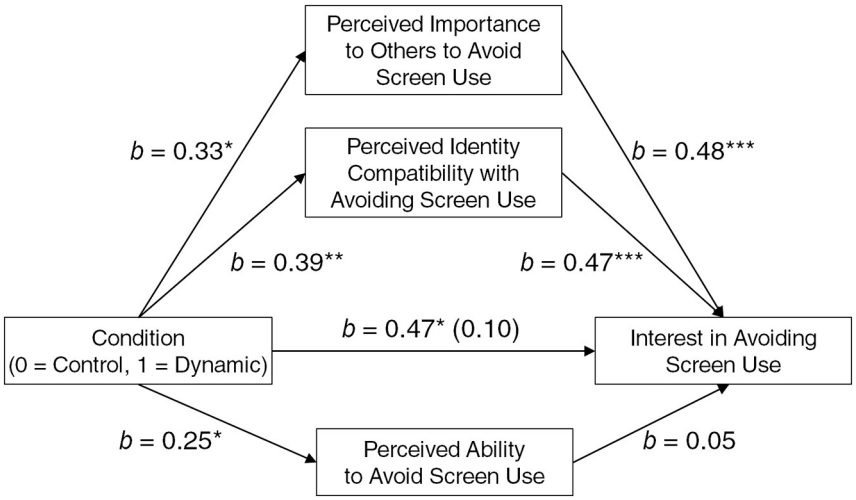

Fig. 2. Multiple mediation analysis from Experiment 2: The results provide correlational evidence consistent with the hypothesis that the effect of the dynamic norm condition on interest in avoiding screen use before bed was dually mediated by increases in the perceived importance to others and in the perceived compatibility of one's identity with avoiding screen use. Values inside the parentheses reflect the condition effect controlling for the process measures. All other values reflect the effects while controlling for all other paths present. Asterisks indicate significant paths: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

4.1. Method

4.1.1. Participants

Six hundred and two adults (315 female, 285 male, 2 non-binary) with a unique IP address in the United States completed a "2–3 minute Psychology Study" for 35 cents posted on Amazon's Mechanical Turk. Because it was easier to drop women from analyses than to prescreen for men, we recruited both men and women (this also avoided the irony of excluding women from a paid study on pay equity). However, the study and norm statements were designed to focus only on men, whose gender identity has been shown to raise compatibility concerns with feminism (Kosakowska-Berezecka et al., 2016; Toller et al., 2004). One hundred participants per condition, with three conditions, yields 80% power to detect an effect size similar to that found in prior research (d = 0.35–0.42; Sparkman & Walton, 2017).

4.1.2. Procedure and measures

All participants were told that we were conducting research on issues related to gender and feminism, and were curious about their views and experiences.

To create the norm statements used in Experiment 3, we examined national polls and asked pilot participants on Mechanical Turk whether they identified as feminist. National polls find that about 20% of Americans identify as feminist, including 16% of men and 23% of women (Kliff, 2015; Swanson, 2013), while a large contingent of both men and women (26%) indicate they are "unsure." Our pilot study (N = 122) found that about 45% of both men and women on MTurk identified as feminist when no option for "unsure" was presented. About 30% indicated that they had begun to identify as feminist in the last 5 years. All considering, we selected "over 35%" for the static norm reference in our norm statements.

We wrote the dynamic norm statement to convey that the change was the result of intentional changes made by many men—not due to cohort shifts, for instance, as participants could believe that younger generations of men are more likely to identify as feminist. The dynamic norm statement read, "The number of men who consider themselves feminists is increasing. National polls show this is because some men, who did not consider themselves to be feminists before, have changed and now do. Now, over 35% of men consider themselves feminists." The static norm only statement read, "Some men consider themselves feminists. Specifically, a national 2015 poll shows that over 35% of men say they consider themselves feminists." In both norm conditions participants were then asked, "Why do you think this is?" and given space to respond. Those in the control condition proceeded directly to the outcome measures. No direct appeal to identify as feminist or support related legislation was made in any condition.

Next participants were asked to what extent they agreed or disagreed with the following statement: "I consider myself a feminist" (*1 = strongly disagree*, *6 = strongly agree*, with no midpoint). While we consider whether men chose to identify as feminist a meaningful outcome itself, it arguably overlaps conceptually with the identity compatibility process measures. Therefore, we also examined whether the condition effect would extend to relevant policy support. Participants were given details about a state pay equity proposition, including three legal changes designed to prevent gender discrimination in wages: it would require companies (1) to disclose average wages of men and women; (2) to prove that gender-based wage differences are due to differences in qualifications; and (3) to not retaliate against employees who raise concerns about gender-based wage discrimination (see Supplemental material for full text). Participants were asked if they would support or oppose such a bill (*1 = strongly oppose*, *6 = strongly support*, with no midpoint).

Finally, participants completed the process measures from Experiment 1 and 2 assessing perceived identity compatibility (e.g. "To what extent do you feel that… 'Being a feminist is compatible with who I am'", α = 0.83) and perceived importance to others (α = 0.82). In both scales, references to others (e.g., similarity to others, importance to others) were in reference to "people" and did not focus only on men. In constructing the questions for this context, it became obvious that the perceived ability to change items would be confusing and even incoherent (e.g., "If you tried to identify as feminist, how likely would you be to succeed?"). Therefore, we excluded that measure. See the Supplemental material.

4.2. Results

4.2.1. Psychological processes

4.2.1.1. Primary analysis: perceived identity compatibility. As hypothesized, men expressed a greater belief that being a feminist was compatible with their identity in the dynamic norm condition (M = 3.13 SD = 0.89) than in the control condition (M = 2.34 SD = 1.02), $t(282) = 5.57$, $p < .001$, d = 0.83, 95% CI of the difference = [0.52, 1.07]. The dynamic norm condition also differed from the static norm only condition (M = 2.74 SD = 0.97), $t(282) = 2.87$, $p = .004$, d = 0.43, 95% CI of the difference = [0.13, 0.66]. The static norm only and control conditions also differed, $t(282) = 2.86$, $p = .005$, d = 0.40, 95% CI of the difference = [0.12,

(*footnote continued*)
participants would not have interpreted the norm statements in terms of this movement.

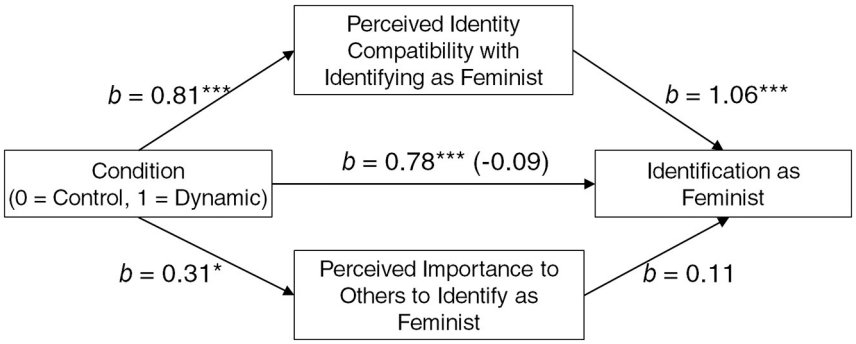

Fig. 3. Multiple mediation analysis from Experiment 3: The results provide correlational evidence consistent with the hypothesis that the effect of the dynamic norm condition on identification as feminist was mediated by the perceived identity compatibility of being feminist but not the perceived importance to others of identifying as feminist. Values inside the parentheses reflect the condition effect controlling for the process measures. All other values reflect the effects while controlling for the effects of all other paths present. Asterisks indicate significant paths: $*p < .05$, $**p < .01$, $***p < .001$.

0.69].

4.2.1.2. Exploratory analyses. Men also reported greater perceived importance to others in identifying as feminist in the dynamic norm condition ($M = 2.97$ $SD = 0.94$) than in the control condition ($M = 2.66$ $SD = 1.01$), $t(282) = 2.23$, $p = .027$, $d = 0.32$, 95% CI of the difference = [0.03, 0.59]. The static norm only condition fell in between ($M = 2.80$ $SD = 0.87$), and did not differ significantly from either of the other conditions, $ts < 1.30$, $ps > .22$.

4.2.2. Identification as feminist

As hypothesized, men identified as feminist more in the dynamic norm condition ($M = 3.52$ $SD = 1.47$) than in the control condition ($M = 2.74$ $SD = 1.41$), $t(282) = 3.71$, $p < .001$, $d = 0.54$, 95% CI of the difference = [0.37, 1.20]. Examined dichotomously, nearly twice as many men identified as feminist (i.e., top half of the scale) in the dynamic norm condition (62.5% did) as in the control condition (34.8% did), $\chi^2(1, N = 188) = 13.36$, $p < .001$. For full dichotomous analyses, see the Supplemental material.

The difference between the static norm ($M = 3.10$ $SD = 1.45$) and control conditions was marginally significant, $t(282) = 1.73$, $p = .085$, $d = 0.25$, 95% CI of the difference = [−0.05, 0.77]. Men also identified as feminist more in the dynamic norm condition than in the static norm condition, $t(282) = 2.01$, $p = .046$, $d = 0.29$, 95% CI of the difference = [0.00, 0.83].

4.2.3. Support for pay equity legislation

The condition effect did not just reflect, for instance, a change in the definition of feminist. It extended to greater support for pay equity legislation in the dynamic norm condition ($M = 4.61$ $SD = 1.25$) as compared to both the control condition ($M = 4.18$ $SD = 1.49$), $t(282) = 2.10$, $p = .036$, $d = 0.31$, 95% CI of the difference = [0.03, 0.82], and the static norm condition ($M = 4.14$ $SD = 1.45$), $t(282) = 2.33$, $p = .020$, $d = 0.35$, 95% CI of the difference = [0.09, 0.86]. The latter conditions did not differ, $t < 1$, $p > .80$. For additional dichotomous analyses, see the Supplemental material.

4.2.4. Mediation

We included both men's belief that being feminist was compatible with their identity and their perception of the importance of this identification to others in a simultaneous mediation model (Fig. 3). Consistent with our hypothesis, identity compatibility statistically mediated the effect of the dynamic norm, $z = 5.39$, $p < .001$, indirect effect = 0.86, 95% CI from 5000 sample bootstrap = [0.55, 1.18]. Perceived importance to others did not, $z = 1.28$, $p = .20$. The same pattern showing full mediation was found for support for pay equity legislation (see Fig. S2).

5. Experiment 4: reducing consumption of sugary drinks

Like Experiment 2, Experiment 4 examined a context where we anticipated that a lack of perceived importance may forestall behavior change: reducing consumption of sugary drinks. Most Americans already report that they try to avoid sugar and soda in particular, and this number has grown (Riffkin, 2015). Many Americans may, therefore, acknowledge the ill effects of drinking sugary beverages (unlike, for instance, using electronic screens before bed), but may not consider it important enough to alter established habits. Further, Study S1 found that the belief that change was not important enough was the most prominent barrier among the three assessed to avoiding sugary beverages (both among a general sample, and among those who drink sugary beverages). Would learning about the increasing number of people who avoid sugary drinks increase the perception that others believe this change is important? Would it, in turn, raise participants' interest in reducing their own consumption?

5.1. Method

5.1.1. Participants

Four hundred and eighty-six adults with a unique IP address in the United States completed a “2–3 minute Psychology Study” for 35 cents posted on Amazon's Mechanical Turk. Of these, 77 reported “never” drinking any sugary beverage (from a list including soda, juice, sweetened tea or coffee, and sports or energy drinks), leaving 409 people (238 female, 168 male, 3 non-binary) who could reduce their consumption of sugary drinks. This satisfied our goal of recruiting at least 300 consumers of sugary beverages.[3] One hundred participants per condition yields 80% power to detect an effect size similar to that found in prior research (*ds* = 0.35–0.42; Sparkman & Walton, 2017).

5.1.2. Procedure and measures

All participants were told that we were conducting research on people's consumption of sugary drinks, and were curious about their views and experiences.

To create the norm statements used in Experiment 4, we used current national polling data on the number of people in the U.S. who try to avoid sugary drinks. This indicates that 62% of Americans actively try to do so, and that this trend has been growing (Riffkin, 2015). To communicate that this social change was an intentional and successful change made by many people, the dynamic norm condition read, “More and more people are making an effort to avoid drinking sugary beverages such as soda and juice. Specifically, surveys find that many people in the US are changing what they drink. Now more than 60% of people in the US try to avoid sugary drinks.” Those in the static norm only condition read, “Most people make an effort to avoid drinking sugary beverages such as soda and juice. Specifically, surveys find that more than 60% of people in the US try to avoid sugary drinks.” In both norm conditions participants were asked, “Why do you think this is?”

[3] Given that we were unsure of what percent of participants would report drinking sugary beverages, we erred on what we anticipated would be the side of having more participants than needed to ensure we would be sufficiently powered.

and given space to respond. Those in the control condition proceeded directly to the outcome measure. No direct appeal to avoid consumption of sugary drinks was made in any condition.

Next participants were asked: "How interested are you in avoiding sugary drinks?" (*1 = not at all, 5 = very much*). They then completed the same battery of process measures used previously with regard to avoiding sugary drinks (e.g., "How important do people think it is to avoid drinking sugary drinks?"): perceived importance to others ($\alpha = 0.70$), perceived identity compatibility ($\alpha = 0.75$), and perceived ability to change (α across the four items = 0.75; correlation across the two parts, $r(406) = 0.47$, $p < .001$). See the Supplemental material.

5.2. Results

5.2.1. Process measures

5.2.1.1. Primary analysis: perceived importance to others. Contrary to our expectations, participants did not perceive that others assigned significantly greater importance to avoiding sugary drinks in the dynamic norm condition ($M = 3.74$ $SD = 0.67$) than in the control condition ($M = 3.67$ $SD = 0.69$), $t(406) = 0.78$, $p = .437$. There was also no difference between the static norm only condition ($M = 3.78$ $SD = 0.74$) and either the dynamic norm or the control condition, $ts < 1.30$, $ps > .20$.

5.2.1.2. Exploratory analyses. Participants expressed a greater belief that avoiding sugary drinks was compatible with their identity in the dynamic norm condition ($M = 3.46$ $SD = 0.88$) than in the control condition ($M = 3.24$ $SD = 0.92$), $t(406) = 2.02$, $p = .044$, $d = 0.24$, 95% CI of the difference = [0.01, 0.43]. The static norm only condition fell in between ($M = 3.34$ $SD = 0.91$) and did not differ significantly from either other condition, $ts < 1.10$, $ps > .30$. Notably, while we did not anticipate this process when we designed Experiment 4, a robust literature shows that perceived identity incompatibility can undermine efforts to change dietary choices (Guendelman, Cheryan, & Monin, 2011; Oyserman et al., 2007; Oyserman, Smith, & Elmore, 2014).

Participants also reported marginally greater ability to avoid sugary drinks in the dynamic norm condition ($M = 3.54$ $SD = 0.93$) than in the control condition ($M = 3.35$ $SD = 1.05$), $t(406) = 1.65$, $p = .099$, $d = 0.19$, 95% CI of the difference = [−0.04, 0.43]. The static norm only condition showed the same difference ($M = 3.58$ $SD = 0.94$) relative to the control condition, $t(406) = 1.94$, $p = .053$, $d = 0.23$, 95% CI of the difference = [−0.01, 0.47]. The dynamic and static norm only conditions did not differ, $t < 1.0$, $p > .70$.

5.2.2. Interest in avoiding sugary drinks

As hypothesized, participants expressed greater interest in avoiding sugary drinks in the dynamic norm condition ($M = 3.72$ $SD = 1.23$) than in the control condition ($M = 3.37$ $SD = 1.28$), $t(406) = 2.28$, $p = .023$, $d = 0.28$, 95% CI of the difference = [0.06, 0.65]. Consistent with the positive norm in this context (most people avoid sugary drinks), participants in the static norm only condition fell in between ($M = 3.58$ $SD = 1.37$) and did not differ from either of the other conditions, $ts < 1.40$, $ps > .18$.

5.2.3. Mediation

Although we predicted that the dynamic norm would increase participants' belief that others thought it important to avoid sugary drinks, only perceived identity compatibility and (marginally) perceived ability to avoid sugary drinks varied by condition. Therefore, we conducted a simultaneous mediation analysis to test which process, if either, statistically mediated the effect (Fig. 4). The results provide correlational evidence that perceived identity compatibility did, $z = 2.00$, $p < .046$, indirect effect = 0.16, 95% CI from 5000 sample bootstrap = [0.01, 0.33]. Perceived ability to avoid sugary drinks did not reach significance, $z = 1.51$, $p = .13$. A simultaneous mediation model with all three process measures produced similar results (see Supplemental material for full mediation model).

6. Experiment 1–4: which barriers when?

Experiments 1–4 show that dynamic norm information *can* lead people to infer that change is possible for oneself, is important to others, and is compatible with their identity. What determines which psychological process or processes will be most affected by dynamic norms in a given context? Many factors may render specific factors salient barriers to change in given behavioral contexts (e.g. common narratives of behavior change problems, observations of others' attempts to change, and/or first-hand experiences). In the case of smoking, for instance, there is a prevalent narrative that quitting is hard because smoking is addictive and this narrative is experienced first-hand as smokers try and fail to quit. We theorized that information about dynamic norms may challenge such narratives so as to mitigate salient psychological barriers to change most. It is as though people ask themselves, "If people have changed, what barrier that had seemed significant was not?".

As noted, this theorizing guided our predictions in Experiments 1–4. Results from Experiments 1–3 found that process measures corresponding to predicted barriers, based in part on participants' predictions (Study S1), to quitting smoking (low self-efficacy), to limiting late-night screen use (lack of perceived importance), and to men identifying as feminist (perceived identity incompatibility) were significantly improved in Experiments 1–3. Interestingly, in Experiment 4, which examined interest in reducing consumption of sugary drinks, dynamic norms impacted perceived identity compatibility, not the predicted perceived lack of importance to others. Further, in Study S1, participants anticipated that perceived importance would be a more substantial barrier than identity compatibility, yet the process measure ratings for the control group in Experiment 4 suggest the opposite. While speculative, one possibility is that self-reports of which beliefs people would expect to serve as barriers to change may not always be the same as the beliefs that come to mind when people actually consider change. It may also be that people commonly underestimate identity incompatibility as a barrier to change until they are in a context in which they are asked to change an established view or behavior (e.g. Barth, Jugert, & Fritsche, 2016).

Experiments 1–4 provide an initial way to test which processes are most responsive to dynamic norms. Specifically, we examined whether the mean level of each psychological process reported by the control group in each context—where lower numbers indicate a greater perceived barrier to change (i.e., lower self-efficacy, perceived importance, perceived identity compatibility)—predicted the size of the dynamic norm effect on that process measure. Across the 11 data points (3 process measures in 3 contexts plus 2 in the fourth), there was a strong negative correlation, $r(9) = -0.88$, $p < .001$. The greater a psychological barrier was perceived (by the control group), the more it was changed by the dynamic norm (for the scatterplot, see Fig. S4; see further analysis and discussion in Supplemental material). While consistent with our theorizing, this pattern of results could also arise from regression to the mean. If process measure strength varies randomly, the lower the process measure in the control group the greater, on average, the dynamic norm effect should be. The relationship is also correlational; spurious factors across contexts could also drive this association.

7. Experiment 5: dynamic norms affect salient barriers most

To provide a direct causal test of whether dynamic norms affect salient barriers most, Experiment 5 experimentally manipulated the salience of all three barriers within a single context. We examined the context of late-night screen use from Experiment 2, as it was the only context in which dynamic norms affected all three process measures (Fig. 2). That finding suggests that all three barriers may be plausible

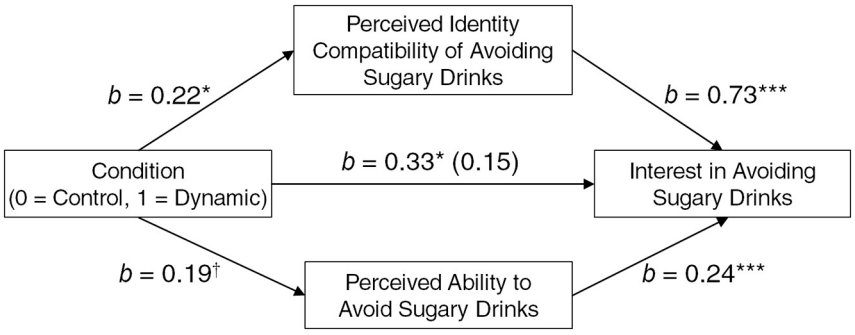

Fig. 4. Multiple mediation analysis from Experiment 4: The results provide correlational evidence consistent with the hypothesis that the effect of the dynamic norm condition on interest in avoiding sugary drinks was mediated by perceived identity compatibility with avoiding sugary drinks. Values inside the parentheses reflect the condition effect controlling for the process measures. All other values reflect the effects while controlling for the effects of all other paths present. Asterisks indicate significant paths: $^{\dagger}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

obstacles to reducing late-night screen use and have room for improvement in response to dynamic norm information.

Participants read one of four short articles regarding late night screen use. The first, control article discussed screen use activities but did not mention any reason to reduce use or barrier to doing so. The three remaining articles also discussed screen use activities. Each then went on to highlight health concerns that arise from late night screen use (poor sleep) and a different psychological barrier that makes reducing such screen use difficult: either an inability to reduce use, the common perception that avoiding late-night screen use is unimportant, or the common perception that it is incompatible with one's identity (i.e., that only specific groups, luddites, or outsiders do not look at screens at night).

Participants then either did or did not see a dynamic norm about reducing late night screen use, drawing on Experiment 2. Thus, we had a 4 (article) × 2 (control or dynamic norm) design. If dynamic norms resolve barriers that are salient most, then reading the dynamic norm information should produce its greatest effect on the psychological process measure corresponding to whichever barrier had been made salient in the article, as compared to measures corresponding to non-highlighted barriers.

Although the primary purpose of Experiment 5 was to test whether dynamic norms affect salient psychological barriers most, a secondary interest was in behavior change. In Experiments 1–4, participants received minimal information about the behaviors they were being asked to consider. Experiment 5, by contrast, provides a more information-rich environment in which to assess dynamic norm effects on interest in personal change: Participants were reminded of the many activities that can be enjoyed on electronic devices and, in some cases, learned about ill health effects and various barriers to change. Do dynamic norms affect interest in personal change even in this more complex and presumably ecologically valid context?

Given the complexity of the design in Experiment 5 (a 4 × 2 between-subjects design, with three psychological processes nested within individuals), we did not conduct meditational analyses. Experiments 1–4 already provide strong (correlational) evidence that dynamic norm information can statistically mediate effects on behavioral intentions and interest. More importantly, in Experiment 5 such analyses would depend on the strength of the association between each process measure and the behavior at hand, reducing late night screen use, which is not relevant to the primary question the study was designed to address—whether process measures related to salient barriers are most affected by dynamic norms.

7.1. Method

7.1.1. Participants

A total of 1180 adults with a unique IP address in the United States completed a "5–9 Minute Psychology Survey" for 80 cents posted on Amazon's Mechanical Turk. Given that we were unsure how strong the predicted interaction effect would be, we increased our sample size per cell from prior studies to one hundred and fifty participants recruited per condition. Statistical power is further increased by the nested nature of the design, in which each participant provides data on all three process measures, allowing us to test whether a barrier made salient for a given participant is more responsive to dynamic norm information, as compared to barriers not made salient for that participant. This design is > 80% powered to detect a small effect (partial $\eta 2 = 0.01$).

We ran Experiment 5 at a time when an increase in suspicious "bot" or "click-farm" activity had been observed on Amazon's Mechanical Turk (Dreyfuss, 2018). To address data quality concerns, we examined whether our online responses came from suspicious longitude and latitude coordinates (an indicator of bot activity, see Bai, 2018). While Experiments 1–4 did not contain suspicious coordinates, some responses in Experiment 5 did. We therefore coded participants' summary of the article they read and other free response questions for a failure to answer appropriately (e.g., leaving it blank, entering numbers, entering gibberish, or otherwise failing to answer the question, Kappa = 0.95). This method is similar to others that have been validated (see TurkPrime, 2018). Out of our total sample, 16% of participants ($N = 192$) failed to answer the free response questions appropriately and were dropped from analysis. Of these cases, 89% shared the exact same geolocation with other participants, which could be an artifact of sharing a proxy server used to get around the survey location qualifications. For the full description of coding, see the Supplemental material.

7.1.2. Procedure and measures

All participants were told that we were studying people's use of electronics and that they would read an article on the subject and then answer some questions about using electronic devices in the hour before going to bed.

The four articles used in Experiment 5 were modeled after online news or blog articles, including a title, subtitle, date, social media links, etc. Each discussed the prevalence of late-night screen use and what people do with screens. The first, control article did not mention any reason to avoid late night screen use or specific barriers to doing so (Fig. S8).

The three remaining articles each provided the same reason to avoid late night screen use, negative sleep and health outcomes, and contrasted the prevalence of screen use with a specific psychological barrier that might forestall change, thus highlighting this barrier (for full articles, see Figs. S5–S8). In the article designed to raise the salience of low self-efficacy, the title read "Can Americans Reduce Screen Use Before Bed? Americans say they can't curb late night screen use, even if they try." The article discussed how screen use has addiction-like qualities and that many Americans try to quit screen use, but often fail. The article designed to raise the salience of a lack of perceived importance was entitled, "'So What?' Do Americans Care About Screen Use Before Bed? Americans say they are not concerned about negative effects of late night screen use." It discussed how Americans were well aware of the possible risks but were unconcerned and believed that looking at devices late at night was worth it. The article designed to

raise the salience of identity compatibility was entitled, "Americans Think Screen Use Before Bed is 'Just Part of Who I Am' Despite health concerns, Americans feel that late night screen use is a normal part of life." It discussed how people were aware of the risks of late-night screen use but felt that using devices at night was normal for people like them and that only specific outgroups such as the very old or luddites avoided screens at night.

After reading one of the articles, participants were asked to briefly summarize its content to help ensure they engaged with the material. The procedure thereafter mirrored Experiment 2: Participants were randomized to a control or dynamic norm condition, using the same statements as in Experiment 2, and then completed same outcome and process measures used there.

7.2. Results

7.2.1. Process measures

As in Experiments 1–4, each participant provided ratings for three different process measures. In Experiment 5, these responses were dummy coded as either matching the barrier made salient in the article or as not matching that barrier (salient = 1, not salient = 0). For those who saw the control article, all process measure responses were coded as not salient, as that article did not raise the salience of any particular barrier. To examine whether dynamic norms improved scores on process measures more for the barrier made salient than for other barriers, we tested the interaction between dynamic-norm condition and barrier salience on the process measure ratings. As the data from the three process measure scales were clustered in the individual, we used a mixed model with a random intercept for participant and included process measure type as a fixed effect. We used the R package lme4 to implement mixed-effects models (Bates, Maechler, Bolker, & Walker, 2014). To calculate *p*-values, we used the R package lmerTest, which uses a Satterthwaite approximation test to estimate the degrees of freedom (Kuznetsova, Brockhoff, & Christensen, 2015).

7.2.1.1. Effect of articles. First, we tested the validity of the article manipulation. Did participants perceive whichever process had been made salient in the article as more significant within the no-dynamic norm condition? As predicted, there was a main effect of article condition. Whichever process that had been made salient in the article was rated as a more significant barrier to change than processes that had not been made salient, $b = -0.12$, $t(2173.1) = -2.60$, $p = .009$, 95% CI = [−0.21, −0.03].

7.2.1.2. Effect of dynamic norms. Second, we tested whether dynamic norms affected the process measures on the whole, as in Experiment 2 (Fig. 2). Here we collapsed across article conditions so as to use the full data. As predicted, there was a main effect of dynamic-norm condition. On average, participants saw the three process measures as less significant barriers to change in the dynamic norm condition than in the no-dynamic norm condition (i.e., perceiving greater self-efficacy, greater importance, and greater identity compatibility to change), $b = 0.12$, $t(986.6) = 2.83$, $p = .005$, 95% CI = [0.04, 0.20].

7.2.1.3. Primary analysis: effects of dynamic norms on salient barriers. The third and primary analysis tested whether the change in process measures caused by dynamic norms was largest for whichever barrier had been made salient. As predicted, there was a significant interaction between dynamic norms and barrier salience, $b = 0.18$, $t(2168.1) = 2.88$, $p = .004$, 95% CI = [0.06, 0.31]. See Fig. 5. The dynamic norm significantly altered perceptions of the belief that had been made salient, as compared to the no-dynamic norm condition, $b = 0.26$, $t(2753.0) = 4.03$, $p < .0001$, 95% CI = [0.13, 0.38]. Beliefs that had not been made salient showed only a non-significant trend as a consequence of the dynamic norm, $b = 0.07$, $t(1255.0) = 1.64$, $p > .10$, 95% CI = [−0.01, 0.16].

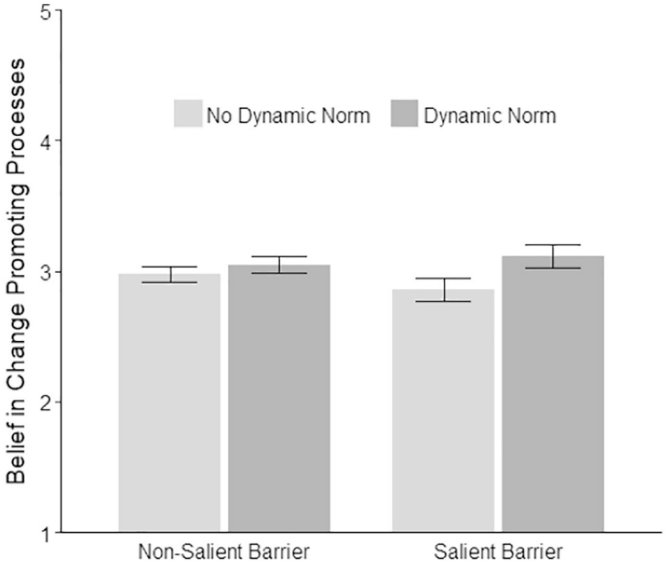

Fig. 5. Interaction between dynamic-norm condition and barrier salience on process measure ratings in Experiment 5: The effect of the dynamic norms on participants' self-efficacy, perceived importance, and perceived identity compatibility to reduce late-night screen use was greater for whichever barrier had been made salient. The y-axis depicts the full range of the process measure scales. Error bars represent 95% confidence intervals.

Although the analysis reported above provides the most complete portrait of the data, it is also possible to test our hypothesis using subsets of the data. We can compare dynamic-norm effects for participants who saw an article that emphasized a barrier (i.e., removing participants who saw the control article) or compare dynamic-norm effects against only those who saw the control article (i.e., removing participants in the no-dynamic norm group who saw any of the barrier articles). These analyses produce similar effects (see Supplemental material).

7.2.2. Behavioral Interest

Finally, we examined whether dynamic norms increased participants' interest in reducing late night screen use in this more information rich context. Collapsing across articles, we found that participants were more interested in doing so in the dynamic norm condition ($M = 3.15$ $SD = 1.24$) than in the control condition ($M = 2.97$ $SD = 1.29$), $t(986) = 2.24$, $p = .025$, $d = 0.14$, 95% CI of the difference = [0.02, 0.34]. Notably, this effect is smaller than the effects observed in prior experiments, suggesting that the effects of dynamic norms may be diluted when presented alongside other relevant information.

8. General discussion

The present research found that dynamic norms can help resolve diverse psychological barriers to personal behavior change across a variety of contexts. Dynamic norms improved reports on three of the best-established mediators of behavior change, leading people to perceive in specific behavioral contexts that personal change was more possible, regarded as more important by others, and more compatible with their identity (Experiments 1–4). Moreover, correlational analyses across Experiments 1–4 and a direct experimental test in Experiment 5 show that it is the most salient barriers to change in a context that are remedied most by dynamic norms. Further, in each context dynamic norms increased intentions or interest to change as compared to no-norm control conditions (Table 2).

The finding that dynamic norms can instigate diverse, powerful mechanisms of behavior change, sometimes simultaneously, in a variety of contexts, and especially affect processes that loom largest as

Table 2
Effect sizes, Experiments 1–4, comparing dynamic norm, static norm, and control, conditions.

Experiment	Outcome	Dynamic vs. control	Static vs. control	Dynamic vs. static
Process measures				
Expt. 1 (quitting smoking)	Perceived ability (hyp.)	0.32* (med.)	0.16	0.17
	Importance to others	−0.06	−0.15	0.10
	Identity compatibility	0.16	−0.04	0.20
Expt. 2 (avoiding screen use)	Perceived ability	0.29*	0.15	0.15
	Importance to others (hyp.)	0.36* (med.)	0.14	0.21
	Identity compatibility	0.48* (med.)	0.26†	0.21
Expt. 3 (men identifying as feminist)	Perceived ability	NA	NA	NA
	Importance to others	0.32*	0.15	0.19
	Identity compatibility (hyp.)	0.83*** (med.)	0.40**	0.43**
Expt. 4 (avoiding sugary beverages)	Perceived ability	0.19†	0.23†	−0.04
	Importance to others (hyp.)	0.10	0.15	−0.06
	Identity compatibility	0.24* (med.)	0.12	0.13
Behavioral intentions/interest				
Expt. 1	Quitting smoking	0.42**	0.28*	0.15
Expt. 2	Avoiding screen use	0.35*	0.03	0.33*
Expt. 3	Men identifying as feminist	0.54***	0.25†	0.29*
Expt. 4	Avoiding sugary beverages	0.28*	0.16	0.11

Note. All effect sizes are Cohen's *d*s. Process measures labeled with "hyp." denote the processes hypothesized to be affected by dynamic norms and to mediate effects on behavioral intentions or interest. Other analyses are exploratory. When process measure effect sizes are labeled with "med.", analyses provide consistent albeit correlational evidence for mediation of the dynamic vs. control effect on behavioral interest or intentions by that process measure. Reflecting national polling and pilot research, the static norms used in Experiment 1 and 4 were positive (i.e., they pertained to a majority of people, 81% and 60%, respectively), while those used in Experiment 2 and 3 were negative (they pertained to a minority of people, 20% and 35%, respectively).

† < .10.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

barriers to change carries important implications. It suggests that dynamic norms may be a particularly robust way to promote personal change. In Experiment 4, for instance, even as the process we anticipated would forestall increased personal interest in reducing consumption of sugary drinks—a lack of perceived importance—turned out to be less relevant, dynamic norms remedied a different process—perceived identity compatibility—and this mediated greater personal interest in change. In applying dynamic norms to change behavior, it may not be necessary to identify the specific barriers to change in a given context, as multiple barriers may seem more surmountable when others change. Certainly, there will be limits to the barriers to personal change that dynamic norms can resolve, as we discuss below. An important direction for future research is to understand the full scope and bounds of dynamic norm effects.

Comparative analysis with static norms was instructive. Whereas dynamic norms consistently led to specific inferences instrumental to personal change in Experiments 1–4 (and in abstract reasoning, see Experiment S2 in Supplemental material), static norms alone rarely did so. Examining interest and intentions to change, we found, consistent with prior research, evidence of conformity effects but only when the static norm was positive (Fig. 6). Meta-analyzing across Experiments 1 and 4 where many people did the behavior in question, the static norm condition was associated with significantly greater intentions and interest to change than the control condition ($d = 0.21$, 95% CI = [0.03, 0.39]). However, this comparison and nonsignificant in Experiments 2 and 3, where the static norm was negative ($d = 0.14$, 95% CI = [−0.06, 0.34]). By contrast, the dynamic norm was effective relative to the control condition regardless of the level of the static norm (see Sparkman & Walton, 2017); if anything the effect was larger when the static norm was negative ($d = 0.44$, 95% CI = [0.24, 0.65]) than when it was positive ($d = 0.34$, 95% CI = [0.16, 0.52]). Directly comparing dynamic and static norm conditions, the dynamic norm was always directionally greater than the static norm. It was significantly so when the static norm was negative ($d = 0.31$, 95% CI = [0.11, 0.51]), and trending so when the static norm was positive ($d = 0.13$, 95% CI = [−0.05, 0.31]). Overall, these results illustrate the potential of dynamic norms to help resolve diverse psychological barriers to change, their robustness to varying levels of the static norm, and further show that the effects of dynamic norms do not stem from the perception of the static norm, which was held constant across the two norm conditions.

9. Limitations and future directions

9.1. Causal change in behavior and recursive processes

For our primary goal, to identify diverse psychological processes dynamic norms can affect across behavioral contexts, it was helpful to assess impacts on multiple potential process measures and their statistical contribution to interest and intentions to change. Indeed, past research shows that causal relationships are likely to flow from perceptions of self-efficacy, injunctive norms, and identity compatibility to behavior change (Ajzen, 1985; Bandura, 1977; Oyserman, 2015; Reno et al., 1993). However, this approach does not rule out the possibility of reverse causality. The psychological processes could also follow from the expressed interest or intention to change. Notably, reverse causality itself is an interesting area of study in this context. An exciting possibility for future research is that, in initiating causal relationships that work in both directions, dynamic norms could create mutually reinforcing cycles of belief and behavior change that help make change endure (see Kenthirarajah & Walton, 2015; Walton & Wilson, 2018).

9.2. Psychological processes in dynamic norms

While the present research examined three well-established psychological processes through which dynamic norms may encourage change, other processes may also be important. For instance, in some contexts, change may seem to be an admission of fault or to indicate the immorality or wrongheadedness of a prior or ongoing behavior. If so, change may be hampered by the desire to maintain a positive view of the self (Sherman & Cohen, 2002; Sherman & Cohen, 2006). Drawing attention to change in others may encourage individuals to consider

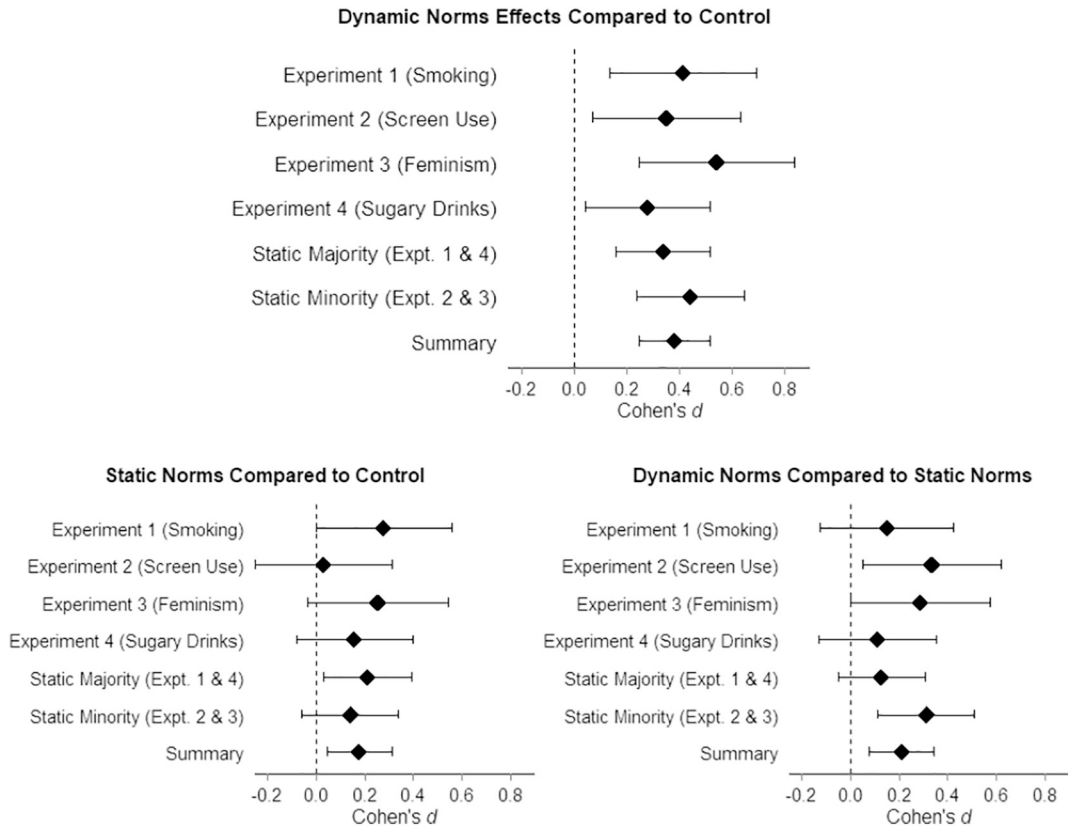

Fig. 6. Effect of dynamic and static norm conditions on behavioral interest and intentions across Experiments 1–4 and meta-analyzing across studies. Bars represent 95% confidence intervals.

broader reasons for a present behavior (e.g., negative current societal norms, poor information), facilitating a representation of change as not an admission of fault but a sign of personal and collective progress. In other contexts, people may not act because they question whether others will also take the steps necessary to achieve collective goals. In social or commons dilemmas, such as reducing carbon emissions to curb climate change, dynamic norms could portray others as increasingly willing to contribute to a collective goal, and thereby signal greater collective efficacy, motivating personal behavior change (see also Howe, Carr, & Walton, 2018).

While we investigated the role of salience in shaping which psychological processes dynamic norms affect, the specific way in which dynamic norm information is conveyed may also play a role. For example, suppose we had emphasized in Experiment 4 others' *success* in reducing their soda consumption. Would participants then have inferred that it was easier to do so? How would this have affected the mediating process and interest in personal reductions? Further research is needed to understand how variation in the presentation and types of change implied in dynamic norm statements affect the inferences people draw.

It is also an open question whether change undergone by a very small number of people can instigate the processes examined here. Research on role models suggests that detailed information about the growth of a specific person in a similar circumstance can be inspiring (Lockwood & Kunda, 1997). However, witnessing a change in society at large is quite a different experience. Future research is needed to compare and contrast these effects.

9.3. Boundary conditions

Another important question involves identifying circumstances in which dynamic norms will not be effective. One such circumstance is when critical barriers to personal change are not psychological (even if such barriers are salient). For instance, dynamic norms are unlikely to reduce driving for commuters who lack other options, at least in the short term. Here the key barrier is structural. We do not expect dynamic norms to enable change or challenge salient barriers when people are not afforded real opportunities to change.

The present research depicted change that resulted from the intentional and successful efforts of others. Other sorts of collective change, such as changes due to cohort or population shifts or to external or structural factors such as when a practice is banned, may or may not instigate processes that remedy personal barriers to change. In these cases, change in other people's behavior may not appear deliberate or reflect importance; in some cases, change may even be expected to soon slow or reverse (i.e., a passing fad). In fact, the rapid adaptation of some behaviors can be seen as a sign that the trend will soon pass (Berger & Le Mens, 2009).

9.4. Real-world behavior change

Although behavioral outcomes were not the focus of the present research, as it has been in past research (Mortensen et al., 2017; Sparkman & Walton, 2017), it is important to examine the link between the mechanisms shown here and behavior, ideally in field settings over time so as to examine recursive processes. The present studies establish a foundation for that work.

Although an obvious approach to field research is to incorporate dynamic norm statements into explicit appeals to change behavior, incorporating dynamic norm information in persuasive appeals is nontrivial. Although this integration can be effective (e.g., to encourage water conservation, Sparkman & Walton, 2017 Experiment 5), explicit normative appeals can also elicit reactance that undermines their effectiveness (Howe et al., 2018; Jung, Shim, & Mantaro, 2010). Notably,

none of the present studies directly asked people to change their behavior; nonetheless, people exhibited a greater openness to change when their attention was drawn to information about change in others. How to embed dynamic norm information in explicit appeals to change behavior, and how this depends on the context, is an important question for research.

9.5. Participant populations

The present research used national samples from Amazon's Mechanical Turk, an appropriate population given our focus on problems that afflict broad US populations. While more representative than traditional college student populations, this population still overrepresents younger, more liberal people (Berinsky, Huber, & Lenz, 2012). An important direction for future research involves including more representative samples to provide a more nuanced understanding of how dynamic effects differ across various populations, especially in specific behavioral contexts.

An intriguing question involves how dynamic norm effects play out in interdependent as compared to independent cultural contexts. On the one hand, dynamic norms may be more influential in interdependent contexts where conformity carries a more positive connotation and static social norms are especially strong predictors of behavior (Eom, Kim, Sherman, & Ishii, 2016; Kim & Markus, 1999). Indeed, in contexts where static norms are typically powerful, dynamic norms could signal that the group as a whole is shifting, and may play a key role in licensing personal change. However, if change is seen as deviance from highly valued norms, dynamic norms may be less influential in interdependent contexts. This may be especially true in contexts with greater cultural "tightness," where norms are more controlling (cf. Gelfand et al., 2011; Triandis, 1989). Cultural variation in the emphasis on individual agency may also affect the inferences people draw from representations of change. In independent cultures, where the actions of others are often assumed to be intentional and reflect personal choice (Savani, Markus, Naidu, Kumar, & Berlia, 2010), dynamic norms could be more impactful as change is readily understood as intentional and reflecting of the importance of an act to others. If people in interdependent cultures are less apt to see change as reflecting a personal choice, focusing more on contextual factors, they may be less likely to infer that others consider the behavior important. For instance, in an independent cultural context people may assume that an increase in the number of people using reusable bags in grocery stores reflects their independent decisions and belief that doing so is important. In interdependent cultures, people may more readily infer that this behavior reflects changing laws or industry promotions. Alternatively, given that people in interdependent cultures often perceive groups as possessing agency (Menon, Morris, Chiu, & Hong, 1999), dynamic norms may indicate a collective decision, in which case they may be just as influential or even more so than in independent cultures. More generally, across cultures and behavioral contexts, existing narratives will guide the inferences people draw from representations of change. In addition to understanding this variability so as to predict the effectiveness of dynamic norms, this intersection opens new theoretical questions including those related to cultural narratives about change and cultural variability in psychological experience.

10. Conclusion

Across multiple contexts, witnessing others change can lead people to reconsider a variety of barriers they might presume stand in the way of their own change—to see change as more possible, as sufficiently important, and as compatible with their identity. Dynamic norms can thus highlight a possible path of change for oneself clear of obstacles. These findings also suggest that dynamic norms may contribute to change as it propagates through society. In many cases broad social change may seem impossible, unimportant to others, or strange for oneself. But social movements and change carried out en masse may provide a representation of change that facilitates personal change, an outcome that reinforces its cause, helping create a self-reinforcing cycle that transforms initial perceptions of change into a broader reality.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jesp.2019.01.007.

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