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Abstract

Promoting transitions towards more sustainable food choices is necessary to mitigate the environmental impact of excessive meat consumption. The present research proposes a collective meal context intervention that includes a nudge and a boost to influence consumers' choices towards more sustainable meal options. Specifically, we tested whether exposing consumers to a (positively/negatively) framed carbon message and a (familiar/unfamiliar element) carbon label can encourage choices towards a mixed bean-beef (vs. beef) burger. Participants (N = 241) were exposed to a negatively or positively framed message (nudge) presented upon a menu decision between a 100% beef burger and a mixed 50% beef 50% beans burger, which was accompanied by either a familiar or unfamiliar element carbon label (boost). The study also included a control condition, in which neither the message nor the labels were included. Results showed that: (a) all combinations of framing with labels were equally effective in encouraging consumers to choose the more sustainable meal (i.e., mixed bean-beef burger), compared to the control condition; (b) the negative framing effect did not significantly differed from the positive one nor the familiar element label effect significantly differed from the unfamiliar element one; (c) exposure to the messages and labels did not influence perceptions (e.g., perceived tastefulness, healthfulness, ethics) of the two choices. Results can be viewed considering Regulatory Focus Theory and participants' possible unwillingness to use and trust the label.

Keywords: Sustainable consumption, Nudge, Boost, Messages, Labels, Framing, Familiarity.

Resumo Alargado

O aquecimento global é uma das maiores ameaças da humanidade. Justificações para esta declaração são difundidas através de várias fontes científicas por todo o mundo. De facto, cerca de 90% dos cientistas climáticos com artigos publicados consideram que o aquecimento global é causado pela libertação de gases com efeito de estufa (Cook et al., 2016), sendo estes libertados por várias indústrias e atividades (Herzog, 2009). Em especial, o setor da produção de carne, que contribui aproximadamente 15% de todos os gases com efeito de estufa (GHG) libertados (Gerber et al., 2013). Para além de produzir elevadas quantidades de GHG, a produção de carne pode também impactar negativamente o ambiente através da destruição de florestas (Ramankutty & Foley, 1999), da sobreutilização da água (Mekonnen & Hoekstra, 2012) e da contaminação dos seus reservatórios naturais (Ward et al., 2005), entre outros problemas. Estes problemas só irão aumentar ao longo das próximas décadas devido ao excessivo e crescente consumo de carne, que por sua vez aumenta ou mantém elevados os níveis de produção (Wellesley et al., 2015).

Uma das possíveis abordagens para mitigar este problema é incentivar mudanças na dieta dos indivíduos (Godfray et al., 2018). Assim, incentivar alternativas sustentáveis à carne irá reduzir as exigências de produção, diminuindo assim o impacto deste setor alimentar. O relatório da EAT Lancet (Willett et al., 2019), por exemplo, criou uma dieta de referência mundial que sublinha a importância de substituir carne por alimentos à base de plantas, de forma a manter uma manutenção sustentável do planeta.

Promover mudanças dietéticas pode passar por intervenções comportamentais focadas em processos mentais conscientes e inconscientes (Marteau, 2017). O presente estudo concilia esses dois processos, através da utilização conjunta de um *nudge* (Thaler & Sunstein, 2008) e de um *boost* (Grüne-Yanoff & Hertwig, 2016), para promover escolhas alimentares sustentáveis.

Entende-se por nudges a manipulação intencional de qualquer elemento da arquitetura de escolha com o desejo intencional de mudar positivamente o comportamento das pessoas de uma forma previsível e sem as restringir ou alterar significativamente os seus incentivos económicos (Thaler & Sunstein, 2008). Os nudges podem ser utilizados em vários contextos, sendo os espaços de restauração coletivas um destes. Estes contextos são locais privilegiados para intervenções focadas na mudança de dietas uma vez que as escolhas alimentares feitas nestes locais influenciam (e são influenciadas por) o que os outros escolhem (Robinson et al., 2011, 2014; Salvy et al., 2007). Por outras palavras, as escolhas alimentares influenciam as normas sociais e são influenciadas por elas.

Intervenções nudge que visam incentivar a escolha de opções mais sustentáveis em espaços de restauração coletiva podem incluir o uso de mensagens informativas. Isto é importante visto que as pessoas têm relativamente pouco conhecimento quanto ao impacto que a produção de carne tem no ambiente (Camilleri et al., 2019; Hartmann & Siegrist, 2017; Macdiarmid et al., 2016; Sanchez-Sabate & Sabaté, 2019; Truelove & Parks, 2012). Pelo lado positivo, indivíduos que percebam os efeitos ambientais que a redução do consumo de carne traz têm maior probabilidade de escolher opções sustentáveis (de Boer et al., 2016; Truelove & Parks, 2012).

Um dos tipos de mensagem que pode ser utilizado para incentivar o consumo de refeições sustentáveis são as mensagens com enquadramento negativo, ou seja, mensagens que utilizam efeitos de enquadramento para manipular o impacto destas nos consumidores. O efeito de enquadramento é um viés cognitivo no qual os juízos e decisões das pessoas são afetados de forma diferente, dependendo da estrutura semântica da informação (Tversky & Kahneman, 1985). Isto significa que é possível manipular avaliações subjetivas dos atributos ou características de um objeto através da valência (positiva ou negativa) da informação (Levin et al., 1998). Estudos recentes têm mostrado que apresentar informação ética negativa de um

produto consegue mover as preferências para longe deste produto mais do que expor informação ética positiva (Grankvist et al., 2004a; Van Dam & De Jonge, 2015). Este efeito pode ser explicado através de outros dois vieses cognitivos: o viés de negatividade (Rozin & Royzman, 2001) e a aversão à perda (Kahneman & Tversky, 1979). Ambos estes vieses predizem que as perdas são percebidas como sendo mais "pesadas" do que ganhos de mesmo valor objetivo (Tversky & Kahneman, 1991). Kahneman e Tversky (1979) referem ainda que estas perdas e ganhos estão dependentes de um ponto de referência subjetivo e que as pessoas têm geralmente uma tendência mais forte para evitar perdas do que para obter ganhos relativamente a este ponto de referência. O presente estudo foca-se, portanto, no uso de efeitos de enquadramento através de mensagens prévias ao momento de decisão entre dois produtos com níveis de qualidade ética (sustentável) distintos (i.e., refeição à base de carne e refeição de base vegetal). Espera-se que o ponto de referência dos consumidores seja o consumo de carne porque as pessoas veem este consumo como sendo normal, necessário, natural e agradável (Piazza et al., 2015). Espera-se, portanto, que a exposição a uma mensagem com um enquadramento negativo, sinalizando perda de qualidade ética da opção carne, seja mais eficaz a mover as preferências para longe desta opção do que expor uma mensagem com um enquadramento positivo que sinalize ganho de qualidade ética da alternativa (refeição de base vegetal). Para além da utilização destas mensagens, este estudo utiliza também um outro fator de intervenção (i.e., boosts).

Compreende-se por boost uma intervenção comportamental que, ao contrário dos nudges, faz uso das competências conscientes dos indivíduos (Hertwig & Grüne-Yanoff, 2017). Estes focam-se em ativar comportamentos específicos através do melhoramento de competências já existentes ou da criação de novas. Os boosts preservam intencionalmente a agência pessoal (ao contrário dos nudges). Para isso, o objetivo de um boost tem de ser claro, na medida em que um indivíduo terá de possuir a opção de o adotar ou não (Grüne-Yanoff &

Hertwig, 2016; Hertwig & Grüne-Yanoff, 2017). Um exemplo concreto seria habilitar a capacidade de os consumidores escolherem opções mais sustentáveis. Isto pode ser feito através da modificação da informação carbónica exposta em rótulos carbónicos, sendo que estes são habitualmente de difícil compreensão (Guenther et al., 2012; Hartikainen et al., 2014; Kause et al., 2019). Um boost possível seria traduzir esta informação carbónica "obscura" em unidades de medida compostas por elementos familiares, tal como minutos de atividade de uma lâmpada (Camilleri et al., 2019). Assume-se também que estes rótulos compostos por elementos familiares possam ainda incluir outro tipo de medida, nomeadamente, quilómetros percorridos por um carro (e.g., BBC Future, 2021)**.**

O objetivo deste estudo foi, portanto, testar a eficácia que uma intervenção dupla, composta por uma frase enquadrada negativamente e um rótulo de elemento familiar, tem na mudança das escolhas de refeições para uma opção mais sustentável (relativamente a uma opção menos sustentável). Esperava-se, portanto, que o efeito de uma mensagem com enquadramento negativo fosse maior do que uma com enquadramento positivo (H1) e que o efeito de um rótulo de elemento familiar fosse maior que um de elemento não familiar (H2). Para além disso, esperava-se que existisse um padrão de efeito tal que: a junção da mensagem enquadrada negativamente com o rótulo familiar fosse mais eficaz relativamente às outras combinações de mensagem e rótulo; que uma mensagem enquadrada positivamente com o rótulo não familiar produzisse o menor efeito e que as outras duas combinações produzissem efeitos intermediários (H3). Por fim, esperava-se que todas estas combinações produzissem, relativamente a uma condição de controlo, efeitos significativos (H4). Análises exploratórias foram também realizadas para avaliar as perceções acerca das duas opções antes e após a manipulação experimental.

Um total de 241 participantes responderam a um questionário online Qualtrics. A análise demográfica revelou que a maior parte deles tinha entre 20 e 30 anos, um curso superior,

trabalhavam e eram do sexo feminino. Os participantes foram aleatoriamente colocados numa de entre cinco condições. Os materiais usados incluíram (a) duas opções de menu- hambúrguer à base de carne e hambúrguer de base vegetal, (b) duas mensagens idênticas- enquadradas positivamente ou negativamente e (c) dois rótulos carbónicos- de elemento familiar ou de elemento não familiar. Para medir as escolhas e perceções, incluíram-se sete perguntas: uma de escolha e outras seis de perceção de sabor, saudabilidade, sustentabilidade, ética, escolha dos outros e aprovação dos outros. Os participantes foram, portanto, expostos a uma das mensagens, sendo que depois teriam de decidir entre duas refeições que eram acompanhadas por rótulos de elemento familiar ou não familiar.

Os resultados obtidos através de análises de variância mostraram não existir efeito de enquadramento, efeito de familiaridade e efeito de interação entre estas duas variáveis nas escolhas dos participantes. Ademais, não foi encontrado um padrão de efeito entre as várias combinações. No entanto, todas estas diferiram significativamente da condição de controlo, confirmando-se assim apenas a H4. A análise exploratória verificou que nenhuma das perceções foi significativamente afetada pela manipulação e que a perceção de escolha dos outros e da sua aprovação manteve pontuações próximas da escolha do hambúrguer de carne (contrariamente às restantes perceções).

A explicação para a não existência de efeitos de enquadramento é discutida através da teoria de Regulatory Focus (Higgins, 1997), nomeadamente, a influência que o foco motivacional do indivíduo tem aquando da exposição de alternativas positivas ou negativas. Quanto à não existência de efeitos de familiaridade, argumenta-se que estes podem ter resultado da falta de motivação dos participantes para entender os rótulos ou devido a possíveis confusões sobre a informação dos mesmos relativamente à informação das mensagens. Quanto à não existência de padrões de efeitos das possíveis combinações, e sim apenas à existência de efeitos das combinações relativamente à condição controlo, presume-se que as mudanças de escolha

tenham apenas acontecido devido à apresentação da informação carbónica e não à forma como esta foi formulada. De notar que estas mudanças podem ter sido inflacionadas em função da constituição da amostra (60% mulheres) e ao facto de a alternativa mais sustentável possuir, em parte, carne. Por fim, argumenta-se que o facto de as escolhas terem mudado para a opção mais sustentável, quando o mesmo não aconteceu para as perceções acerca dos outros, tenha sido causado por efeitos de ignorância pluralística (Allport, 1933, as cited in Kunda, 1999) ou superioridade ilusória (see Hoorens, 1993).

Algumas limitações deste estudo podem ser apontadas, designadamente, os níveis de conhecimento dos participantes acerca do impacto da produção de carne e os níveis de preocupação ambiental e de normas sociais não foram recolhidos. Além disso, a criação da mensagem pode ter criado efeitos inesperados de "backfire". Por último, o contexto proposto aos participantes na experiência e o timing de apresentação da mensagem talvez não tenham sido os mais apropriados.

Palavras-chave: Consumo Sustentável, Nudge, Boost, Mensagens, Rótulos, Enquadramento, Familiaridade.

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Introduction

Global Warming and Meat

Global warming is undoubtedly one of humanity's greatest threats. Proof of its existence is unequivocal, and it is shared publicly through countless organizations around the world. For instance, the 2020 Global Climate Report from NOAA (National Oceanic and Atmospheric Administration) has shown that every monthly temperature of 2020 was one of the top four warmest ever recorded for the respective month. The same organization states that global temperature (land and oceans) has risen 0.08º Celsius per decade since the 1880's and that the average rate of increase has escalated to 0.18º Celsius since 1981 (U.S. Global Change Research Program et al., 2017).

The main cause of global warming is also a subject of widespread scientific consensus. A study published by Cook et al. (2016) has shown that more than 90% of publishing climate scientists consent to the fact that human activity is driving global warming. Moreover, it is also agreed upon by 90% of publishing climatologists that global warming's strongest contributor is the human-induced release of greenhouse gases (GHG) into the atmosphere (Verheggen et al., 2014; as cited in Cook et al., 2016). Indeed, since the mid-20th century, advances in science and technology and increases in wealth and population levels have led to an exponential growth of industrial and human activities, and with it, an exponential growth of GHG emissions. These gases are released from almost every major human industries and activities such as transportation (14.3%), electricity and heat (24.9%), industry (14.7%), land use change (12.2%), agriculture (13.8%), among other smaller GHG sources (Herzog, 2009).

Food systems, which are included in all these sectors, are responsible for approximately a third of all GHG released into the atmosphere (Crippa et al., 2021). Meat production, a fundamental part of this system, accounts for 60% of this amount. Put differently, around 15%

of all GHG released into the atmosphere comes from meat production (Gerber et al., 2013), with some authors suggesting this percentage can be higher (e.g., Steinfeld et al., 2006). The most important GHG are carbon dioxide (CO_2; 76% of all GHG emissions), nitrous oxide (N_2O; 6% of all GHG emissions) and methane (CH_4; 16% of all GHG emissions; US EPA, 2016), with meat production releasing all three into the atmosphere and being the prime source of the latter (Herrero et al., 2011). These emissions happen on different stages of meat production. They start at the agricultural input production and persist through feed production, livestock production for slaughter, meat processing, transportation, and retail (aan den Toorn et al., 2017). Cattle production is the most noxious, but pig and chicken production also deliver sizable contributions to GHG emissions (aan den Toorn et al., 2017). Global estimated emissions for cattle are 3090.3-3406.1 Mt (Mega ton) CO_2-eq (CO_2 equivalent gases include all GHG in CO_2 equivalent terms) with pig and chicken 380.1-873.8 Mt CO_2-eq and 374.2-1014.9 Mt CO_2-eq, respectively (aan den Toorn et al., 2017, p. 359).

Besides emitting GHGs, meat production can also negatively impact the environment in other ways. These include destroying forests to create pasture for cattle and arable land to generate food for livestock (Ramankutty & Foley, 1999), utilizing vast amounts of water (a third of all the water used for agricultural activities), possibly leading to its scarcity in other important areas, such as ecosystems maintenance (Mekonnen & Hoekstra, 2012), and damaging aquatic ecosystems and thus potentially human health, due to the soil infiltration of nitrogen and phosphorus present on animal manure (Ward et al., 2005), to name a few.

These problems are only bound to rise given the continuous growth of meat consumption across the world, driven by population growth and increasing average individual incomes (FAOSTAT, 2020), which in turn keeps the production levels at peak (Wellesley et al., 2015). Through food balance sheet data, average global consumption of all meats is estimated to be at $122g/day^{-1}$, with a fifth being beef, a third pork and poultry and the rest from

other animals (Godfray et al., 2018). In high-income countries consumption has reached a peak and remained steady or might have even slightly declined. Meat consumption in low-income regions like Africa has also remained stable, but with low values. The opposite scenario has been occurring in middle-income regions like Central and South America and Asia (except India), with China and East Asia topping the list of meat consumption growth.

Various meat consumption evolution models have been concordant as to the expected increase in meat demand for the future (Godfray et al., 2018). Some statistical approach studies, that combine Bennet's law[1] (Bennett, 1941) and expected future economic growth, report an average 100% increase in meat consumption between 2005 and mid-century due to the assumed rise in wealth (Tilman et al., 2011). Other studies, that attempt to predict changes in the economic dynamics of the food system, disclose a 62-144% increase in demand for livestock products by 2050 (Valin et al., 2014). Finally, an expert-based review by the United Nations' Food and Agriculture Organization (Alexandratos & Bruinsma, 2012) predicts a 76% rise in global meat consumption by mid-century, including a doubling in poultry, a 42% increase in pork and a 69% increase in beef. Although these projections may fluctuate to some degree, the fact that all of them suggest that meat demand will continuously rise from already unsustainable levels, lays a secure foundation on which global and local policy makers can base their sustainability-oriented plans.

Diet Change as a Pathway for Food Sustainability Transitions

One type of approach that can be used to mitigate meat overconsumption's harmful effects on the environment is to promote dietary habits change (Godfray et al., 2018). Namely, reducing meat consumption levels would lead to a decrease in production demands, which in

[1] Bennet's law notes that as people's incomes start to rise, their diet transitions from being largely focused on starchy staple foods (e.g., rice, potatoes, cereal) to more nutrient-dense meats, vegetables, fruits, refined grains, oils and dairy.

turn would reduce the impact that this sector has on the environment. Plant-based foods, for instance, can be appropriate alternatives to meat. The EAT Lancet report (Willett et al., 2019), which created a healthy and sustainable global reference diet, upholds that consumers should adopt a diet which largely favours vegetables and fruits, whole grains cereals, nuts, legumes, unsaturated oils and vegetable based proteins like chickpeas and beans, over the (zero to low) consumption of red and processed meat and refined grains. These dietary changes that focus on reducing meat consumption can be implemented through behavioural interventions that target conscious and unconscious processes (Marteau, 2017). Accordingly, the current study aims to explore the potential that an unconscious-based intervention, embedded on the *nudge* framework (Thaler & Sunstein, 2008), combined with a conscious-based intervention, embedded on the *boost* framework (Grüne-Yanoff & Hertwig, 2016), have on encouraging consumers to choose a more pro-environmental food choice. Before presenting the respective nudge and boost interventions it is important to clarify what conscious and unconscious processes signify and how they can be employed to promote change.

According to a dual process perspective of human cognition, the cognitive architecture of the mind involves two processing systems (Stanovich & West, 2000). System 1, also dubbed automatic system, which is unconscious, fast, and intuitive and System 2, or deliberate system, which is slow, controlled, and analytical (Kahneman, 2003, 2011). Given its speed and automatic nature, System 1 works as an effective (although many times not accurate) channel for our brains to deal with mundane ordinary tasks that don't require a lot of cognitive resources (e.g., driving on an empty road or finding the answer to 2x2). On the other hand, System 2 is used whenever a given task or mental challenge can´t be surpassed by automatic reasoning, thus needing a certain level of mental effort (e.g., driving on a busy road or finding the answer to a math equation). System 1 is a great way of dealing with a diverse number of mental activities that encompass our daily routines, but given its essence, it’s also prone to a great deal

of systematic errors and biases (Gilovich et al., 2002). These errors and cognitive biases are the result of mental shortcuts (heuristics) that are qualitatively different from normative models of judgment and decision making and that often save time and energy. Cognitive biases have long been studied and documented through numerous studies stationed on the *heuristic-and-biases* program (e.g., Kahneman 2003, 2011). Some examples include the *confirmation bias* (e.g., Lewicka, 1998)- the tendency to favour information that confirms previously existing beliefs, the *anchoring bias* (e.g., Campbell & Sharpe, 2009)- when people overly rely on first or pre-existing information, or the *survivorship bias* (e.g., Carpenter & Lynch, 1999)- when people base their judgements on surviving information. The insight that the human mind is highly dependent on System 1, and therefore motivational and judgemental shortcomings are highly expected, reveals an interesting opportunity for policy makers to make use of these biases to steer individuals into a direction that favours their ultimate goals and preferences (Thaler & Sunstein, 2008)**.**

Nudging through messages

The concept of nudge was introduced by Richard Thaler and Cass Sunstein (2008) and it has been ever since a major central concept within the fields of behavioural sciences, behavioural economics and political studies. Nudge is the intended manipulation of any element of choice architecture with the intentional desire to positively change people's behaviour in a predictable way without restraining them or significantly changing their economic incentives (Thaler & Sunstein, 2008). It follows the principle of libertarian paternalism which states that choice architects can (and should) positively impact people's lives without restraining their possibility of opting out of arrangements, therefore respecting freedom of choice (Thaler & Sunstein, 2008). Nudges can be applied in various contexts such as health

and well-being, tax compliance, education, financial decisions and, especially relevant for this study, food habits (Egan, 2013).

Indeed, one of the settings in which nudging can be applied to guide individuals towards more sustainable meal options is in collective meal areas such as canteens, restaurants, or bars. These areas may be one of the more suitable alternatives to encourage pro-environmental dietary changes since food choices in collective meal contexts influence (and are influenced by) what others choose (Robinson et al., 2011, 2014; Salvy et al., 2007). It is therefore assumed that as more consumers start to choose plant-based foods as an alternative to meat, so does the social norm that these are normal choices start to increase, which in turn leads others to choose them more often. Moreover, these locations might be a prime opportunity to change dietary patterns because they are currently starting to offer consumers the possibility of getting in touch with more plant-based dishes and because one of the main barriers for people to change their diets is the difficulty to start cooking their own plant-based dishes (Graça et al., 2019). Recent interventions that nudged consumers in collective meal contexts into choosing plant-based foods over meat included: naming vegetable-based meals with exciting, flavourful and indulgent names (e.g., "spicy chickpea curry"), increasing choice by 25% (Turnwald et al., 2017); decreasing (12%) meat and doubling vegetable portions in a restaurant, resulting in an 87% increase in vegetable intake and 13% decrease in meat intake, without affecting meal satisfaction (Reinders et al., 2017); and highlighting sustainable meals as the "dish of the day", leading up to 25% more people choosing these meals (Saulais et al., 2019).

Nudging in collective meal contexts can also include the use of messages. In particular, informative messages that attempt to lead individuals into opting for more sustainable meal options. This is important because consumer awareness about the environmental impact of food production is low (Camilleri et al., 2019; Hartmann & Siegrist, 2017; Macdiarmid et al., 2016; Sanchez-Sabate & Sabaté, 2019; Truelove & Parks, 2012). Moreover, consumers are generally

not aware of the impacts of global warming (Miniard et al., 2020). This can be in part explained by the great deal of time, space and social distance between consumers and climate change, turning the problem more abstract and less salient (Trope & Liberman, 2010). The upside is that consumers that understand the effects that meat reduction has on GHG emissions are more likely to reduce meat consumption (de Boer et al., 2016; Truelove & Parks, 2012). Along these lines, the present study proposes one nudge intervention that may be effective in influencing meal choices towards more sustainable options, namely, negatively framed messages.

Negatively Framed Messages

Stakeholders motivated to encourage meal habits in collective meal contexts can make use of the framing effect to manipulate message impact on consumers. The framing effect is a cognitive bias in which an individual's judgements and decisions are affected differently depending on the semantic structure of information (Tversky & Kahneman, 1985). Particularly, it is possible to manipulate the subjective evaluation of an object's attributes or characteristics through the valence display - positive or negative - of the information (Levin et al., 1998). Recent studies have explored this framing effect, proposing that exposing negative ethical information about a product can move preference away from such products (into more ethical ones) more than exposing positive ethical information (Grankvist et al., 2004a; Van Dam & De Jonge, 2015). Said studies have explained this, stating that two other cognitive biases can explain this effect of negative product information on consumer preference.

The *negativity bias* (Rozin & Royzman, 2001) and *loss aversion* (Kahneman & Tversky's, 1979), conform to the idea that losses carry more weight (loom larger) than gains of the same objective value (Tversky & Kahneman, 1991). This assumption has evolutionary roots. Organisms that take threats more seriously than opportunities have higher chances of surviving and reproducing (Kahneman, 2011). The superior effect of negative versus positive events has long been studied in different areas. Some of the findings reveal that negative traits

are more important than positive traits in impression formation (Anderson, 1974), that people pay attention for longer periods of time and more often to negative information than to positive information (Fiske, 1980) and that negative experiences elicit more physiological activation than positive experiences (Schwarz, 1990). Some studies have even focused on the subject of sustainability. For instance, Van Dam and De Jonge (2015) showed that signalling negative ethical information about sustainability has a greater effect on attitude, preference and choice than signalling positive ethical information. Specifically, their results showed that negatively labelling low ethical product alternatives has a stronger effect in the adoption of ethical products than positively labelling high ethical quality products. Loss aversion can be further explained through another principle called *reference dependence* (Kahneman & Tversky's, 1979). This principle establishes that "carriers of value are gains and losses defined relative to a reference point" (Tversky & Kahneman, 2000, p. 143). This means that our judgements and evaluations of events, objects or their attributes are based on losses and gains (changes) relative to a reference point, and not through their absolute levels (Kahneman & Tversky, 1979). Kahneman and Tversky (1979) stated that people generally have a stronger tendency to avoid losses than to obtain gains. That is to say that individuals perceive the "difference in attribute level [as] greater when evaluated in terms of losses, i.e., worse than the reference point, compared to gains, i.e., better than the reference point." (Van Dam & De Jonge, 2015, p. 20).

Unlike Van Dam and De Jonge's (2015) study, where the use of negativity bias and loss aversion effects are explored through labelling, the current study focuses on the use of the framing effect through messages that precede a meal choice between two options that have different levels of ethical (sustainability) quality. More specifically, a single phrase message that presents a comparison between meat and vegetable GHG emissions. It is assumed that, upon the display of such a comparative message, the reference point that most consumers will use is meat consumption. This is because eating meat is mostly viewed as being *normal*-belief

that this is what most people in civilized society do and it is what people expect from us, *necessary*-belief that we need meat to not only survive but to be strong and healthy, *natural*-belief that humans nature evolved to crave and consume meat, *nice*-consuming meat is an hedonic experience (Piazza et al., 2015). It is then assumed that, if consumers are faced with a negatively framed message that signals loss of ethical quality- through the display of meat (reference point) production GHG emissions versus vegetable production GHG emissions- they will have a stronger tendency to move away from meat consumption (relative to vegetable consumption) than if they were faced with a positively framed message that signals gain of ethical quality- through the display of vegetable production GHG emissions versus meat (reference point) production GHG emissions. This will happen because it is assumed that consumers will be more tempted to avoid losing (sustainable) ethical quality than to obtain it.

In summary, this study investigates whether, through effects of negativity bias and loss aversion, presenting a negatively framed message that contains a carbon comparison between two food proteins (meat and vegetables) will have a larger impact on people deciding for the more ethical (sustainable) option than presenting a positively framed message.

Messages that precede meals in collective meals contexts can be an effective strategy to influence pro-environmental food choices (Collins et al., 2019; Prusaczyk et al., 2021; Sparkman & Walton, 2017). Nevertheless, if the desired outcome is to increase the probabilities of consumers choosing more sustainable alternatives, it is assumed that such interventions could benefit from an additional interventional factor, as it was seen in some previous studies (Horgen & Brownell, 2002; Rozin et al., 2011; Slapø & Karevold, 2019; Thorndike et al., 2016). Besides, and given the fact that collective meal contexts are usually places where consumers are socially engaged with others and that are loaded with visual and auditory stimuli (e.g., chairs, cutlery, conversations), missing a message in a poster is something to be expected. Moreover, if the placement of the message isn't carefully thought out to be in a prime position

to be seen, consumers might miss it. However, if a second interventional factor can be implemented in a location that it's hard to miss, the probability of obtaining the desired outcome increases. Such addition will be discussed in the following chapter.

Boosting through carbon labels

Stakeholders can also structure their dietary change plans following a new behavioural science approach, specifically *boosts* (Grüne-Yanoff & Hertwig, 2016). Like nudges, this non fiscal and non-coercive type of intervention also exhibits great potential in creating efficient interventions. While nudge theory proclaims that decision-making is systematically fallible and that a great deal of cognitive and motivational deficiencies can be expected (Kahneman, 2003, 2011; Thaler & Sunstein, 2008), boost theory follows a distinct vision which evolved from relevant criticism to the heuristics-and-biases program (e.g., Klein, 1999; Oaksford & Chater, 2009; Phillips, 1983). Boosts assume that the human intellect has flaws but also competences, which can be assisted towards more optimal decisions (Hertwig & Grüne-Yanoff, 2017). They focus on enabling specific behaviours by fostering existing competences or developing new ones (Grüne-Yanoff & Hertwig, 2016; Hertwig & Grüne-Yanoff, 2017). As opposed to nudges, the aim here is to preserve personal agency and make it possible for people to consciously exert it or avoid it if they so wish. For this to happen, the specific objective of a boost must be transparent to the boosted individual. Boosts can engage resources associated with human cognition, like motivation, decision strategies or procedural routines, with the environment, like information representation or physical environment, or both (Hertwig & Grüne-Yanoff, 2017, p. 977). In addition, competence acquisition or nurturance can be specific to a single area, such as carbon emissions, or linked to more general areas, like environmental literacy. Once an individual improves or acquires a given competence, they have the option to deliberately use it or reject it in making informed choices (Hertwig & Grüne-Yanoff, 2017).

An example of such is empowering consumers' ability to choose more pro-environmental products when they are faced with a decision between products with different carbon emissions levels.

One of the ways that boosts can be used to influence food choice is through carbon labels. This type of environmental label has the purpose to influence consumer choices towards more environmentally friendly options through the presentation of GHG emissions associated with the lifecycle of a product (Zhao et al., 2020). Carbon labels were firstly introduced by UK Carbon Trust in 2006 (Zhao et al., 2017) with a number of developed countries pursuing this tradition in the following years (Liu et al., 2016). Their context of application is usually supermarkets, but carbon labels can also be applied to different contexts such as construction and tourism (Zhao et al., 2020). Importantly, carbon labels can also be applied to food options in collective meals contexts such as campus cafeterias (Brunner et al., 2018; Slapø & Karevold, 2019) and restaurants (Babakhani et al., 2020; Pulkkinen et al., 2016).

Current carbon labelling visual schemes can vary. Some can simply display the manufacturer's commitment to reduce GHG emissions, but most are based on carbon footprints schemes that display numerical estimates of carbon dioxide equivalent emissions (Liu et al., 2016), such as "100g of CO_2-eq per product". The problem with the latter type of label is that consumers usually find them difficult to understand (Guenther et al., 2012; Hartikainen et al., 2014; Kause et al., 2019) even if they include schemes like the red-yellow-green traffic light system normally used in nutritional labels (Scarborough et al., 2015; Thorndike et al., 2012, 2016). This confusion may lead to consumers not making more sustainable choices when purchasing products (Camilleri et al., 2019) despite supporting carbon label policies (Carbon Trust, 2020) and being willing to pay a premium for certified products (Feucht & Zander, 2018; Koistinen et al., 2013; Upham et al., 2011). Considering this, more research is needed to find intelligible ways of conveying carbon label information to consumers.

Familiar element carbon labels

As it was mentioned before, consumers have a low understanding of the effects that meat production has on the environment (Camilleri et al., 2019; Hartmann & Siegrist, 2017; Macdiarmid et al., 2016; Sanchez-Sabate & Sabaté, 2019; Truelove & Parks, 2012). Adding to this, pro-environmental efforts of stakeholders to design efficient carbon labels haven't been successful (Guenther et al., 2012; Hartikainen et al., 2014). With that in mind, Camilleri et al. (2019) developed a carbon label boost to help customers understand the relative GHG emissions impact between different products. The objective was to translate the usual "obscure" information, present in most carbon footprint labels, in terms of a familiar element unit. Concretely, the authors translated the GHG emission values of a set of products to an equivalent light-bulb minutes (e.g., "2,127 light-bulb minutes equivalent per serving"; Camilleri et al., 2019, p. 57). Results showed that this light-bulb minutes carbon label was effective at moving participants' average choices from a beef product towards a vegetable one and that this was caused by a better estimation of GHG emissions for the two products. This intervention was essentially a boost because it explicitly fostered the competence of consumers to understand a familiar element - minutes of light-bulb usage - to increase their capacity to perceive relative emissions between two product alternatives (thus promoting personal agency). Similar to the light-bulb measure, it is assumed that other familiar elements can be used in carbon labels to achieve better understanding of food products GHG emissions, such as a car-mileage measure (e.g., BBC Future, 2021). This measure can also be an efficient tool because it is assumed that people are usually familiarized with the experience of travelling in a car, with distances, and even how much fuel costs are needed to travel them. Like in Camilleri et al. (2019), this study aims to confirm the potential of utilizing a familiar element carbon label as an effective tool to move consumers towards more environmentally friendly options.

Overview

Finding efficient and feasible ways of mitigating meat consumption environmental impacts is a necessity. Considering this, the current study aimed to explore the potential of a behavioural intervention that included a negative valence carbon message and an intelligible carbon label on moving meal choices towards more sustainable options. Specifically, the objective was to test if the combined exposition of a negatively framed carbon message and a familiar element carbon label could encourage choices towards said alternatives. We also tested whether negatively framed messages have a significantly superior effect, relative to positively framed messages, and if familiar element carbon labels also have a superior effect, relative to unfamiliar element carbon labels, on moving these consumers' choices. A secondary objective consisted in discerning if this intervention would positively influence a set of consumers' perceptions towards the more sustainable alternatives. To this end, this study's experiment presented participants with a negatively or a positively framed message upon a menu decision between a 100% beef burger and a beef-bean mixed burger, with these options being accompanied by either familiar or unfamiliar element carbon labels (between-subjects factorial design). Some participants were not exposed to neither the message nor the carbon labels stimuli (control condition). Choice and perceptions about the two options were registered. This study anticipates that:

H1: Exposing consumers to a negatively framed carbon message influences the choice towards a more sustainable meal (i.e., beef-bean mixed burger), relative to a less sustainable meal (i.e., beef burger), more than a positively framed carbon message.

H2: Exposing consumers to a familiar element carbon label influences the choice towards a more sustainable meal (i.e., beef-bean mixed burger), relative to a less sustainable meal (i.e., beef burger), more than an unfamiliar element carbon label.

H3: A pattern of choice influence is expected towards a more sustainable meal (i.e., beef-bean mixed burger), relative to a less sustainable meal (i.e., beef burger), such that: combining a negatively framed carbon message with a familiar element carbon label produces the strongest effect; combining a negatively framed carbon message with a unfamiliar element carbon label and combining a positively framed carbon message with a familiar element carbon label produces intermediate effects; combining a positively framed carbon message with an unfamiliar element carbon label produces the weakest effect.

H4: Compared to a control condition, exposing consumers to either one of the experimental conditions should influence the choice towards a more sustainable meal (i.e., beef-bean mixed burger), relative to a less sustainable meal (i.e., beef burger).

Method

Participants

A total of two hundred and seventy-six participants voluntarily took part in an online survey, via Qualtrics, in exchange for the possibility of winning a raffle for a gift card worth 50€. Participants were recruited through social networks posts and through the email outreach database of Faculdade de Psicologia da Universidade de Lisboa' lab. Participants' ages ranged from 16 to 75 years old (M = 32.51, SD = 12.73), with approximately 61% (N = 167) of the participants being between 20 and 30 years old, 33% (N = 91) between 30 and 60 and 7% below 20 or above 60 (N = 15). Sample analysis showed that most participants were female (N = 161, male N = 112), had a higher education degree (N = 207) and had a job (N = 155) or were students (N = 91). About 87% of the participants (N = 241) successfully completed the survey. Of those participants, 11 were excluded from the experimental manipulation because they do not include meat on their diet.

Participants lunch meat-based dishes four days a week on average (*M* = 3.81, *SD* = 1.578) and vegetable-based dishes one day a week (*M* = 1.27, *SD* = 1.525). As for dinners, participants reported eating less meat (*M* = 3.26, *SD* = 1.765) but more vegetable-based dishes (*M* = 1.72, *SD* = 1.858). Regarding the usual meal contexts, participants eat cooked foot at home around five days a week (*M* = 5.42, *SD* = 1.601), with orderings or takeaways (*M* = 1.13 *SD* = 1.371) and traditional restaurants (*M* = .90, *SD* = 1.254) being much less frequent and fast-food restaurants (*M* = .55, *SD* = .895), coffees or snack-bars (*M* = .53, *SD* = .993) and canteens (*M* = .60, *SD* = 1.417) even less frequent. Lastly, participants reported eating between three and five times a month beef burger (*M* = 2.80, *SD* = 1.460), between one and three times a month chicken burger (*M* = 2.02, *SD* = 1.421) and once a month, at most, vegetable (*M* = 1.57, *SD* = 1.012) burger.

Participants were randomly assigned to one of five groups:

Negative message - Unfamiliar element label

Negative message - Familiar element label

Positive message - Unfamiliar element label

Positive message - Familiar element label

Control

Forty-six participants were assigned to the “Negative message - Unfamiliar element label” group (N-U), 47 to the “Negative message - Familiar element label” group (N-F), 47 to the “Positive message - Unfamiliar element label” group (P-U), 47 to the “Positive message - Familiar element label” group (P-F) and 43 to control group. No significant sex and age differences were found between conditions.

Materials

Meal options. Two posters representing each one a meal option were created: a 100% beef burger with chips, worth 4.5€, and a 50% beef 50% beans mixed burger, also worth 4.5€ (see Figure 2 and 3). Each menu option contained an image of a burger, a caption, and a carbon label (or no carbon label). The posters were created using Microsoft PowerPoint and the burger image used (see Figure 1) was collected and adapted from mosespreciado (2012).

Figure 1

Mushroom Swiss Burger 1

Note. "Mushroom Swiss Burger 1", by mosespreciado, 2012, is licensed under CC BY 2.0. Obtained from Flickr (https://www.flickr.com/photos/49326400@N00/6870386851).

Messages. Two types of messages were used: one positively framed, and one negatively framed. Both were identical in terms of the information displayed, only differing on its connotative value. Each message comprised a suggestive phrase followed by an informative one. The suggestive phrase presents a plea to the reader to reduce their meat consumption or to increase meat alternatives. The informative phrase informs the reader of relative emission rates between meat and vegetable production. The emission rates were an estimate derived from the BBC carbon footprint calculator (BBC Future, 2021). The negative and positive messages, respectively, were as it follows:

"Decrease your meat intake! Meat production generates up to 10x more CO_2 than vegetable production"

"Choose meat alternatives! Vegetable production generates up to 10x less CO_2 than meat production"

Carbon labels. Two types of carbon labels were also used: an unfamiliar element one (see Figure 2), representing the normally used (static description) scheme of carbon labels and a familiar element one (see Figure 3), which helps the consumer understand carbon information. The unfamiliar element carbon label is composed of a number, depicting the weight (in grams) of the CO_2 emissions associated with the production of a meal and by a brief explanatory caption - "CO_2 emissions per meal". The familiar element carbon label is composed of a figure of a car with an exhaust fumes cloud behind it (left of it). Inside this car there is a number (in kilometres) indicating the distance an average car would need to travel to achieve the equivalent of the CO_2 emissions associated with the production of the meal. On the exhaust fumes cloud there is a "CO_2 emissions" caption.

Figure 2

Menu Options with Unfamiliar Element Carbon Labels

Figure 3

Menu Options with Familiar Element Carbon Labels

Measures

Dependent variables. To collect participants' choices and perceptions about the two products, a set of seven questions were created. We asked participants *"which of the two options presented…*

-do you think you would choose"

-do you think is the tastier"

-do you think is the healthiest"

-do you think is the more sustainable"

-do you think is the most ethical"

-do you think most people would choose"

-do you think most people would approve"

The questions' presentation order was randomized. Participants' answers were registered through a 100-point sliding bar with the endpoints being the beef (left) and the mixed burger (right). Each sliding bar had a movable slider anchored at midpoint (point 50), which participants moved to state their choice and perceptions. Responses closer to 0 (beef burger) or

100 (mixed burger) meant more polarized preferences and perceptions about the beef and mixed burger, respectively. Conversely, responses closer to the midpoint meant more balanced preferences and perceptions about the two options.

Procedure

After answering a brief inquiry about pre-pandemic meal habits, participants were shown the following message:

"Imagine you are in a restaurant and there are two choices on the menu: a burger made with 100% beef, and a mixed burger, made with 50% beef and 50% beans."

Across all conditions, except the control one, participants also saw the phrase *"Imagine also that, next to these options, you find the message...",* followed by the negative or positive framed message. On the next survey page, participants were again shown the assigned condition message (positive or negative) and were presented with the two menu options. Depending on the condition, both options would be accompanied by the familiar or unfamiliar element carbon label, or no label at all (control). Participants were then asked to state their choice and perceptions through seven questions. At the end of the survey participants received a brief explanation about the aim of the study, introduced their email address for the raffle and were thanked for their participation.

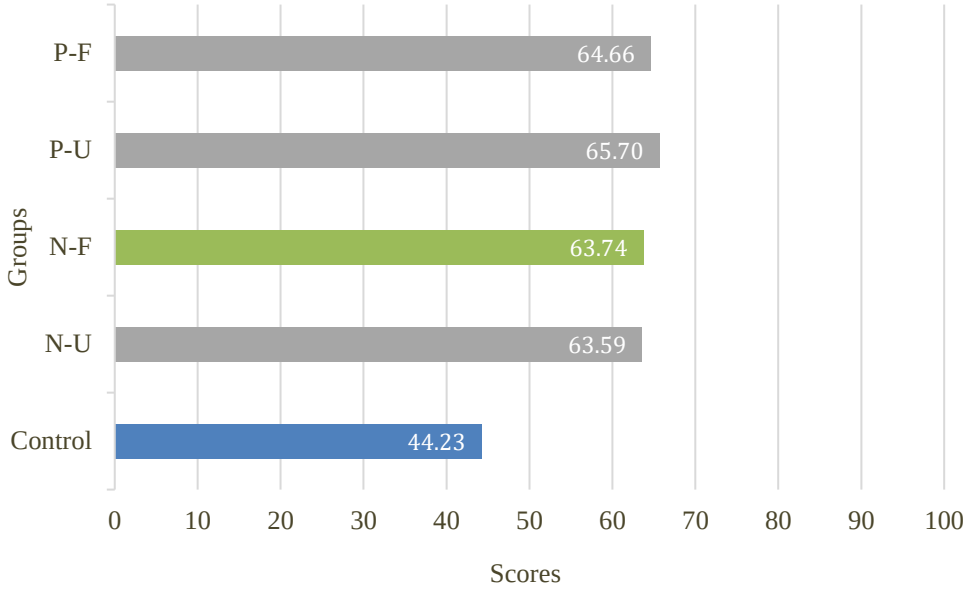
Results

Outcome variables were evaluated in terms of a 0-to-100-point scale in which a sub-50-point response meant a preference for the beef burger option and a plus-50-point response meant a preference for the mixed burger option. Choice averages for all five groups can be seen

in Figure 4. Preliminary analysis showed a significant effect of gender on choice, $F(1,225) = 8.314$, $p = 0.004$ ($M_{male} = 51.42$, $SD_{male} = 41.91$; $M_{female} = 66.66$, $SD_{female} = 37.35$), taste, $F(1,225) = 6.852$, $p = 0.009$ ($M_{male} = 31.71$, $SD_{male} = 34.52$; $M_{female} = 44.28$, $SD_{female} = 36.63$) and ethics, $F(1,225) = 3.913$, $p = 0.049$ ($M_{male} = 77.04$, $SD_{male} = 30.91$; $M_{female} = 84.33$, $SD_{female} = 24.55$). Age, level of education and occupation showed no such interactions.

Figure 4.

Choice Averages Across Groups



Note. Average choices for the control, negative message - unfamiliar element label (N-U), negative message - familiar element label (N-F), positive message - unfamiliar element label (P-U) and positive message - familiar element label (P-F) group. The sub-50-point range represents the beef burger and the plus-50-point range the mixed burger. As shown, manipulation increased willingness to choose the mixed burger option similarly across groups.

Framing and labelling on meal choice: main and combined effects

A two-way ANOVA was conducted to compare the main effects of framing (i.e., negative, and positive) and label familiarity (i.e., familiar, and unfamiliar) as well as their interaction effects on choice scores (see Appendix I for the two-way ANOVA tabulated results). Analysis showed no main effect of framing on choice scores, $F(1, 183) = .072$, $p = .789$, $\eta p2 < .001$, thus rejecting H1 and suggesting that exposing consumers to a negatively framed carbon message does not influence the choice towards a more sustainable meal, relative to a less sustainable meal, more than a positively framed carbon message. There was also no main effect of labelling on choice scores, $F(1, 183) = .006$, $p = .938$, $\eta p2 < .001$, thus rejecting H2 and suggesting that exposing consumers to a familiar element carbon label does not influence the choice towards a more sustainable meal, relative to a less sustainable meal, more than an unfamiliar element carbon label. Finally, results also showed no interaction effect between the type of framing and the type of label used, $F(1, 183) = .011$, $p = .915$, $\eta p2 < .001$, indicating that there was no combined effect for framing and labelling on choice scores (H3). A one-way ANOVA between groups and their average choice scores (see Appendix II) was also conducted, followed by a Planned Comparison test (see Appendix III) that compared the experimental groups average score with the control group average score. Results of the ANOVA showed a significant effect, $F(4,225) = 2.311$, $p = .059$, of groups on average choice scores ($M_{N\text{-}F} = 63.74$, $SD_{N\text{-}F} = 37.18$; $M_{N\text{-}U} = 63.59$, $SD_{N\text{-}U} = 38.17$; $M_{P\text{-}U} = 65.70$, $SD_{P\text{-}U} = 40.40$; $M_{P\text{-}F} = 64.66$, $SD_{P\text{-}F} = 38.57$; $M_{control} = 44.23$, $SD_{control} = 42.99$) and the Planned Comparison test showed that experimental groups average score and control group average score were significantly different, $F(1, 225) = 9.150$, $p < .001$. This confirms H4, which suggests that when compared to a control condition, exposing consumers to either one of the experimental conditions should influence the choice towards a more sustainable meal, relative to a less sustainable meal. We further strengthened this finding through a *post hoc* Dunnett's

test (>control), following the previously mentioned one-way ANOVA, that compared each experimental group to the control one (see Appendix IV for Dunnett's test). Results showed that all experimental groups average choice scores were significantly different from the control group average choice score ($p < .05$).

Experimental conditions on meal perceptions

Analysis of variance (one-way ANOVA) were also conducted between groups and their average perception scores of taste, healthiness, sustainability, ethics, what others would choose and what others would approve, as well as Planned Comparison tests to compare the experimental groups average scores to the control ones. Average perception scores across groups can be seen in Appendix V and VI. Results showed no significant effect of groups on average scores for taste, $F(4, 225) = 1.851$, $p = .120$, healthiness, $F(4, 225) = 1.408$, $p = .232$, sustainability, $F(4, 225) = .480$, $p = .750$, ethics, $F(4, 225) = .742$, $p = .564$, others choice, $F(4, 225) = .202$, $p = .937$, and others approval, $F(4, 225) = .600$, $p = .663$. Planned Comparisons also showed no significant difference between the experimental groups average score and the control group average score for perceptions of taste, $F(1, 225) = 1.704$, $p = .193$, healthiness, $F(1, 225) = 3.263$, $p = .072$, sustainability, $F(1, 225) = 1.175$, $p = .279$, ethics, $F(1, 225) = 1.246$, $p = .265$, others choice, $F(1, 225) = .172$, $p = .679$, and others approval, $F(1, 225) = .000$, $p = .991$. Further exploration through Dunnett' tests for all perceptions showed that only one experimental group average score was significantly different than the control group average score for that perception. Concretely, the P-U group average healthiness perception score ($M_{P\text{-}U} = 90.91$, $SD_{male} = 15.05$) was significantly different ($p = .037$) than the control one ($M_{control} = 78.26$, $SD_{control} = 33.65$). These results suggest that even though exposing any type of framed message and carbon label moves choice towards the more sustainable alternative, the perceptions do not significantly change in favour of this option.

Discussion

The purpose of this study was to assess the effect that a carbon message and a carbon label have on moving choices towards more sustainable food options. Specifically, it was expected that a negatively framed message in combination with a familiar element carbon label would impact choice towards a more sustainable meal. Additionally, it was expected that the negative framing, relative to the positive one, and that the familiar element carbon label, relative to the unfamiliar one, would significantly affect choices towards this option. Contrary to the framing effect expectation, the effect of the negatively framed message did not significantly differ from the positively framed message. This result implies that negativity bias and loss aversion did not influence participants' preference for the more sustainable option. An explanation can be provided considering Higgins's (1997) regulatory focus theory. Namely, consumer preferences and attitudes towards positive or negative ethical product information can also be influenced by the consumer regulatory focus and the corresponding regulatory fit (Grankvist et al., 2004b; Van Dam & De Jonge, 2015). Regulatory focus theory proposes that one of the factors that sways decision making is the motivational aim of the individual. This theory evolved from the notion that individuals have a self-regulatory mechanism that either guides them to approach a goal that has a positive valence or avoid a goal that has a negative valence (Carver et al., 1994). Higgins (1997; as cited in Van Dam & De Jonge, 2015). Approach motives entail promotion focus and avoidance motives entail prevention focus. The objective of promotion focus driven motivation is to satisfy the need for advancement, growth, and accomplishment, in other words, nurturance needs. As for prevention focus, the objective is to satisfy the need for protection, safety, and responsibility, that is, security needs (Higgins, 1997). Promotion focus is defined by the sensitivity to the presence or absence of positive outcomes upon facing gain-nongain situations. Conversely, prevention focus is defined by the sensitivity to the absence or presence of negative outcomes in front of nonloss-loss situations

(Idson et al., 2000). Whenever the motivational aim of the consumer (promotion or prevention focus) is in line with the presentation of alternatives, regulatory fit occurs (Higgins, 2000, 2005). Accordingly, promotion focus matches with information about positive outcomes that can be pursued, and prevention focus matches with information about negative outcomes that can be avoided (Van Dam & De Jonge, 2015). Once regulatory fit is achieved, individuals engage more strongly in their activities, have a feeling of being right and message effectiveness is increased (Higgins, 2005). In this study concretely, it is assumed that the exposure of the positively framed message (gain of quality) to participants with a promotion focus, thus achieving regulatory fit, would have led to a greater influence in participants choices. Conversely, the same effect would have occurred if participants with a prevention would have been shown the negatively framed message (loss of quality; regulatory fit). In turn, if a participant with a promotion focus was shown the negatively framed message or a participant with prevention focus was shown the positively framed message, regulatory fit would not have occurred. Since it was expected that participants that were exposed to the negatively framed message would have had larger choice preference for the more sustainable option, it might have been the case that most participants in this condition had a promotion focus, thus lowering choice preference for the more sustainable option and influencing a greater choice preference for participants in the positively framed message condition.

This study also aimed to test the hypothesis that a familiar element carbon label influences choice towards a more sustainable meal more than an unfamiliar element carbon label. This was not the case, as the effect of the familiar element carbon label did not significantly differ from the effect of the unfamiliar element carbon label. This might have occurred for at least two reasons. For one, the information displayed required a modicum of motivation and cognitive effort to be understood and made use of. Participants most likely noticed the information but, contrary to the message, which was relatively easy to understand,

found it not worth the effort to understand and compare it between the options, thus deciding not to use it. Secondly, participants might have considered the information to be wrong or contradictory and thus unworthy of their attention. This might have happened because the message stated that the difference between meat and vegetable production emissions could be up to a 10-fold factor and in the carbon label the values between the two burgers were only slightly more than double. It is assumed that, much like in health and nutritional statistics, if the information displayed is perceived as misleading or not transparent, the probability of achieving beneficial outcomes is reduced (Hertwig & Grüne-Yanoff, 2017). Although this cannot be assessed with the current data, future research that implements two interventional factors with similar information should consider ways of preventing possible effects of confusion or mistrust.

In combination with the two previously mentioned expectations, we expected that not only exposing consumers to a negatively framed message with a familiar element carbon label would significantly influence choice towards a more sustainable meal, but also that this combination would produce a significantly superior effect than any other type of framing and label combination. By contrast, results suggested that exposing any type of carbon message (either positively or negatively framed) with any type of carbon label (either familiar or unfamiliar element one) could be an effective strategy to move choices towards a more sustainable burger option. Some possible insights can be made following this result. Firstly, participants' awareness of the environmental impact of meat may have been low and the groups that opted for the more sustainable meal (all but control) most likely did so because they were successfully informed about the comparative dimensions of meat versus vegetable and beef burger versus mixed burger GHG emissions, and not because of the way the message was formed. It is, although, important to point out that participants' gender might have influenced the observed levels of shift towards the more sustainable option. Specifically, results showed

that female participants, who accounted for approximately 60% of the sample, were more in favour of choosing the more sustainable burger, thus possibly inflating choices towards this option. This is concordant with several studies that have found that women are more willing to decrease meat consumption than men (e.g., Campbell-Arvai, 2015; De Groeve & Bleys, 2017; Sanchez-Sabate & Sabaté, 2019). Like previous studies (e.g., de Boer et al., 2014, 2016), age and level of education had no such influences. Finally, these results should be viewed according to the fact that the more sustainable meal option was a 50% beef and 50% beans burger and not a 100% plant-based option, which most likely left participants more willing to choose the alternative to the meat burger.

Exploratory analysis showed that participants clearly believed (average scores were above the 75-point mark) that the mixed burger option was the healthier, more sustainable and ethical option and showed that these perceptions were not significantly affected by the message and label manipulation. The same lack of effect could also be observed for perceptions about taste and what others would choose and approve, which remained in favour of the beef burger option. It does not come as a surprise that perceptions about taste and healthiness did not significantly change since the messages and labels did not include information related to these dimensions. But for sustainability and ethics perceptions, it would be assumed that these would increase towards the mixed burger option since they matched the information content of the manipulation. Interestingly enough, the fact that participants' choices moved towards (and even transitioned to) the more sustainable meal upon message and label exposition, but perceptions about others choices and approval remained steady, can suggest the occurrence of pluralistic ignorance (Allport, 1933, as cited in Kunda, 1999). This cognitive bias states that although most individuals of a group privately reject a group norm, they believe that all others accept it. Particularly, participants in this study clearly believe that they possess attitudes and perceptions towards the more sustainable meal option, but also believe that these attitudes and perceptions

are not shared by others. It might also be the case that participants were victims of the above-average effect, also named illusory superiority (see Hoorens, 1993). In other words, participants might have overestimated their own pro-environmental qualities relative to others.

Limitations and future directions

Some limitations of this study can be pointed out. Firstly, it is assumed that participants' pre-intervention knowledge about meat production was low (Camilleri et al., 2019; Hartmann & Siegrist, 2017; Macdiarmid et al., 2016; Sanchez-Sabate & Sabaté, 2019; Truelove & Parks, 2012), but we did not measure the degree of such knowledge in this study, which would strengthen the assumption that participants felt compelled to choose the more sustainable option because they were successfully informed about relative emissions rates between meat and vegetables and between the two burgers. Future studies should have this in consideration. Secondly, the pro-environmental shift shown by participants towards the more sustainable burger may have been influenced by participants' level of environmental concern (e.g., Thøgersen, 2010) or personal norms (e.g., Biel & Thøgersen, 2007; van der Iest et al., 2011). These variables were not included in the analysis. Fortunately, and since this study was conducted individually through an anonymous survey, the probability of participants having opted for the more pro-environmental option because of social enhancement reasons (Griskevicius et al., 2010) is low. Thirdly, the usage of the first phrase in the message ("Decrease your meat intake!" and "Go for meat alternatives!") might have unwantedly functioned as an additional cue that affected meal choices. Particularly, the first phrase in the negative message groups might have had a more imperative connotation than the first phrase in the other groups. This is since asking people to decrease their meat intake is a more explicit and direct appeal (single behaviour) than asking for people to go for meat alternatives (more than one alternative behaviour). Indeed, this might have led participants to respond negatively

to this request, eventually causing psychological reactance[2] (Brehm & Brehm, 2013). Fourthly, the spatial and temporal distance between the message and the meal decision was practically non-existent, since participants saw the message at the same moment they declared their choice and perceptions. It is assumed that in collective meals contexts this distance is larger, which in turn might lower the probability for consumers to base their choices on messages. Finally, the setting proposed for participants to imagine they were in may have influenced the meal options. Specifically, upon presenting the message and the menu options with the carbon labels, participants were asked to imagine that they were in a restaurant. The survey was designed this way because it was assumed that a lot more consumers go to restaurants than other collective meal contexts. This may have lowered average choices for the more sustainable burger because people are usually more focused on having hedonic experiences when going to restaurants compared to when going to cafeterias, for example. Future studies should base their research following the previously mentioned discussion and limitations. They should include not only strategies that influence decisions between full meat-based meals against mixed protein-based meals but also strategies that leverage full plant-based alternatives. Moreover, future research directions should also accommodate the study of factors that influence different meal choices, account for any possible confusion or backfire effects that can emerge in consumer communication and explore the dynamics of bringing nudges and boosts together. In conclusion, efforts should be directed towards reproducing and finding new simple, practical, and well-designed strategies that effectively influence environmentally friendly food choices. This comes as a must if we are to succeed in lowering the harmful effects that meat overconsumption yields on the environment.

[2] Psychological reactance is defined by the motivational state that one might be found in when confronted with situations (e.g., requests, rules) that threaten his/her sense of freedom. If this is the case, the subject might indulge in unexpected and unintended behaviours to try to preserve his/her sense of freedom.

Conclusions

This study aimed to explore the effect of a two-factor behavioural intervention (i.e., negatively/positively framed carbon message and familiar/unfamiliar element carbon label) on willingness to choose a mixed beef and beans burger, relative to a beef burger. The findings showed that the negative framing effect did not significantly differ from the positive framing effect, that the familiar element effect did not significantly differ from the unfamiliar element effect, and that no combined effect was found between the framing and the familiarity of elements. All experimental groups' choices were significantly affected by the presence of any type of message and label. This suggests that carbon messages and carbon labels may be effective to encourage consumers' choices towards more sustainable meal options, independently of frame and familiarity features used in the communication products (i.e., message and label). In other words, this suggests that simply conveying information about the environmental impact of different meal options may - on some occasions - be sufficient to encourage more sustainable food choices.

References

aan den Toorn, S. I., van den Broek, M. A., & Worrell, E. (2017). Decarbonising meat: Exploring greenhouse gas emissions in the meat sector. *Energy Procedia*, *123*, 353–360. https://doi.org/10.1016/j.egypro.2017.07.268

Alexandratos, N., & Bruinsma, J. (2012, Junho 11). *World agriculture towards 2030/2050: The 2012 revision*. AgEcon Search. https://doi.org/10.22004/ag.econ.288998

Allport, F. H. (1933). Institutional Behavior. Essays to a Re-Interpreting of contemporary social Organization.

Anderson, N. H. (1974). Cognitive algebra: Integration theory applied to social attribution. Em L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 7, pp. 1–101). Academic Press. https://doi.org/10.1016/S0065-2601(08)60035-0

Babakhani, N., Lee, A., & Dolnicar, S. (2020). Carbon labels on restaurant menus: Do people pay attention to them? *Journal of Sustainable Tourism*, *28*(1), 51–68. https://doi.org/10.1080/09669582.2019.1670187

BBC Future. (2021, Fevereiro 5). *Calculate the 'foodprint' of what you eat*. BBC Future. https://www.bbc.com/future/bespoke/follow-the-food/calculate-the-environmental-footprint-of-your-food.html

Bennett, M. K. (1941). Wheat in national diets. *Wheat Studies*, *18*(1388-2016-116736), 37-76.

Biel, A., & Thøgersen, J. (2007). Activation of social norms in social dilemmas: A review of the evidence and reflections on the implications for environmental behaviour. *Journal of Economic Psychology*, *28*(1), 93–112. https://doi.org/10.1016/j.joep.2006.03.003

Brehm, S. S., & Brehm, J. W. (2013). *Psychological reactance: A theory of freedom and control*. Academic Press.

Brunner, F., Kurz, V., Bryngelsson, D., & Hedenus, F. (2018). Carbon label at a university restaurant – label implementation and evaluation. *Ecological Economics*, *146*, 658–667. https://doi.org/10.1016/j.ecolecon.2017.12.012

Camilleri, A. R., Larrick, R. P., Hossain, S., & Patino-Echeverri, D. (2019). Consumers underestimate the emissions associated with food but are aided by labels. *Nature Climate Change*, *9*(1), 53–58. https://doi.org/10.1038/s41558-018-0354-z

Campbell, S. D., & Sharpe, S. A. (2009). Anchoring bias in consensus forecasts and its effect on market prices. *Journal of Financial and Quantitative Analysis*, *44*(2), 369–390. https://doi.org/10.1017/S0022109009090127

Campbell-Arvai, V. (2015). Food-related environmental beliefs and behaviours among university undergraduates: A mixed-methods study. *International Journal of Sustainability in Higher Education*, *16*(3), 279–295.https://doi.org/10.1108/IJSHE-06-2013-0071

Carbon Trust. (2020, Abril 21). *Product carbon footprint labelling: Consumer research 2020.* Accessed 13 October 2021. https://www.carbontrust.com/resources/product-carbon-footprint-labelling-consumer-research-2020

Carpenter, J. N., & Lynch, A. W. (1999). Survivorship bias and attrition effects in measures of performance persistence. *Journal of Financial Economics*, *54*(3), 337–374. https://doi.org/10.1016/S0304-405X(99)00040-9

Carver, C. S., Reynolds, S. L., & Scheier, M. F. (1994). The possible selves of optimists and pessimists. *Journal of Research in Personality*, *28*(2), 133–141. https://doi.org/10.1006/jrpe.1994.1011

Collins, E. I. M., Thomas, J. M., Robinson, E., Aveyard, P., Jebb, S. A., Herman, C. P., & Higgs, S. (2019). Two observational studies examining the effect of a social norm and a health message on the purchase of vegetables in student canteen settings. *Appetite*, *132*, 122–130. https://doi.org/10.1016/j.appet.2018.09.024

Cook, J., Oreskes, N., Doran, P. T., Anderegg, W. R. L., Verheggen, B., Maibach, E. W., Carlton, J. S., Lewandowsky, S., Skuce, A. G., Green, S. A., Nuccitelli, D., Jacobs, P., Richardson, M., Winkler, B., Painting, R., & Rice, K. (2016). Consensus on consensus: A synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters*, *11*(4), 048002. https://doi.org/10.1088/1748-9326/11/4/048002

Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N., & Leip, A. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*, *2*(3), 198–209. https://doi.org/10.1038/s43016-021-00225-9

de Boer, J., de Witt, A., & Aiking, H. (2016). Help the climate, change your diet: A cross-sectional study on how to involve consumers in a transition to a low-carbon society. *Appetite*, *98*, 19–27. https://doi.org/10.1016/j.appet.2015.12.001

de Boer, J., Schösler, H., & Aiking, H. (2014). "Meatless days" or "less but better"? Exploring strategies to adapt western meat consumption to health and sustainability challenges. *Appetite*, *76*, 120–128. https://doi.org/10.1016/j.appet.2014.02.002

De Groeve, B., & Bleys, B. (2017). Less meat initiatives at ghent university: Assessing the support among students and how to increase it. *Sustainability*, *9*(9), 1550. https://doi.org/10.3390/su9091550

Egan, M. (2013). Nudge Database v1. 2. *University of Stirling.* Accessed 15 October 2021 *https://www.stir.ac.uk/media/schools/management/documents/economics/Nudge%20Database, 201*.

FAO, FAOSTAT (2018). *Data*. Food and Agriculture Organization of the United Nations. Accessed 10 July 2021. <www.fao.org/faostat/en/?#data>

Feucht, Y., & Zander, K. (2018). Consumers' preferences for carbon labels and the underlying reasoning. A mixed methods approach in 6 european countries. *Journal of Cleaner Production*, *178*, 740–748. https://doi.org/10.1016/j.jclepro.2017.12.236

Fiske, S. T. (1980). Attention and weight in person perception: The impact of negative and extreme behavior. *Journal of Personality and Social Psychology*, *38*(6), 889–906. https://doi.org/10.1037/0022-3514.38.6.889

Gerber, P. J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A., & Tempio, G. (2013). Tackling climate change through livestock: A global assessment of emissions and mitigation opportunities. *Tackling Climate Change through Livestock: A Global Assessment of Emissions and Mitigation Opportunities.* Accessed 5 July 2021 https://www.cabdirect.org/cabdirect/abstract/20133417883

Gilovich, T., Griffin, D., Kahneman, D., & Press, C. U. (2002). *Heuristics and biases: The psychology of intuitive judgment*. Cambridge University Press.

Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., Pierrehumbert, R. T., Scarborough, P., Springmann, M., & Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science*, *361*(6399). https://doi.org/10.1126/science.aam5324

Graça, J., Godinho, C. A., & Truninger, M. (2019). Reducing meat consumption and following plant-based diets: Current evidence and future directions to inform integrated transitions. *Trends in Food Science & Technology*, *91*, 380–390. https://doi.org/10.1016/j.tifs.2019.07.046

Grankvist, G., Dahlstrand, U., & Biel, A. (2004a). The impact of environmental labelling on consumer preference: Negative vs. positive labels. *Journal of Consumer Policy*, *27*(2), 213–230. https://doi.org/10.1023/B:COPO.0000028167.54739.94

Grankvist, G., Dahlstrand, U., & Biel, A. (2004b). The Impact of Environmental Labelling on Consumer Preference: Negative vs. Positive Labels. *Journal of Consumer Policy*, *27*(2), 213–230. https://doi.org/10.1023/B:COPO.0000028167.54739.94

Griskevicius, V., Tybur, J. M., & Van den Bergh, B. (2010). Going green to be seen: Status, reputation, and conspicuous conservation. *Journal of Personality and Social Psychology*, *98*(3), 392–404. https://doi.org/10.1037/a0017346

Grüne-Yanoff, T., & Hertwig, R. (2016). Nudge Versus Boost: How Coherent are Policy and Theory? *Minds and Machines*, *26*(1), 149–183. https://doi.org/10.1007/s11023-015-9367-9

Guenther, M., Saunders, C. M., & Tait, P. R. (2012). Carbon labeling and consumer attitudes. *Carbon Management*, *3*(5), 445–455. https://doi.org/10.4155/cmt.12.50

Hartikainen, H., Roininen, T., Katajajuuri, J.-M., & Pulkkinen, H. (2014). Finnish consumer perceptions of carbon footprints and carbon labelling of food products. *Journal of Cleaner Production*, *73*, 285–293. https://doi.org/10.1016/j.jclepro.2013.09.018

Hartmann, C., & Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology*, *61*, 11–25. https://doi.org/10.1016/j.tifs.2016.12.006

Herrero, M., Gerber, P., Vellinga, T., Garnett, T., Leip, A., Opio, C., Westhoek, H. J., Thornton, P. K., Olesen, J., Hutchings, N., Montgomery, H., Soussana, J.-F., Steinfeld, H., & McAllister, T. A. (2011). Livestock and greenhouse gas emissions: The importance of getting the numbers right. *Animal Feed Science and Technology*, *166–167*, 779–782. https://doi.org/10.1016/j.anifeedsci.2011.04.083

Hertwig, R., & Grüne-Yanoff, T. (2017). Nudging and boosting: Steering or empowering good decisions. *Perspectives on Psychological Science*, *12*(6), 973–986. https://doi.org/10.1177/1745691617702496

Herzog, T. (2009). *World Greenhouse Gas Emissions in 2005*. Accessed 20 October 2021. https://www.wri.org/research/world-greenhouse-gas-emissions-2005

Higgins, E. T. (1997). Beyond pleasure and pain. *The American Psychologist*, *52*(12), 1280–1300. https://doi.org/10.1037//0003-066x.52.12.1280

Higgins, E. T. (2000). Making a good decision: Value from fit. *American Psychologist*, *55*(11), 1217–1230. https://doi.org/10.1037/0003-066X.55.11.1217

Higgins, E. T. (2005). Value from regulatory fit. *Current Directions in Psychological Science*, *14*(4), 209–213. https://doi.org/10.1111/j.0963-7214.2005.00366.x

Hoorens, V. (1993). Self-enhancement and superiority biases in social comparison. *European Review of Social Psychology*, *4*(1), 113–139. https://doi.org/10.1080/14792779343000040

Horgen, K. B., & Brownell, K. D. (2002). Comparison of price change and health message interventions in promoting healthy food choices. *Health Psychology*, *21*(5), 505–512. https://doi.org/10.1037//0278-6133.21.5.505

Idson, L. C., Liberman, N., & Higgins, E. T. (2000). Distinguishing gains from nonlosses and losses from nongains: A regulatory focus perspective on hedonic intensity. *Journal of Experimental Social Psychology*, *36*(3), 252–274. https://doi.org/10.1006/jesp.1999.1402

Kahneman, D., & Tversky, A. (1979). On the interpretation of intuitive probability: A reply to Jonathan Cohen. *Cognition*, *7*(4), 409-411.

Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist*, *58*(9), 697–720. https://doi.org/10.1037/0003-066X.58.9.697

Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.

Kause, A., Bruin, W. B. de, Millward-Hopkins, J., & Olsson, H. (2019). Public perceptions of how to reduce carbon footprints of consumer food choices. *Environmental Research Letters*, *14*(11), 114005. https://doi.org/10.1088/1748-9326/ab465d

Klein, G. (1999). Sources of Power: How People Make Decisions. Em *MIT Press Books* (Vol. 1). The MIT Press. https://ideas.repec.org/b/mtp/titles/0262611465.html

Koistinen, L., Pouta, E., Heikkilä, J., Forsman-Hugg, S., Kotro, J., Mäkelä, J., & Niva, M. (2013). The impact of fat content, production methods and carbon footprint information on consumer preferences for minced meat. *Food Quality and Preference*, *29*(2), 126–136. https://doi.org/10.1016/j.foodqual.2013.03.007

Kunda, Z. (1999). *Social cognition: Making sense of people*. MIT Press.

Levin, I. P., Schneider, S. L., & Gaeth, G. J. (1998). All frames are not created equal: A typology and critical analysis of framing effects. *Organizational Behavior and Human Decision Processes*, *76*(2), 149–188. https://doi.org/10.1006/obhd.1998.2804

Lewicka, M. (1998). Confirmation Bias. In M. Kofta, G. Weary, & G. Sedek (Eds.), *Personal Control in Action: Cognitive and Motivational Mechanisms* (pp. 233–258). Springer US. https://doi.org/10.1007/978-1-4757-2901-6_9

Liu, T., Wang, Q., & Su, B. (2016). A review of carbon labeling: Standards, implementation, and impact. *Renewable and Sustainable Energy Reviews*, *53*, 68–79. https://doi.org/10.1016/j.rser.2015.08.050

Macdiarmid, J. I., Douglas, F., & Campbell, J. (2016). Eating like there's no tomorrow: Public awareness of the environmental impact of food and reluctance to eat less meat as part of a sustainable diet. *Appetite*, *96*, 487–493. https://doi.org/10.1016/j.appet.2015.10.011

Marteau, T. M. (2017). Towards environmentally sustainable human behaviour: Targeting non-conscious and conscious processes for effective and acceptable policies. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *375*(2095), 20160371. https://doi.org/10.1098/rsta.2016.0371

Mekonnen, M. M., & Hoekstra, A. Y. (2012). A global assessment of the water footprint of farm animal products. *Ecosystems*, *15*(3), 401–415. https://doi.org/10.1007/s10021-011-9517-8

Miniard, D., Kantenbacher, J., & Attari, S. Z. (2020). Shared vision for a decarbonized future energy system in the united states. *Proceedings of the National Academy of Sciences*, *117*(13), 7108–7114. https://doi.org/10.1073/pnas.1920558117

Mosespreciado (2013). *Mushroom Swiss Burger 1* [Photograph]. Flickr. https://www.flickr.com/photos/49326400@N00/6870386851

Oaksford, M., & Chater, N. (2009). Précis of bayesian rationality: The probabilistic approach to human reasoning. *Behavioral and Brain Sciences*, *32*(1), 69–84. https://doi.org/10.1017/S0140525X09000284

Phillips, L. D. (1983). A theoretical perspective on heuristics and biases in probabilistic thinking. In P. Humphreys, O. Svenson, & A. Vári (Eds.), *Advances in Psychology* (Vol. 14, pp. 525–543). North-Holland. https://doi.org/10.1016/S0166-4115(08)62256-6

Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4ns. *Appetite*, *91*, 114–128. https://doi.org/10.1016/j.appet.2015.04.011

Prusaczyk, E., Earle, M., & Hodson, G. (2021). A brief nudge or education intervention delivered online can increase willingness to order a beef-mushroom burger. *Food Quality and Preference*, *87*, 104045. https://doi.org/10.1016/j.foodqual.2020.104045

Pulkkinen, H., Roininen, T., Katajajuuri, J.-M., & Järvinen, M. (2016). Development of a climate choice meal concept for restaurants based on carbon footprinting. *The International Journal of Life Cycle Assessment*, *5*(21), 621–630. https://doi.org/10.1007/s11367-015-0913-8

Ramankutty, N., & Foley, J. A. (1999). Estimating historical changes in global land cover: Croplands from 1700 to 1992. *Global Biogeochemical Cycles*, *13*(4), 997–1027. https://doi.org/10.1029/1999GB900046

Reinders, M. J., Huitink, M., Dijkstra, S. C., Maaskant, A. J., & Heijnen, J. (2017). Menu-engineering in restaurants - adapting portion sizes on plates to enhance vegetable consumption: A real-life experiment. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 41. https://doi.org/10.1186/s12966-017-0496-9

Robinson, E., Thomas, J., Aveyard, P., & Higgs, S. (2014). What everyone else is eating: A systematic review and meta-analysis of the effect of informational eating norms on eating behavior. *Journal of the Academy of Nutrition and Dietetics*, *114*(3), 414–429. https://doi.org/10.1016/j.jand.2013.11.009

Robinson, E., Tobias, T., Shaw, L., Freeman, E., & Higgs, S. (2011). Social matching of food intake and the need for social acceptance. *Appetite*, *56*(3), 747–752. https://doi.org/10.1016/j.appet.2011.03.001Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, *5*(4), 296–320. https://doi.org/10.1207/S15327957PSPR0504_2

Rozin, P., Scott, S. E., Dingley, M., Urbanek, J., Jiang, H., & Kaltenbach, M. (2011). Nudge to nobesity I: Minor changes in accessibility decrease food intake. *Judgment and Decision Making*, 323–332.

Salvy, S.-J., Jarrin, D., Paluch, R., Irfan, N., & Pliner, P. (2007). Effects of social influence on eating in couples, friends and strangers. *Appetite*, *49*(1), 92–99. https://doi.org/10.1016/j.appet.2006.12.004

Sanchez-Sabate, R., & Sabaté, J. (2019). Consumer attitudes towards environmental concerns of meat consumption: A systematic review. *International Journal of Environmental Research and Public Health*, *16*(7), 1220. https://doi.org/10.3390/ijerph16071220

Saulais, L., Massey, C., Perez-Cueto, F. J. A., Appleton, K. M., Dinnella, C., Monteleone, E., Depezay, L., Hartwell, H., & Giboreau, A. (2019). When are "Dish of the Day" nudges most effective to increase vegetable selection? *Food Policy*, *85*, 15–27. https://doi.org/10.1016/j.foodpol.2019.04.003

Scarborough, P., Matthews, A., Eyles, H., Kaur, A., Hodgkins, C., Raats, M. M., & Rayner, M. (2015). Reds are more important than greens: How uk supermarket shoppers use the different information on a traffic light nutrition label in a choice experiment. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 151. https://doi.org/10.1186/s12966-015-0319-9

Schwarz, N. (1990). Feelings as information: Informational and motivational functions of affective states. Em *Handbook of motivation and cognition: Foundations of social behavior, Vol. 2.* (pp. 527–561). The Guilford Press.

Slapø, H. B., & Karevold, K. I. (2019). Simple eco-labels to nudge customers toward the most environmentally friendly warm dishes: An empirical study in a cafeteria setting. *Frontiers in Sustainable Food Systems*, *3*. https://doi.org/10.3389/fsufs.2019.00040

Sparkman, G., & Walton, G. M. (2017). Dynamic norms promote sustainable behavior, even if it is counternormative. *Psychological Science*, *28*(11), 1663–1674. https://doi.org/10.1177/0956797617719950

Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M., & De Haan, C. (2006). *Livestock's long shadow: Environmental issues and options*. FAO. Accessed 29 September 2021. http://agritrop.cirad.fr/553609/1/document_553609.pdf

Thaler, R. H., & Sunstein, C. R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. Yale University Press.

Thøgersen, J. (2010). Country Differences in Sustainable Consumption: The Case of Organic Food. *Journal of Macromarketing*, *30*(2), 171–185. https://doi.org/10.1177/0276146710361926

Thorndike, A. N., Riis, J., & Levy, D. E. (2016). Social norms and financial incentives to promote employees' healthy food choices: A randomized controlled trial. *Preventive Medicine*, *86*, 12–18. https://doi.org/10.1016/j.ypmed.2016.01.017

Thorndike, A. N., Sonnenberg, L., Riis, J., Barraclough, S., & Levy, D. E. (2012). A 2-phase labeling and choice architecture intervention to improve healthy food and beverage choices. *American Journal of Public Health*, *102*(3), 527–533. https://doi.org/10.2105/AJPH.2011.300391

Tilman, D., Balzer, C., Hill, J., & Befort, B. L. (2011). Global food demand and the sustainable intensification of agriculture. *Proceedings of the National Academy of Sciences*, *108*(50), 20260–20264. https://doi.org/10.1073/pnas.1116437108

Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, *117*(2), 440–463. https://doi.org/10.1037/a0018963

Truelove, H. B., & Parks, C. (2012). Perceptions of behaviors that cause and mitigate global warming and intentions to perform these behaviors. *Journal of Environmental Psychology*, *32*(3), 246–259. https://doi.org/10.1016/j.jenvp.2012.04.002

Turnwald, B. P., Boles, D. Z., & Crum, A. J. (2017). Association between indulgent descriptions and vegetable consumption: Twisted carrots and dynamite beets. *JAMA Internal Medicine*, *177*(8), 1216. https://doi.org/10.1001/jamainternmed.2017.1637

Tversky, A., & Kahneman, D. (1985). The Framing of Decisions and the Psychology of Choice. In G. Wright (Ed.), *Behavioral Decision Making* (pp. 25–41). Springer US. https://doi.org/10.1007/978-1-4613-2391-4_2

Tversky, A., & Kahneman, D. (1991). Loss aversion in riskless choice: A reference-dependent model. *The Quarterly Journal of Economics*, *106*(4), 1039–1061. https://doi.org/10.2307/2937956

Upham, P., Dendler, L., & Bleda, M. (2011). Carbon labelling of grocery products: Public perceptions and potential emissions reductions. *Journal of Cleaner Production*, *19*(4), 348–355. https://doi.org/10.1016/j.jclepro.2010.05.014

US EPA, O. (2016, Janeiro 12). *Global Greenhouse Gas Emissions Data* [Overviews and Factsheets]. Acessed 20 September 2021. https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data

U.S. Global Change Research Program, Wuebbles, D. J., Fahey, D. W., Hibbard, K. A., Dokken, D. J., Stewart, B. C., & Maycock, T. K. (2017). *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. U.S. Global Change Research Program. https://doi.org/10.7930/J0J964J6

Valin, H., Sands, R. D., Mensbrugghe, D. van der, Nelson, G. C., Ahammad, H., Blanc, E., Bodirsky, B., Fujimori, S., Hasegawa, T., Havlik, P., Heyhoe, E., Kyle, P., Mason-D'Croz, D., Paltsev, S., Rolinski, S., Tabeau, A., Meijl, H. van, Lampe, M. von, & Willenbockel, D. (2014). The future of food demand: Understanding differences in global economic models. *Agricultural Economics*, *45*(1), 51–67. https://doi.org/10.1111/agec.12089

Van Dam, Y. K., & De Jonge, J. (2015). The positive side of negative labelling. *Journal of Consumer Policy, 38*(1), 19–38. https://doi.org/10.1007/s10603-014-9274-0

van der Iest, H., Dijkstra, J., & Stokman, F. N. (2011). Not 'Just the two of us': Third party externalities of social dilemmas. *Rationality and Society, 23*(3), 347–370. https://doi.org/10.1177/1043463111412716

Verheggen, B., Strengers, B., Cook, J., van Dorland, R., Vringer, K., Peters, J., Visser, H., & Meyer, L. (2014). Scientists' views about attribution of global warming. *Environmental Science & Technology*, *48*(16), 8963–8971. https://doi.org/10.1021/es501998e

Ward, M. H., deKok, T. M., Levallois, P., Brender, J., Gulis, G., Nolan, B. T., & VanDerslice, J. (2005). Workgroup report: Drinking-water nitrate and health—recent findings and research needs. *Environmental Health Perspectives, 113*(11), 1607–1614. https://doi.org/10.1289/ehp.8043

Wellesley, L., Froggatt, A., & Happer, C. (2015, Novembro 24). *Changing climate, changing diets: Pathways to lower meat consumption*. Chatham House – International Affairs Think Tank. Accessed 25 October 2021. https://www.chathamhouse.org/2015/11/changing-climate-changing-diets-pathways-lower-meat-consumption

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., Vries, W. D., Sibanda, L. M., … Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet, 393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

Zhao, R., Min, N., Geng, Y., & He, Y. (2017). Allocation of carbon emissions among industries/sectors: An emissions intensity reduction constrained approach. *Journal of Cleaner Production*, *142*, 3083–3094. https://doi.org/10.1016/j.jclepro.2016.10.159

Zhao, R., Wu, D., & Patti, S. (2020). A bibliometric analysis of carbon labeling schemes in the period 2007–2019. *Energies*, *13*(16), 4233. https://doi.org/10.3390/en13164233

Appendixes

Appendix I. Two-way ANOVA results (Choice)

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*	partial η2
(Intercept)	776051.153	1	776051.153	520.854	< .001	.740
Framing	107.297	1	107.297	.072	.789	.000
Familiarity	9.150	1	9.150	.006	.938	.000
Frame x Familiarity	16.836	1	16.836	.011	.915	.000
Error	272662.471	183	1489.959		.	

Note. Dependent variable was choice. Framing variable includes negative and positive framing. Label variable includes familiar element and unfamiliar element. As shown, no main effects of framing and familiarity, and no combined effect of framing and familiarity were seen.

Appendix II. One-way ANOVA between groups and their average choice scores

		Sum of Squares	*df*	Mean Square	*F*	*p*	η2
Choice	Between groups	14392.028	4	3598.007	2.311	.059	.039
	Within groups	350298.146	225	1556.881			
	Total	364690.174	229				

Note. As shown, there is a marginally significant effect of groups on choice scores.

Appendix III. Planned Comparison

		Sum of Squares	*df*	Mean Square	*F*	*p*
Contrast	Effect	14252,18	1	14252,18	9.150	.000*
	Error	350298,15	225	1556,88		

Note. Planned comparison tests if the experimental groups average score is significantly different than the control group average score.

*. Indicates $p < .001$

Appendix IV. Dunnett's t (>control) *post hoc* test (Choice)

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	*p*	Lower Bound[b]
Dunnett t[a]	N-U	control	19.354	8.370	.036*	1.22
	N-F	control	19.512	8.327	.033*	1.47
	P-U	control	21.470	8.327	.018*	3.43
	P-F	control	20.427	8.327	.025*	2.39

Note. Dunnett' t-test compared all experimental groups' choice averages against the control choice average.

* indicates $p < .05$

a. Dunnet t-test treats one group as a control, and compare all other groups against it

b. 95% Confidence Interval

Appendix V. Average perception scores for Taste, Healthiness, Sustainability and Ethics, across groups.

Groups	Means (SD)			
	Taste	Healthiness	Sustainability	Ethics
Control	33.02 (37.86)	78.26 (33.65)	85.49 (28.66)	76.98 (31.83)
N-U	45.11 (35.48)	86.28 (22.74)	88.28 (22.06)	81.67 (27.43)
N-F	37.34 (35.69)	83.11 (29.03)	89.21 (23.67)	79.09 (29.61)
P-U	48.74 (38.65)	90.91* (15.05)	92.00 (14.31)	86.38 (20.14)
P-F	32.74 (32.48)	84.62 (26.89)	88.98 (22.15)	81.60 (27.86)
Total	39.48 (36.33)	84.74 (26.19)	88.85 (22.42)	81.21 (27.52)

Note. The sub-50-point range represents the beef burger and the plus-50-point range the mixed burger. Groups' average scores for perceptions of Taste positioned in the sub-50-point range, indicating that participants found the beef burger tastier. All other groups' averages positioned in the plus-50-point range, indicating they find the mixed burger as being more healthy, sustainable, and ethical. Positive message – unfamiliar element label group (P-U) average score for perception of Healthiness is significantly different than the control group.

* indicates $p < .05$ for Dunnett's test which compared all experimental groups against the control condition

Appendix VI. Average perception scores for Others Choice and Others Approval, across groups.

Groups	Means (SD)	
	Others Choice	Others Approval
Control	19,70 (30,60)	37,67 (38,30)
N-U	23,09 (28,48)	43,63 (35,39)
N-F	22,06 (27,07)	38,96 (37,91)
P-U	22,47 (26,90)	35,79 (34,99)
P-F	18,91 (25,09)	32,60 (32,67)
Total	21,27 (27,44)	37,70 (35,74)

Note. The sub-50-point range represents the beef burger and the plus-50-point range the mixed burger. Groups' average scores for perceptions of Others Choice and Others Approval positioned in the sub-50-point range, indicating that participants believe that others would choose and approve the beef burger over the mixed burger.