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## Can graphic warning labels reduce the consumption of meat?

Jan Andre Koch<sup>a</sup>, Jan Willem Bolderdijk<sup>b,\*</sup>, Koert van Ittersum<sup>c</sup>

<sup>a</sup> Doctoral Candidate at the Marketing Department, University of Groningen, Nettelbosje 2, 9747AE, Groningen, the Netherlands

<sup>b</sup> Associate Professor of Marketing, University of Groningen, Nettelbosje 2, 9747AE, Groningen, the Netherlands

<sup>c</sup> Professor of Marketing and Consumer Well-Being, University of Groningen, Nettelbosje 2, 9747AE, Groningen, the Netherlands

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### ABSTRACT

The classification of red meat as “probably carcinogenic” and processed meat as “carcinogenic” was followed by pleas to place warning labels, akin to those used for tobacco products, onto meat products. These labels educate people about the health risks associated with the target behavior and are typically accompanied by graphic imagery that elicits disgust (e.g., a picture of blackened lungs). Although the emotion of disgust has been shown to be an effective tool to affect consumer attitudes toward meat, it remains unclear whether such graphic warning labels that recruit disgust would also affect people’s intentions to reduce their meat consumption. Two experiments reveal that graphic warning labels, by recruiting disgust, can increase people’s intention to reduce their current levels of meat consumption. However, by eliciting disgust, graphic warning labels can simultaneously trigger reactance: graphic images can make people feel they are being manipulated, thereby ironically decreasing meat-reduction intentions. In a final experiment, we aimed to circumvent reactance by providing disgusting information under the guise of trivia, thereby avoiding the perception that the disgusting information was meant to manipulate. Via this route, disgust becomes a potent tool to influence consumers’ intentions to consume meat. Ethical concerns are discussed.

### 1. Introduction

Globally, meat consumption is on the rise and unlikely to reduce anytime soon without intervention (Cole & McCoskey, 2013). Consuming meat is not only deeply entrenched in several cultures (Leroy & Praet, 2015) and perceived as a sign of masculinity (Ruby & Heine, 2011), eating meat is likewise believed to be “natural, normal, necessary, and nice” (Piazza et al., 2015). Meat, however, is also classified as a “carcinogen” (World Health Organization, 2015), which means that, similar to tobacco smoke and asbestos, the consumption of (particularly processed) meat is associated with the development of cancer. Immediately following this classification, the introduction of warning labels akin to those displayed on tobacco products has been advocated by academics (Hadi, 2016) and consumer advocacy groups (Center for Science in the Public Interest, 2016).

Warning labels, like those displayed on tobacco products, not only educate consumers about the detrimental consequences of engaging in certain behaviors, but typically also include graphic images illustrating these consequences, which elicit negative emotions such as fear and disgust (Hammond, 2011). For instance, the warning labels found on

tobacco products not only state in words that smoking kills but actually illustrate it, by displaying graphic images of cancerous ulcers, mutilated bodies, and corpses (Canadian Cancer Society, 2018). Disgust works akin to a “behavioral immune system” (Schaller, 2006, p. 96) seeking to protect the body from potential harm, referring to death and disease is thus a potent way to elicit disgust (Haidt, McCauley, & Rozin, 1994) and avoidance (Shook, Thomas, & Ford, 2019). As disgust reliably elicits the singular reaction of avoidance (Morales, Wu, & Fitzsimons, 2012), disgust can increase the persuasiveness of cessation interventions.

Graphic warning labels for meat products have been called for, yet their effect on consumer intentions to reduce their meat consumption has not been tested. Considering some of the critical differences between the consumption of tobacco versus meat, the findings from tobacco warning labels may not be generalizable to the meat domain. For instance, not only are consumers generally less aware of meat being a risk factor for cancer compared to tobacco (Ryan et al., 2015), even if consumers are aware, the specific guidelines regarding how much meat to consume may still be unknown (Lynes et al., 2016). Accordingly, we seek to test whether the use of graphic warning labels, by eliciting disgust, also decreases consumers’ interest in meat consumption.

\* Corresponding author.

E-mail addresses: [j.a.koch@rug.nl](mailto:j.a.koch@rug.nl) (J.A. Koch), [j.w.bolderdijk@rug.nl](mailto:j.w.bolderdijk@rug.nl) (J.W. Bolderdijk), [k.van.ittersum@rug.nl](mailto:k.van.ittersum@rug.nl) (K. van Ittersum).

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## 2. Theoretical background

### 2.1. Graphic warning labels: conscious and subconscious influences

Warning labels typically communicate the detrimental consequences of the to-be-ceased behavior with text. We define *graphic* warning labels as labels that add disgust-eliciting imagery to text-based warnings. As such, graphic warning labels follow two strategies: they educate consumers and they elicit negative emotions—disgust.

The text-based warning feature of graphic warning labels educates consumers. As seen in the warning labels applied to tobacco products in 118 countries worldwide (Canadian Cancer Society, 2018), warning labels educate by creating awareness about the potentially detrimental consequences of smoking both to smokers and non-smokers (Hammond, 2011). For instance, not all consumers may a priori know about the links between consuming tobacco products and tooth decay or impotence. Warning labels explain these consequences and thus enable consumers to make an educated, conscious decision about whether to start or continue the to-be-ceased behavior.

The graphic images typically accompanying the text-based warnings often vividly display the potential consequences of engaging in the target behavior. For example, graphic warning labels on tobacco products show blackened lungs, deceased smokers, or cancerous ulcers (Canadian Cancer Society, 2018). Warning labels typically elicit disgust by using graphic imagery showing death and disease (Hammond, Fong, McDonald, Brown, & Cameron, 2004; Kemp, Niederdeppe, & Byrne, 2019)—two prominent disgust elicitors (Haidt et al., 1994). By eliciting disgust, graphic warning labels create a subconscious motivation to avoid the target behavior.

Disgust is a powerful emotion that consistently motivates the avoidance of its elicitors (Rozin, Haidt, & McCauley, 1999). This unconscious motivation to avoid that disgust elicits is difficult to override or change as it primarily seeks to protect against invisible threats (Tybur, Lieberman, & Griskevicius, 2009). This tenacity of disgust makes sense: a false negative, where a contaminant is falsely accepted (e.g., a rotten fruit), may be much more costly than a false positive where something is falsely rejected for being contaminating, when it is not (e.g., a fruit that looks rotten but is not). Disgust has thus been argued to have an oversensitive hair-trigger (Kelly, 2011), working akin to a smoke detector that indiscriminately warns against the presence of smoke irrespective of whether or not it stems from an actual threatening fire (Randler et al., 2017).

### 2.2. Disgust and the cessation of behaviors

Given the potency of disgust to influence behavior, researchers and policymakers have examined whether disgust can also be recruited in behavior change interventions. Academic support for the use of disgust in cessation interventions is offered by Morales et al. (2012) who found that across contexts and for both pictorial and textual messages, those that elicit both disgust and fear are more persuasive and more likely to be complied with than messages solely eliciting fear. For instance, a text vividly describing the consequences of not applying sunscreen (“Wart-like growths that ooze and bleed”) was found to be more persuasive than a more sober description (“An increased chance of developing fatal skin cancer”). Unlike fear, Morales et al. (2012) propose, disgust elicits a singular behavioral response—avoidance—and thus more reliably makes people follow the appeal.<sup>1</sup>

Utilizing disgust via graphic warning labels has accordingly been found to reduce behaviors such as smoking (Azagba & Sharaf, 2013), but also to increase hand hygiene practices (Porzig-Drummond, Stevenson,

<sup>1</sup> Important to note may be that while fear can be elicited without eliciting disgust, disgust often coincides with the fear of something disgusting happening (Lupton, 2015).

Case, & Oaten, 2009). Within the meat domain, the effect of graphic warning labels, akin to those currently used on tobacco products, has not yet been researched. There is, however, reason to believe that graphic warning labels might be effective to change behavior in this domain as well. Palomo-Vélez, Tybur, & Van Vugt (2018) have shown disgust to negatively affect consumers’ anticipated enjoyment and likelihood of consuming meat. However, these findings were based on participants who—under the pretense of a recall task—were exposed to elaborate, full-page opinion pieces framing meat production to be disgusting (e.g., “it is downright disgusting”). The information provided was thus not only containing a value judgment rather than offering facts, while reading it, participants were also likely unaware that this information was meant to persuade them: it was not positioned as an explicit attempt to reduce readers’ meat consumption.

While this research shows that recruiting disgust can influence consumers’ attitudes towards meat, it is as of yet still unclear whether graphic warning labels on actual meat products—a simple and realizable intervention currently being discussed by policymakers—would also affect meat reduction intentions. One crucial difference, for instance, is that when graphic warning labels are placed on the packaging of meat products, meat-eaters may feel coerced: they realize they are encouraged to change their behavior. As such, this paper is, to our knowledge, the first to test the ecological validity of utilizing graphic warning labels to reduce meat consumption. With this paper we thus seek to answer the question of whether graphic warning labels on meat products, via recruiting disgust, will reduce the consumption of meat.

## 3. The current research

In this research, we test whether graphic warning labels, by recruiting disgust, could reduce people’s intention to consume meat. In Study 1, we tested whether a graphic (vs. non-graphic) warning label regarding the consumption of processed meat would lead to more disgust and consequently reduce participants’ intention to consume meat. In short, we tested for mediation. Although the graphic warning label elicited more disgust than the non-graphic one, and disgust reduced people’s intentions to consume meat, Study 1 did not find the graphic warning label to increase consumers’ intention to reduce their meat consumption more than the non-graphic one. The results of Study 1 suggest that a third, unmeasured variable suppresses the direct effect of the graphic warning label on the intention to consume meat. Accordingly, in Study 2 we tested for a suppressor of the effect of disgust. Specifically, we hypothesized—and confirmed—that the graphic warning label not only elicited more disgust but also elicited more resistance toward the message than the non-graphic one. While disgust thus increased participants’ intention to reduce their consumption of meat, reactance reduced this intention. In sum, these two effects canceled each other out. Finally, in Study 3 we sought to remove reactance from the equation and thereby isolate the effect of disgust-eliciting imagery (accompanied by text) on participants’ behavioral intention to reduce the consumption of meat. This, we argue, would demonstrate what graphic warning labels could do if implemented on consumer products. To do so, in Study 3, we elicited disgust using a trivial fact about the production of meat. Presenting a disgusting fact under the guise of trivia, we argue, would, in contrast to the explicit warnings used in Study 1 and 2 not be perceived as a direct request to limit one’s meat consumption and therefore not elicit reactance.

## 4. Study 1: testing the effect of graphic warning labels on intentions

We sought to test whether a graphic warning label, compared to a non-graphic warning label, elicits more disgust, which in turn would increase participants’ intention to reduce their meat consumption. Thus, in a between-subjects design, we exposed a sample of participants pre-screened to be meat-eaters to the image of an unopened package of

minced meat. The package of meat was accompanied by either a graphic or non-graphic warning label about the causal role of the consumption of processed meat in the development of colorectal cancer. We expected that the graphic label, by recruiting disgust, would elicit relatively higher meat-reduction intentions.

#### 4.1. Method

**Participants.** A sample of 541 participants were invited to take part in a study on warning labels via Prolific Academic. Although participants were pre-screened to consume meat, 10 participants indicated that they did not consume meat, the final sample used for the analysis was thus 531 participants ( $M_{\text{Age}} = 35.02$ ,  $SD = 13.01$ , 62.5% female, 35.8% male, 1.7% other). Sensitivity power analysis (power = 80%,  $\alpha = 0.05$ ) indicated Cohen's  $d = 0.24$  as the minimal detectable effect size for this sample ( $N = 531$ ) to test the effect of a graphic warning label on the intention to reduce meat consumption using an independent-samples  $t$ -test.<sup>2</sup>

**Design and Procedure.** After a brief welcome, participants were introduced to the fact that in 2015 the World Health Organization classified red meat as “probably carcinogenic to humans” and processed meat as “carcinogenic to humans.” Further, participants were informed that this implies that the consumption of meat, similar to smoking, may cause cancer, and that because of this connection, policymakers were discussing the implementation of warning labels akin to those found on tobacco products (full material of Study 1 available upon request). The carcinogenic effect of meat was chosen as the stimulus for this study because it is the specific reason why graphic warning labels have been called for (e.g., Hadi, 2016) and because bodily symptoms related to death (e.g., cancerous ulcers) are a powerful trigger of disgust (e.g., Haidt et al., 1994). Next, participants were shown a package of minced meat on which either a graphic warning label showing the inside of a cancerous colon ( $N = 267$ ) or a non-graphic warning label showing the hands of a woman resting on her stomach was displayed ( $N = 264$ ). Both warning labels were created for the purpose of the study, positioned in the bottom left corner of the package of minced meat, of the same size, and red the same text in uppercase “Processed Meat Causes Rectal Cancer.”

**Dependent Measure.** In order to obscure the study's purpose, the two items measuring our dependent variable—participants' intention to reduce their consumption of meat—were asked alongside of the Meat Attachment Questionnaire, which measures participants' attachment to the consumption of meat on a 7-point Likert scale (1 = “Strongly disagree”; 7 = “Strongly agree”) (MAQ; Graça, Calheiros, & Oliveira, 2015). One question (“I am willing to reduce my meat consumption”;  $M = 5.02$ ,  $SD = 1.76$ ) was positioned at the top of the MAQ, while the other question (“I would not cut back on my meat consumption”; reverse scaled:  $M = 5.06$ ,  $SD = 1.74$ ) was randomly positioned among the other MAQ items. The average of the two items formed our key dependent variable—participants' intention to reduce their meat consumption (Cronbach's  $\alpha = 0.83$ ;  $M = 5.04$ ,  $SD = 1.62$ ).

To test the extent to which the graphic warning label elicited disgust, participants were then asked to what extent they experienced the emotions listed in the Discrete Emotions Questionnaire (Harmon-Jones, Bastian, & Harmon-Jones, 2016) when seeing their respective warning label; four items of this measured disgust, namely “Grossed out” ( $M = 4.14$ ,  $SD = 2.15$ ), “Nausea” ( $M = 2.93$ ,  $SD = 1.95$ ), “Sickened” ( $M = 3.64$ ,  $SD = 2.07$ ), and “Revulsion” ( $M = 3.79$ ,  $SD = 2.16$ ). All four items reliably measured the same underlying construct (Cronbach's  $\alpha = 0.92$ ), accordingly the mean of the four items was calculated to create the variable “disgust” ( $M = 3.63$ ,  $SD = 1.87$ ). We intentionally administered the Discrete Emotions Questionnaire after the Meat Attachment

Questionnaire, to avoid priming participants and thus artificially inflating the role of disgust in shaping participants' meat reduction intentions. Lastly, participants' demographics were measured alongside a question regarding their “dietary group membership” taken from Rosenfeld, Rothgerber, & Tomiyama (2020).

#### 4.2. Results

We tested for mediation: whether graphic warning labels, by recruiting disgust, reduced participants' intention to consume meat. Using Hayes' PROCESS macro (2013) model 4 with 10,000 bootstrapped samples at a 95% confidence interval, we tested for this indirect effect. As expected, the graphic warning elicited more disgust ( $M_{\text{Graphic}} = 4.73$ ,  $SD_{\text{Graphic}} = 1.59$ ) than the non-graphic warning label ( $M_{\text{Non-graphic}} = 2.51$ ,  $SD_{\text{Non-graphic}} = 1.41$ ;  $t(1, 522.778) = 17.067$ ;  $M_{\text{Difference}} = 2.22$ , Cohen's  $d = 1.48$ ,  $p < .001$ , 95% CI [1.97, 2.48]). Participants who reported feeling more disgust, in turn, had a higher intention to reduce their meat consumption ( $b = 0.21$ , 95% CI [0.12, 0.30]). The indirect effect of the graphic vs. non-graphic warning label via disgust on intentions was positive and significant ( $b = 0.46$ , 95% CI [0.25, 0.68]). In other words, in line with our expectations, we find that graphic warning labels, via recruiting disgust, increase participants' meat-reduction intentions. However, contrary to our expectations, the total effect of the graphic warning label on the intention to reduce the meat consumption is insignificant ( $b = -0.05$ , 95% CI [-0.33, 0.23]): despite the fact that the graphic warning label elicited more disgust, participants in the graphic warning label condition did not report higher meat-reduction intentions ( $M_{\text{Graphic}} = 5.01$ ,  $SD_{\text{Graphic}} = 1.63$ ) than those who had seen the non-graphic warning label ( $M_{\text{Non-graphic}} = 5.06$ ,  $SD_{\text{Non-graphic}} = 1.61$ ;  $t(1, 529) = -0.365$ ;  $M_{\text{Difference}} = -0.05$ , Cohen's  $d = 0.03$ ,  $p = .715$ , 95% CI [-0.33, 0.23]).<sup>3</sup>

#### 4.3. Discussion

Relative to the non-graphic warning label, the graphic warning label elicited more disgust which, in turn, increased the intention to reduce the target behavior. However, compared to the non-graphic warning label, the graphic warning label itself was found to have no effect on participants' intention to reduce their meat consumption, contrary to our initial hypothesis. In other words, we find an indirect effect in absence of a total effect (see Fig. 1). This data pattern suggests there may be an alternative process taking place in parallel that suppresses the effect of disgust on the intention to reduce participants' meat consumption (MacKinnon, Krull, & Lockwood, 2000).

A viable and widely accepted process that may have eliminated the total effect of disgust on intention is reactance (e.g., Brehm, 1966). When people perceive their behavioral freedom to be threatened, reactance—a state of negative arousal—may motivate people to reinstate these freedoms by acting in the exact opposite way (Brehm, 1966). For instance, health labels seeking to persuade consumers to make more healthy choices may be perceived as a threat to one's freedom of choice. As a result, consumers may ironically increase the unhealthy behavior (Hall et al., 2016). Note that reactance is typically considered a two-step process, where a freedom threat is first recognized and subsequently anger and other negative cognitions are elicited, which may motivate people to act in the opposite way (e.g., Quick & Considine, 2008). For instance, health labels seeking to persuade consumers may be perceived as a threat to one's freedom of choice, accordingly, consumers may try to give counterarguments against the labels which ultimately may lead to an increase in the target behavior (Hall et al., 2016). The level of reactance people may display is further dependent on the importance of the targeted behavior and the perceived level of threat; more important

<sup>2</sup> This and all other studies discussed in the manuscript obtained ethical approval by the ethics committee of the University of Groningen.

<sup>3</sup> The results above do not differ significantly when including participants' diet or gender as a covariate.

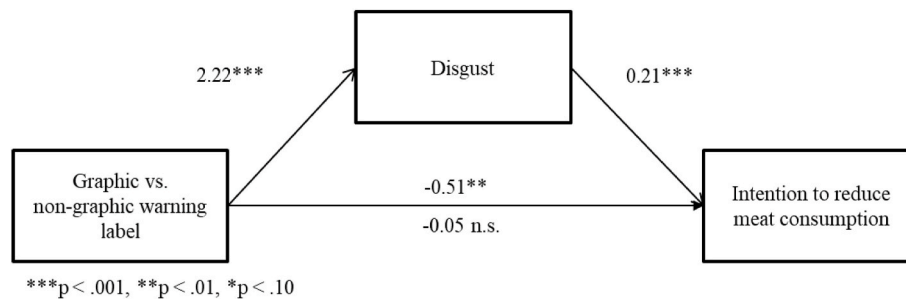


Fig. 1. Unstandardized regression coefficients for the relationship between the type of warning label and the intention to reduce the consumption of meat with the mediator disgust.

behaviors being targeted and larger threats elicit more reactance (Steindl, Jonas, Sittenthaler, Traut-Mattausch, & Greenberg, 2015). As eating meat is considered to be “natural, normal, necessary, and nice” (Piazza et al., 2015), interfering with the consumption of meat could have elicited reactance in the participants of this study. Further, compared to text-only warnings, pictorial warnings have been found to elicit greater reactance (Noar et al., 2016), arguably because they are perceived as a larger infringement on one’s freedom (Hall et al., 2016). Accordingly, graphic warning labels—eliciting stronger negative emotions—may be perceived as a more aggressive infringement than non-graphic warning labels and thus also elicit larger levels of reactance, thereby undermining the effect of disgust and explaining the absence of a total effect. We test for this in Study 2.

## 5. Study 2: testing for reactance

In Study 2 we employed the same set-up as in Study 1 but additionally included a measure of reactance (Hall, Noar, Ribisl, Boynton, & Brewer, 2017). We measured whether the graphic warning label, relative to the non-graphic warning label, made people feel manipulated and thus motivated them to reinstall their freedom. In a between-subjects design, like Study 1, we used the same image of an unopened package of minced meat accompanied by either a graphic or a non-graphic warning label highlighting the causal role of the consumption of processed meat in the development of colorectal cancer. Participants were again pre-screened for their consumption of meat. We hypothesized that the graphic warning label not only elicits more disgust but also more reactance as participants perceive the graphic warning label, which blatantly manipulates their emotions, as a larger freedom threat than the non-graphic warning label. In other words, we expected that the graphic warning label elicits these two effects that cancel each other out, consequently we tested for parallel mediation.

### 5.1. Method

**Participants.** A distinct sample of 480 participants was collected via Prolific Academic, despite indicating to eat meat in the pre-screen, eight participants specified not to consume meat in the study. As such, a sample of 472 participants ( $M_{Age} = 36.30$ ,  $SD = 13.09$ , 57.2% female, 40.9% male, 1.9% other) was used in the analysis. Sensitivity power analysis (power = 80%,  $\alpha = 0.05$ ) indicated Cohen’s  $d = 0.26$  as the minimal detectable effect size for this sample ( $N = 472$ ) to test for the effect of the graphic warning label on the intention to reduce the meat consumption using an independent-samples  $t$ -test.

**Design and Procedure.** Participants followed the exact same procedure as in Study 1 but additionally answered the Brief Reactance to Health Warnings Scale (Hall et al., 2017) with regard to the specific warning label they saw; the graphic warning label ( $N = 237$ ) or the non-graphic warning label ( $N = 235$ ) (full material of Study 2 available upon request).

**Dependent Measure.** Participants answered the MAQ (Graça et al.,

2015) and the same two items measuring the intention to reduce the meat consumption as in Study 1 on a 7-point Likert scale ranging from 1 (“Strongly disagree”) to 7 (“Strongly agree”). The two items measuring the intention to reduce the meat consumption measured the same underlying concept (Cronbach’s  $\alpha = 0.87$ ) and thus the mean of both items was taken to, again, create the variable “intention to reduce meat consumption” ( $M = 5.01$ ,  $SD = 1.72$ )—our dependent variable. To test for reactance, participants were presented with their respective warning label again and scored their answers to the Brief RHWS (Hall et al., 2017) consisting of the following three items: “This warning is trying to manipulate me” ( $M = 3.66$ ,  $SD = 1.26$ ), “The health effect on this warning is overblown” ( $M = 3.42$ ,  $SD = 1.23$ ), “This warning annoys me” ( $M = 3.22$ ,  $SD = 1.35$ ). The three items measured the same underlying concept reliably (Cronbach’s  $\alpha = 0.83$ ) and thus the mean of all items was taken to create the variable “reactance” ( $M = 3.43$ ,  $SD = 1.11$ ). To test to what extent participants experienced disgust, participants again answered the Discrete Emotions Questionnaire (Harmon-Jones et al., 2016) in which all four disgust-related items also showed to measure the same underlying construct (Cronbach’s  $\alpha = 0.93$ ) and therefore the mean of these items was used to calculate a new item called “disgust” ( $M = 3.42$ ,  $SD = 1.94$ ). As in Study 1, we measured disgust after intentions, to avoid inflating the influence of disgust. Finally, participants’ demographics and “dietary group membership” (Rosenfeld et al., 2020) were measured.

### 5.2. Results

As in Study 1, we tested for mediation using Hayes’ PROCESS macro (2013) model 4 with 10,000 bootstrapped samples at a 95% confidence interval but in this analysis, we included both disgust and reactance as mediators. As before, compared to the non-graphic warning label ( $M_{Non-graphic} = 2.26$ ,  $SD_{Non-graphic} = 1.35$ ), the graphic warning label ( $M_{Graphic} = 4.58$ ,  $SD_{Graphic} = 1.75$ ;  $t(1, 443.398) = -16.161$ ;  $M_{Difference} = -2.32$ , Cohen’s  $d = 1.49$ ,  $p < .001$ , 95% CI  $[-2.60, -2.04]$ ) elicited more disgust. The graphic warning label ( $M_{Graphic} = 3.58$ ,  $SD_{Graphic} = 1.07$ ) also increased reactance relative to the non-graphic warning label ( $M_{Non-graphic} = 3.28$ ,  $SD_{Non-graphic} = 1.25$ ;  $t(1, 470) = 2.897$ ;  $M_{Difference} = 0.29$ , Cohen’s  $d = 0.27$ ,  $p = .004$ , 95% CI  $[0.09, 0.49]$ ). In other words, participants in the graphic condition experienced higher levels of disgust but simultaneously exhibited more reactance. While disgust had a positive, significant effect on the intention to reduce the meat consumption ( $b = 0.23$ , 95% CI  $[0.14, 0.31]$ ), the effect of reactance on intentions was negative and significant ( $b = -0.76$ , 95% CI  $[-0.88, -0.63]$ ).

Thus, as in Study 1, there was no difference in intention to reduce the consumption of meat between participants exposed to the graphic warning label ( $M_{Graphic} = 5.05$ ,  $SD_{Graphic} = 1.69$ ) and participants exposed to the non-graphic warning label ( $M_{Non-graphic} = 4.99$ ,  $SD_{Non-graphic} = 1.75$ ;  $t(1, 470) = 0.415$ ;  $M_{Difference} = 0.07$ , Cohen’s  $d = 0.04$ ,  $p = .678$ , 95% CI  $[-0.25, 0.38]$ ). Both the indirect effect via disgust ( $b = .52$ , 95% CI  $[0.32, 0.74]$ ) and the indirect effect via reactance ( $b = -0.22$ , 95% CI  $[-0.38, -0.07]$ ) are significant. Finally, neither the

direct effect ( $b = -0.24$ , 95% CI  $[-0.57, 0.10]$ ) nor the total effect ( $b = 0.07$ , 95% CI  $[-0.25, 0.38]$ ) of the type of warning label on the intention to reduce the meat consumption were significant (see Fig. 2).<sup>4</sup>

### 5.3. Discussion

As in Study 1, we found that, relative to non-graphic warning labels, graphic warning labels elicit higher levels of disgust, but do not appear to affect the intention to reduce meat consumption more than non-graphic warning labels. Reactance theory (Brehm, 1966) states that people may perceive persuasion attempts to threaten their freedom which elicits a state of reactance where people react defensively and resist the appeal rather than follow it. The data of Study 2 confirm this: the graphic warning label seems to simultaneously have elicited higher levels of disgust and reactance. In short, reactance may have canceled out the effect of disgust on the intention to follow the appeal of the graphic warning label.

Study 2 thus shows that the graphic warning label elicited more disgust but also provoked more reactance compared to the non-graphic warning label. As the amount of reactance elicited is directly related to the importance of the behavior targeted and the level of the threat (Steindl et al., 2015), the more aggressive warning label was found to elicit more reactance which, in turn, negated the positive effect on the intention to reduce the consumption of meat that eliciting disgust had. This conclusion implies that disgust-eliciting facts regarding the consumption of meat may become a potent tool to influence behavior only when reactance can be circumvented. We tested this in the final study.

## 6. Study 3: circumventing reactance

We hypothesized (and preregistered, see <https://aspredicted.org/blind.php?x=mc2rx6>) that by eliciting disgust in a way that avoids giving people the feeling they are being persuaded, we could effectively eliminate reactance and thus would find the isolated effect of disgust on participants' intentions to reduce their meat consumption.

Thus, instead of presenting the disgust-eliciting image in the form of a warning label (which is likely perceived as an attempt to influence), we presented a disgust-eliciting image under the guise of a "trivial fact." Specifically, we supplied participants with images accompanying seven "surprising food facts," such as that bananas contain more sugar than a glazed donut, that honey cannot spoil, and—the key disgust-eliciting image—that cows may grow pus-filled abscesses that can end up in consumers' food. Further, by presenting this disgusting image alongside a set of six other pieces of trivia, we sought to ensure that participants did not perceive the specific disgust-eliciting image as a persuasion attempt.

### 6.1. Method

**Participants.** A distinct sample of 789 participants, pre-screened to eat meat, was collected via Prolific Academic. Despite the pre-screen, 12 participants indicated to refrain from the consumption of meat during the study and were thus excluded from the analysis, resulting in a final sample of 777 participants ( $M_{Age} = 34.33$ ,  $SD = 13.29$ , 58.7% female, 40.0% male, 1.3% other). Sensitivity power analysis (power = 80%,  $\alpha = 0.05$ ) indicated Cohen's  $d = 0.20$  as the minimal detectable effect size for this sample ( $N = 777$ ) to test for a difference in the effect of a graphic burger fact (vs. control) on the intention to consume a burger using an independent-samples  $t$ -test.

**Design and Procedure.** Participants were invited to a purported study about "surprising food facts." To fit the cover story and to make the purpose of the study less salient, participants were presented with six

"surprising food facts" in random order after an initial, brief introduction. Each fact was presented in form of a "Did you know ... ?" question and accompanied by an image illustrating the specific the fact. For instance, the fact that a single can of Coca-Cola contains approximately 10 cubes of sugar was accompanied by an image of a can of Coca-Cola and 10 sugar cubes. Furthering the cover story, for each fact we asked participants to indicate how surprising they found this fact on a 5-point Likert scale ranging from 1 ("Not surprising at all") to 5 ("Extremely surprising"). After the sixth random food facts, the seventh food fact—our manipulation—was displayed. In the disgust-eliciting condition ( $N = 388$ ), participants were asked whether they knew that cows can grow pus-filled abscesses that may end up in consumers' burgers. Thus, we introduced the disgusting meat fact in a way that did not seem like a warning or a persuasion attempt, but more like mere trivia, albeit disgusting. In the control condition ( $N = 389$ ), participants were asked whether they knew that McDonald's sells 75 burgers every second of every day. Accompanying the text in the manipulation condition was a graphic image of a large piece of meat oozing of a greenish liquid whereas the control condition showed the image of a McDonald's hamburger (full material of Study 3 available upon request).

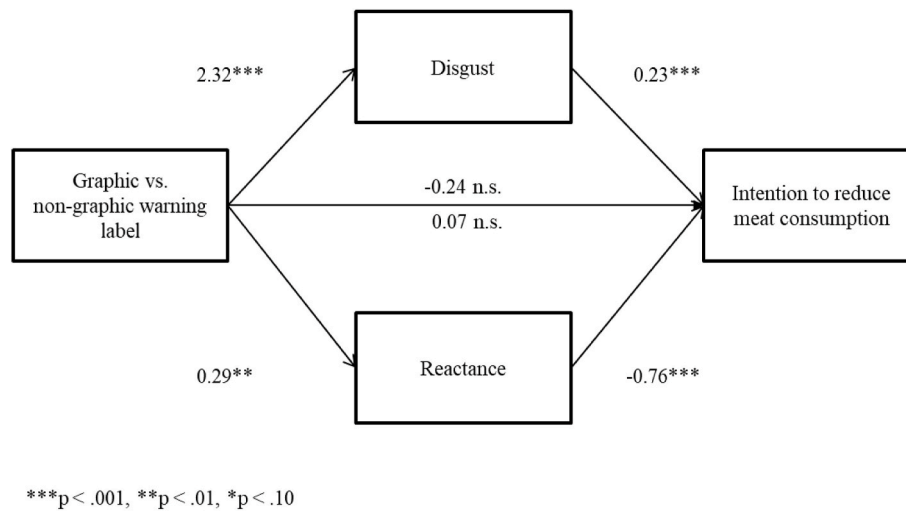
**Dependent Measure.** In order to avoid giving participants the impression that the facts were included to persuade them, we designed the study to present trivial knowledge and the dependent variable to be unobtrusive. As such, after having seen all seven surprising food facts, participants simply answered to what extent they agreed with seven statements presented in random order such as "I would like to drink a can of Coca-Cola right now" and—the target question—"I would like to eat a burger right now," on a 7-point Likert scale (1 = "Strongly disagree", 7 = "Strongly agree"). The extent to which participants agreed with wanting to eat a burger was our dependent variable ( $M = 3.51$ ,  $SD = 2.11$ ). Although this question differs somewhat from the dependent variables of Studies 1 and 2, this was intentional. As a perceived threat to one's freedom of choice elicits reactance, providing participants with unpleasant information and consequently asking whether they would reduce a controversial behavior (eating meat) would likely elicit reactance. We therefore chose not to ask participants directly whether they would change their overall consumption of meat, but used an indirect measure to examine participants' interest in meat.

To test whether the hypothesized effect of disgust additionally translated into a sustained commitment when circumventing reactance, participants were introduced to the meat-free week campaign and asked whether they would be interested in signing up for it (1 = "Definitely not", 5 = "Definitely yes";  $M = 3.10$ ,  $SD = 1.31$ ). After participants' demographics and "dietary group membership" (Rosenfeld et al., 2020) were measured, participants were again presented with the same image and fact regarding the burger they saw earlier and asked to answer to what extent they recalled experiencing the emotions listed in a shortened version of the Discrete Emotions Questionnaire (Harmon-Jones et al., 2016) when seeing this material. As in Studies 1 and 2, the emotions were measured after measuring the key DV to avoid priming participants and thus inflating the role of disgust. The four items related to disgust that were of keen interest, showed to reliably measure the same underlying concept (Cronbach's  $\alpha = 0.95$ ), and thus their mean was calculated to create the variable "disgust" ( $M = 3.30$ ,  $SD = 2.10$ ).

### 6.2. Results

We expected that the disgust-eliciting image, by recruiting disgust, would make people less interested in consuming meat. We tested for mediation using Hayes' PROCESS macro (2013) model 4 at a 95% CI with 10,000 bootstrapped samples. Participants exposed to the disgust-eliciting burger fact recalled experiencing more disgust ( $M_{GraphicBurgerFact} = 4.87$ ,  $SD_{GraphicBurgerFact} = 1.62$ ) than those in the control condition ( $M_{Control} = 1.73$ ,  $SD_{Control} = 1.13$ ;  $t(1, 692.712) = 31.313$ ,  $M_{Difference} = 3.14$ , Cohen's  $d = 2.25$ ,  $p < .001$ , 95% CI  $[2.94, 3.34]$ ). Perceived disgust, in turn, decreased participants' intention to consume

<sup>4</sup> The results do not differ significantly when including participants' diet or gender as a covariate.



**Fig. 2.** Unstandardized regression coefficients for the relationship between the type of warning label and the intention to reduce the consumption of meat with the mediators disgust and reactance.

a burger ( $b = -0.53$ , 95% CI  $[-0.62, -0.44]$ ). Thus, consistent with our expectations, we find that participants in the disgust-eliciting condition were significantly less willing to consume a burger ( $M_{\text{GraphicBurgerFact}} = 2.76$ ,  $SD_{\text{GraphicBurgerFact}} = 1.97$ ) than participants in the control condition ( $M_{\text{Control}} = 4.27$ ,  $SD_{\text{Control}} = 1.98$ ;  $t(1, 775) = -10.684$ ,  $M_{\text{Difference}} = -1.51$ , Cohen's  $d = 0.77$ ,  $p < .001$ , 95% CI  $[-1.79, -1.23]$ ). Accordingly, in contrast to Studies 1 and 2, the total effect of the disgust-eliciting condition is negative and significant ( $b = -1.51$ , 95% CI  $[-1.79, -1.23]$ ), while the direct effect is not significant ( $b = 0.15$ , 95% CI  $[-0.24, 0.54]$ ). As before, the indirect effect is negative and significant ( $b = -1.67$ , 95% CI  $[-1.96, -1.38]$ ); participants exposed to the disgust-eliciting condition experienced more disgust, thus decreasing participants' intention to consume a burger. In short, we find full mediation (see Fig. 3): the effect of the disgust-eliciting condition (vs. the control) on the willingness to consume a burger is fully accounted for by disgust.<sup>5</sup>

Importantly, this effect seems to be more than just a mere spoiling of appetite: while participants in the graphic burger fact condition were less willing to consume a burger than participants in the control condition, there was no negative effect of the graphic burger fact on participants' willingness to consume any of the other foods (see supplementary material).

Although the graphic burger fact reduced participants' appetite for a burger, we did not find that participants in the graphic burger fact condition were more willing to sign up for the meat-free week. There was no significant difference in the intention between participants in the graphic burger fact condition ( $M_{\text{GraphicBurgerFact}} = 3.16$ ,  $SD_{\text{GraphicBurgerFact}} = 1.25$ ) and participants in the control condition ( $M_{\text{Control}} = 3.05$ ,  $SD_{\text{Control}} = 1.36$ ;  $t(1, 769.715) = 1.157$ ,  $M_{\text{Difference}} = 0.11$ , Cohen's  $d = 0.08$ ,  $p = .247$ , 95% CI  $[-0.08, 0.29]$ ). This may again be a result of reactance, which we elaborate upon below.

### 6.3. Discussion

Study 3 shows that disgust, when introduced in a way that circumvents reactance, seems to temporarily reduce people's appetite for meat specifically. Participants who saw the disgust-eliciting burger fact indicated a significantly lower interest in consuming a burger. Importantly, we find that this effect was not merely due to a spoiled appetite but instead made the specific target behavior less appealing while not

<sup>5</sup> The results stated above do not differ significantly when including participants' diet or gender as a covariate, see supplementary material.

reducing general appetite. This could be an important step toward reducing people's meat consumption: providing truthful yet disgusting information without a direct persuasion attempt, may make consumers reconsider eating meat.

The finding that participants' intention to sign up for the meat-free week remained unaffected by the disgusting fact could possibly be interpreted as participants again displaying reactance: connecting the invitation to the meat-free week with the disgust-eliciting burger fact that participants saw shortly before *may* have come across as persuasion attempt, thus triggering reactance.

## 7. General discussion

Graphic warning labels on meat products have been called for since the classification of meat as a carcinogen (Center for Science in the Public Interest, 2016; Hadi, 2016). By recruiting disgust, such graphic warning labels may be uniquely equipped to reduce the consumption of meat. While previous research has found that disgust may, under certain circumstances, affect consumer attitudes toward meat (Palomo-Vélez et al., 2018), the current research is, to our knowledge, the first to test whether graphic warning labels, via eliciting disgust, would curb people's appetite for meat. We show that graphic warning labels can reduce people's appetite for meat specifically, albeit with a caveat.

In Study 1, in contrast to our initial hypothesis, we did not find that a graphic warning label increases participants' intention to reduce their meat consumption. Although the graphic warning label elicited more disgust than the non-graphic warning label and disgust was linked to an increased intention to reduce the consumption of meat, there was no difference in the intention between participants exposed to the graphic and participants exposed to the non-graphic warning label. In Study 2, we find that the absence of this effect may be explained by reactance: the use of a graphic warning label made people feel more manipulated, which in turn decreased their meat-reduction intentions. In Study 3 we therefore sought to circumvent reactance by presenting a disgust-eliciting image under the guise of trivia instead of an explicit warning label that is likely perceived as aiming to persuade consumers. In this disguised form, disgust does seem effective to reduce people's meat intake.

Together, these three studies show that disgust reduces people's interest in meat and that when disgust is elicited in the form of a graphic warning label, consumers may exhibit reactance which will mitigate this effect. We note here that across all studies, the effects were consistently mediated by feelings of disgust. This implies that, above and beyond individual differences, disgust is a pathway via which graphic warning

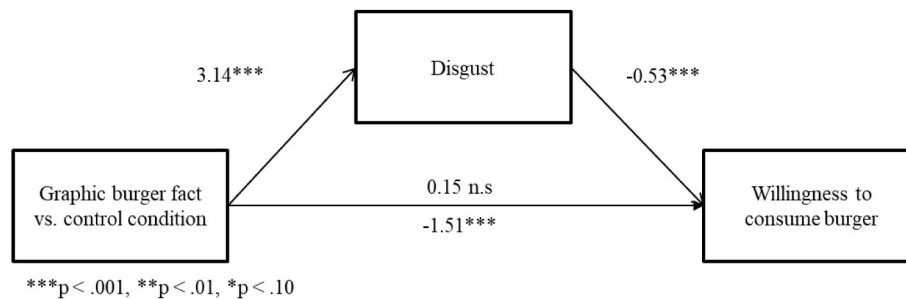


Fig. 3. Unstandardized regression coefficients for the relationship between the type of burger fact seen and the intention to consume a burger with the mediator disgust.

labels can affect intentions. Disgust is thus most effective in changing consumers' meat consumption intentions when it is not perceived as an attempt to manipulate behavior or when reactance is circumvented.

It should be noted that the design of Studies 1 and 2 do not allow us to draw conclusions on the absolute effect of graphic warning labels on the consumption of meat, as the control condition also warned participants against the risks of meat consumption. Instead, Studies 1 and 2 zoomed in on a different question: what is the effect of adding disgust to a warning label? Relative to non-graphic warning labels, graphic warning labels increase the intention to reduce the consumption of meat while simultaneously eliciting reactance.

Despite this potential for behavior change, the use of graphic warning labels should be considered carefully. The use of disgust in health communication has previously been hypothesized to lead to coercion rather than true conviction (Lupton, 2015) and our results cannot dismiss this concern. Across different types of meat-eaters, the graphic warning label elicited more disgust than the non-graphic warning label; disgust, in turn, was related to an increased intention to reduce the consumption of meat. As reactance mitigated the effect of the graphic warning label on intention, the findings presented in this paper may be considered to be relatively conservative. The disgust response in a real consumption context, where reactance is less likely to mitigate the effect, is accordingly expected to be more pronounced. However, that response may more closely resemble an involuntary avoidance of meat instead of a true change in conviction.

## 8. Limitations and future research

The current study looks at the potency of graphic warning labels to limit the consumption of meat. Processed meat has been categorized as “carcinogenic to humans” and red has been categorized as “probably carcinogenic to humans” (World Health Organization, 2015). Accordingly, graphic warning labels against this characteristic—akin to how tobacco products warn against the detrimental consequences of their consumption—may be due (Center for Science in the Public Interest, 2016; Hadi, 2016). Although our findings offer theoretical support for the potential effects of the use of graphic warning labels to target the consumption of meat, our results may be somewhat conservative. Because of the COVID-19 epidemic, we have been unable to conduct experimental research involving real consumption behavior in a field setting. This may have reduced the level of disgust while increasing reactance. On the one hand, being a food related emotion (Rozin & Fallon, 1987), disgust can be expected to elicit a strong behavioral reaction, possibly one that consumers can only forcefully—if at all—overcome.

Accordingly, measuring intention instead of actual consumption behavior may have reduced the effect of participants experiencing disgust. On the other hand, it may be that due to the design of Study 2, the effect of reactance may be especially pronounced thus making the graphic warning label seem less potent than it may be when applied in real life. We opted for explicit measures of reactance and intentions.

Explicitly measuring reactance, however, could have primed participants and thus increased their reactance scores. Additionally, asking participants to articulate the intention to reduce their meat intake may have made them realize that they *are* being influenced more than if they had to make a less conscious choice (e.g., simply choosing whether or not to eat something). We thus call for further research on the effects of graphic warning labels involving more behavioral measures or ideally actual consumption behavior to test the effect of disgust and reactance under real-life circumstances.

Another factor that may make the results discussed in this paper somewhat conservative, is the fact that we used minced meat as an example of processed meat. Although technically minced meat may be considered processed, as it is treated to improve shelf-life, minced meat is not the stereotypical example of processed meat. Accordingly, participants may have struggled to understand the link between the warning label warning against the effect of *processed* meat on a package of seemingly unprocessed meat. While this is unlikely to have affected the results because they asked about *any* type of meat, this is a shortcoming and future research would be encouraged to use stereotypical examples of processed meats such as sausages or cold cuts. Further, graphic warning labels in the tobacco industry have been shown to suffer from wear-out effects, stimulating a constant need to update these labels (Woelbert & d’Hombres, 2019). Although warning labels in the tobacco industry may wear-out more rapidly given that smokers may be exposed to them every time they smoke a single cigarette, wear-out effects are also likely for graphic warning labels for meat-products. As such, different messages and images and their effects over time need to be tested. The effect of graphic warning labels may differ depending on how graphic, how persuasive, and how believable, the warnings are.

Study 3 offers some limitations and thus avenues of future research. We assumed the way we elicited disgust in participants (i.e., under the guise of a “trivial fact”) would be sufficient to avoid triggering reactance. The results are consistent with this: relative to participants in the control condition, participants in the disgust condition expressed a reduced interest in consuming meat. However, we did not measure reactance levels. Future research can explicitly measure reactance to corroborate our reasoning. On the other hand, Study 3 offers unanticipated results that warrant future research: participants in the disgust condition of Study 3 were significantly more likely to want to consume alcohol, bananas, white chocolate, and honey than those in the control condition (see [supplementary material](#)). These results may indicate compensatory behavior of participants, who after rejecting the consumption of meat, may have (briefly) accepted other source of nutrition more than participants in the control condition. This, however, is speculative and thus may require further investigation.

The different stimuli used in this paper further warrant additional research. As tested in Study 1 and 2, warning labels using more or less vivid imagery to warn against the risk of, for instance, cancer are perceived as being manipulative and thus can elicit reactance, rendering them less effective. To circumvent reactance and thus demonstrate the isolated effect of disgust, in Study 3, we used disgusting trivia instead of



disgusting warning labels. While this worked in the setting of the study, utilizing trivia as an actual intervention in real life may be less applicable. Possibly, a combination of stimuli not tested in this research works best in reducing the consumption of meat while circumventing reactance. For instance, disgusting imagery without an explicit warning may combine the effect of disgusting trivia with the applicability of graphic warning labels.

We further call for more research on the ethical implications of using graphic warning labels to reduce the consumption of meat. While our research suggests that consumers, when perceiving them as an attempt to influence, do not appreciate graphic warning labels, it is possible that graphic warning labels actually undermine social cohesion. For example, aggressive campaigns against the consumption of tobacco have been found to lead to the stigmatization of lung cancer patients (Riley, Ulrich, Hamann, & Ostroff, 2017).

Finally, graphic warning labels utilize disgust which may bear some detrimental consequences of its own. Disgust has not only been shown to amplify the moral conviction regarding moral issues such as abortion (Wisneski & Skitka, 2017), but disgust has also been found to moralize (Rozin, 1999), that is to give a previously morally neutral behavior or idea a moral load (Feinberg, Kovacheff, Teper, & Inbar, 2019). Pairing disgust with any behavior or idea may thus eventually render it immoral and consequently invalid—irrespective of whether or not there is merit to it and whether or not the disgust is warranted at all. Thus, pairing the consumption of meat with the elicitation of disgust may make eating meat seem fundamentally wrong and thereby may make consumers comply with the moral alternative—to comply with the cessation intervention irrespective of initial preferences. Such concerns may be why Kelly (2011) argues disgust to possess a “slope [...] too slippery to endorse” (p. 178). Future research should test whether these concerns are warranted.

## Appendix A. Supplementary material

Supplementary material to this article can be found online at <https://doi.org/10.1016/j.appet.2021.105690>.

## Ethical statement

The authors confirm that, as part of the data management procedure, the research in this article has received the ethical approval of the university’s Institutional Review Board. The corresponding reference number for the research is FEB-20200228-10479. All participants were informed about and agreed to the data collection procedure. The authors confirm to have treated all research data anonymously.

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