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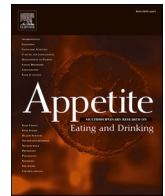
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# Do EU consumers think about meat reduction when considering to eat a healthy, sustainable diet and to have a role in food system change?

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## ABSTRACT

This paper aims to highlight the position of meat reduction in what EU consumers think “eating a healthy and sustainable diet” involves and who has a role to play in achieving food system change. The data are based on the Eurobarometer 93.2 survey (mid 2020). The participants were asked to make their own selections out of a variety of food-related items and actors, linked to meat (“Eating meat less often”) and other aspects of diets (“Eating more fruit and vegetables”). Their responses were analyzed separately in two EU regions: Northwest Europe—consisting of the 10 richest EU countries with the highest scores on economic and social sustainable development indicators— and the East and the South. Three principal components of dietary thinking were distinguished, relating to 1) nutrition issues, 2) easy “light green” issues and 3) more demanding “deeper green” issues, respectively. The analysis also distinguished three types of actors in the value chain (food chain actors, supporting actors, and governmental actors). In Northwestern Europe, a majority of consumers saw a role for themselves in making the food system more sustainable and a large minority saw meat reduction as part of a healthy and sustainable diet. Both responses were much less common in the East and South. In the Northwest, meat reduction was relatively strongly related to “deeper green” thinking but also weakly to nutrition-focused thinking, whereas the opposite was found in the East and South. However, meat reduction had no prominent position in their considerations. For policy-makers, therefore, it is crucial that both nutrition and environment can be motivating factors for consumers to consider meat reduction, albeit to different degrees.

## 1. Introduction

In many countries, there is an increasing awareness and recognition of the necessity to change Western eating practices, for both health and environmental reasons. This is reflected by many scientific publications on these topics, such as the report by the EAT Lancet Commission on Food, Planet, Health (Willett et al., 2019). This report indicates that a change towards healthy diets from sustainable food systems will have important consequences for the consumption of animal protein, as reductions of (on average) more than 50% are recommended for the coming decades. Based on scientific evidence, the national authorities who provide consumers with Food-Based Dietary Guidelines (FBDGs) are increasingly revising their guidelines, which now recommend consumers to reduce (or replace) the intake of animal protein (de Boer & Aiking, 2021b; Scherer, Behrens, & Tukker, 2019). In addition, recent zoonotic outbreaks, such as the COVID-19 pandemic, have led to an increasing public awareness of these risks, but the literature offers no clear evidence of how this will shape the future of meat consumption,

apart from some short-term changes (Attwood & Hajat, 2020; Niemiec, Jones, Mertens, & Dillard, 2021). Yet, policy-makers have to address urgent questions about how major shifts in diet can be supported, given the existing preferences for meat because of its nutritional content and traditional significance (Graça, Godinho, & Truninger, 2019; Hoek, Pearson, James, Lawrence, & Friel, 2017; Päivrinta et al., 2020). In addition, many stakeholders are trying to nudge protein choices in other directions, using various kinds of marketing techniques to promote meat or high protein intake in general (Chen & Eriksson, 2019; Ocejo, 2014). Also, there are social media protests against “anti-meat agendas” (Garcia, Galaz, & Daume, 2019; Olausson, 2018) although even producers of meat alternatives avoid on-package messages that would place meat in an unfavorable light (Armstrong Soule & Sekhon, 2019). Hence, given the urgency of these matters and the potential controversies associated with meat-related recommendations, an important question is how the prospect of meat reduction is currently perceived by consumers.

The present paper addresses this question based on survey data collected by the European Union (EU), which often uses questions in

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public opinion surveys (Eurobarometer) for policy development purposes (Haverland, De Ruiter, & Van de Walle, 2018). The survey (Eurobarometer 93.2) was carried out in the 27 Member States of the EU during the COVID-19 pandemic in 2020 (European Commission, 2020b). In this case, the aim was to gauge consumers' appetite for change, which should be seen in the context of EU's new Farm to Fork (F2F) Strategy for a fair, healthy and environmentally-friendly food system (European Commission, 2020a). The ambition of the F2F strategy is to tackle climate change, protect the environment and preserve biodiversity, simultaneously. Although F2F has a strong focus on the production side of food systems, it also aims to change consumption patterns. The EU notes that "Moving to a more plant-based diet with less red and processed meat and with more fruits and vegetables will reduce not only risks of life-threatening diseases, but also the environmental impact of the food system" (European Commission, 2020a, p. 14). Hence, meat reduction has been carefully placed in a broader context and that is also the approach taken in Eurobarometer 93.2, which asks consumer what they think "eating a healthy and sustainable diet" involves, with "Eating meat less often" as one of the fifteen answers that could be chosen.

The question about what "eating a healthy and sustainable diet" involves refers, in fact, to an extremely complex problem, which embraces the full length of the food chain and its interactions within its wider socioeconomic and environmental settings, including short- and long-term public health considerations and cultural dimensions of consumption (Rayner, Barling, & Lang, 2008). EU's notion of "healthy and sustainable diets" is a recent and still evolving development in EU policy-making. This multi-faceted concept comes with some inherent trade-offs, for example, between nutritional and environmental repercussions of particular food choices; i.e. fish has several benefits that make it a desirable part of a healthy diet (Thilsted et al., 2016), but public health institutes have reasons to consider the optimum number of fish servings per week, beyond which there are no additional health gains, but only sustainability losses due to overfishing (Kromhout, Spaaij, de Goede, & Weggemans, 2016). Also, there is still a serious lack of knowledge about many sustainability issues, for instance, regarding the benefits and costs of organic agriculture when controlling for lower organic yields (Seufert & Ramankutty, 2017), and, more generally, the trade-offs and co-benefits of high-vs lower-yield systems (Balmford et al., 2018). Yet, the recent EU strategy has been welcomed as an integrated approach, which significantly broadens the range of environmental issues linked to food production and consumption (Schebesta & Candel, 2020). This integration will be new to many stakeholders, particularly to consumers.

### 1.1. Consumer beliefs about the environmental repercussions of food consumption

The way in which consumer decisions throughout the consumption process are being influenced by environment-related criteria depends on both the persons and the choices they face (Peattie, 2001). In this paper, a person's level of environmental orientation is often characterized by different shades of grey and green: "Grey" consumers show little interest in the environment and are skeptical about environmentalists' claims; "green" consumers are those whose lifestyle, purchasing and consumption are all influenced and informed by environmental concern; in between lie different shades of grey and green (Peattie, 2001). Consumer decisions are also being influenced by the degree of compromise involved in making a particular choice (i.e. costs and efforts versus co-benefits), and the degree of confidence generated in its environmental benefits or repercussions (Peattie, 2001). As demonstrated below, the latter is dependent on the material consequences and the cultural meanings of activities or practices, which include structures of knowledge about proper behavior (Reckwitz, 2002), i.e. also about proper nutritional and environmental choices.

About a decade ago, many consumers in Western countries believed that the environmental repercussions of their food consumption were

limited to the material flow of packaging waste, which they could personally experience (Tobler, Visschers, & Siegrist, 2011; Van Dam, 1996). However, through various symbolic processes (e.g. education), consumer beliefs about food's environmental repercussions have evolved to include criticism of pesticide use (Jamison, 2003; Vogt, 2007) and, to a certain extent, carbon emissions (Bostrom et al., 2012). Earlier Eurobarometers and other studies examined the options of buying eco-friendly produced food or organic food as well as buying seasonal and local products (European Commission, 2015a; 2015b). Buying eco-friendly produced food or organic food correlated with the degree to which consumers felt connected to nature and cared about species becoming extinct (Ditlevsen, Sandøe, & Lassen, 2019; Hedlund-de Witt, de Boer, & Boersema, 2014; Janssen, 2018), or had health concerns (Roininen, Arvola, & Lähdenmäki, 2006). Buying seasonal and local products has become a reasonably accepted, food-related option to mitigate climate change, which could be related to carbon emissions (de Boer, de Witt, & Aiking, 2016; Hoolohan, Berners-Lee, McKinstry-West, & Hewitt, 2013; Whitmarsh, Seyfang, & O'Neill, 2011), although consumers may also have other reasons for choosing these products, such as quality and freshness (Bazzani, Caputo, Nayga, & Canavari, 2017; Feldmann & Hamm, 2015). In a recent Eurobarometer, the option of buying seasonal and local products was replaced by an option that was explicitly related to the carbon footprint of one's food purchases, which was, however, less popular (European Commission, 2019).

Eurobarometer 93.2 was the first to fully address the issue of food and sustainability (European Commission, 2020b). The survey made it somewhat easier for the participants to define a healthy and sustainable diet by providing a list of possible answers, such as "Eating more fruit and vegetables," "Eating fish more often," "Eating vegetarian or vegan," "Avoiding wasting food," and "Eating foods with a low carbon footprint", which partly reflect the content of current FBDGs (de Boer & Aiking, 2021b; Herforth et al., 2019). This presentation may enable the participants to recognize some conceptual organizing principles, for instance, based on familiar nutritional and environmental terms, which they can intuitively use when they are choosing their answers (Barsalou, 2016). The effects of such organizing principles can be made visible by statistical techniques that help to discover patterns of related answers, although there may be some diversity in the ideas about sustainability in the European context (Dernini & Berry, 2015). Hence, despite the complexities, it is possible to improve our understanding of consumers' beliefs about these issues by exploring whether nutritional and environmental aspects can be considered as different organizing principles of their answers.

The distinction between nutrition- and environment-oriented thinking is in particular relevant for the issue of meat reduction. Over the past decades meat reduction has increasingly been promoted in the context of food sustainability initiatives to tackle climate change (Ivanova et al., 2020) and biodiversity loss (Selinske et al., 2020). However, meat moderation is also part of certain cultural and culinary traditions, such as the Mediterranean diet (de Boer & Aiking, 2018; Turmo, 2012) and FBDG-messages to reduce the intake of red or processed meat (de Boer & Aiking, 2021b; Herforth et al., 2019), which brings it closer to the nutritional aspects. This variety makes it not only important to assess how frequent the items that on face value relate to meat reduction ("Eating meat less often," "Eating foods with a low carbon footprint," and "Eating vegetarian or vegan") are being mentioned but also whether they are more related to nutrition or to sustainability-oriented thinking. The latter question requires an analysis at the level of individual beliefs about what eating a healthy and sustainable diet involves, but it will also be helpful to consider these beliefs in the context of regional differences in Europe, which the Eurobarometer data allows (see below).

### 1.2. Beliefs about the roles of actors

Although the Eurobarometers do not have an explicit theoretical background, their aim is often twofold: Firstly to assess the policy-

relevant expectations of citizens regarding an issue and secondly to consider how citizens see their own contributions to solutions. As the EU aims to empower consumers to make informed, healthy and sustainable food choices, an important question is whether (or not) they themselves think consumers have a role to play in making food systems more sustainable (European Commission, 2020b). This question on the role of consumers can be considered a variant of the perceived consumer efficacy concept (Ghvanidze, Velikova, Dodd, & Oldewage-Theron, 2016; Kinnear, Taylor, & Ahmed, 1974; Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013), which refers to a person's belief that the efforts of an individual can make a difference in the solution to a problem (versus having a sense of futility). It should be noted that the definitions and measurements of this concept may slightly vary, as it refers to a domain-specific belief that may be directly affected by knowledge, personal experience, and the experiences of others (Ellen, Wiener, & Cobb-Walgreen, 1991; Peattie, 2001). In the domain of food, the role of consumers may be put in the broader perspective of value chain thinking, which sheds light on actors who are connected vertically and horizontally within an agricultural chain (farmers, food industries, retailers), and supporting actors who are connected horizontally to the chains (government, financial or educational institutions) (Kusnandar, Brazier, & Van Kooten, 2019). Several of these actors were mentioned in the Eurobarometer questionnaire in a list of potentially relevant players in making food systems sustainable.

### 1.3. Differences between the EU countries

The results of this study may partly depend on historically grown differences between the EU countries, which have many dimensions, including economic, environmental, social, cultural, culinary, institutional, and geographic. Some of the relevant differences can be expressed through indicators of how the countries are currently performing in terms of the Sustainable Development Goals of the United Nations (UN SDGs) (Cling, Eghbal-Téhérani, Orzoni, & Plateau, 2020). Based on a set of indicators that was adapted to the EU context, Cling, et al. (2020) applied principal component and hierarchical cluster analyses to examine distances in performance between the countries; these analyses revealed a split between, on the one hand, the countries of Western and Northern Europe, and, on the other hand, the countries of East and Southern Europe. The first group was relatively homogeneous and consisted of the 11 (in 2019) richest countries in the EU, which were also, on the whole, those with the healthiest population. In addition, these countries could also benefit from both a higher level of education and better employment conditions, as well as better governance, but their indicators relating to the environment in a broad sense (i.e. energy, climate, life on land) were much more heterogeneous (Cling et al., 2020). The latter is remarkable as the Northwest has a longer history in environmental awareness and action (Rootes, 2004). With regard to food, the North had traditionally a high animal protein and low plant protein diet, although the other regions, in particular the South, have recently shown an increased demand for animal protein (de Boer & Aiking, 2018). Though modelling country differences is not the topic of the present study, identifying these differences can be extremely relevant to understanding consumer responses. Therefore, the analyses are done separately for consumers in Northwestern (henceforth NW) countries and Eastern and Southern (henceforth E & S) countries.

In sum, this paper aims to provide a systematic, multivariate analysis of the position of meat reduction in consumers' beliefs about what "eating a healthy and sustainable diet" involves. The basic strategy is to examine the differences between nutritional and environmental aspects of these beliefs and to assess the position of meat reduction in this context. Also, it will investigate whether consumers perceive that they have a role to play in making food systems more sustainable and how this relates to their perceptions of other actors in the value chain and to their beliefs about what "eating a healthy and sustainable diet" involves.

## 2. Method

### 2.1. Data

The survey, covering the European population of 15 years and older, was carried out by research firm Kantar in the 27 Member States of the EU between 3 August and 15 September 2020 among 27,237 European citizens (European Commission, 2020b). The normal procedure is that the participants (around 1000 in each country, 500 in the three smallest countries) are interviewed face-to-face at home in their mother tongue, based on a multi-stage, random (probability) design, providing a representative sample at the regional and national levels. However, because of the coronavirus pandemic, alternative interview modes to face-to-face were necessary as a result of the situation in some countries. In these countries, participants were interviewed online, mostly after recruiting them in a probabilistic way by telephone. For all face-to-face interviews, hygiene and physical distancing measures have always been respected in line with government regulations, and whenever possible, interviews were conducted outside homes, on doorsteps, to remain in open air and maintain social distance. The data have been archived centrally and the technical documents report that for each country a national weighting procedure was carried out based on gender, age, region and size of locality, using marginal and intercellular weighting (European Commission, 2021). The numbers of participants split out by interview mode (online or face-to-face) and region (NW and E & S) are presented in Table 1. Mixed method research (online and face-to-face), which is becoming more common, shows that differences between the modes are partly related to recruitment, as persons with a high education level (tertiary education) tend to be over-represented in online panels while persons with a low and/or persons with a middle level of education are under-represented (Luijckx et al., 2021). Another difference is the presence of an interviewer who can motivate respondents to answer and help when a question is hard to answer, but whose presence might also lead to interviewer effects, such as socially desirable responding. In the analysis, potential mode effects will be taken into account (Hox, De Leeuw, & Zijlman, 2015).

### 2.2. Measures

After some opening questions on characteristics of "sustainable" food and aspects of a sustainable diet, the key question was introduced by the questionnaire referring to people talking about the importance of eating a healthy and sustainable diet. In addition, the participants were asked what they think eating a healthy and sustainable diet involves. They were shown fifteen answer categories, which were also read out, and they could give multiple answers. The answers were documented as binary variables (1 = mentioned, 0 = not mentioned), representing different aspects of beliefs about healthy and sustainable eating. Additionally, the participants were asked which actors from a list of potential actors in their opinion have a role to play in making our food systems sustainable. Again, they could give multiple answers, which were documented as a binary variable taking value 1 for participants who

**Table 1**

Numbers of participants in NW and E & S countries who were interviewed in online or face-to-face mode.

Interview mode	NW countries <sup>a</sup>	E & S countries <sup>b</sup>
Online mode	4967	1815
Face-to-face mode	5602	14,853
Total	10,569	16,668

<sup>a</sup> NW Europe consists of Sweden, Finland, Denmark, Ireland, Belgium, the Netherlands, Luxembourg, France, Germany, and Austria.

<sup>b</sup> The E & S European countries include Estonia, Latvia, Lithuania, Poland, Czechia, Slovakia, Hungary, Bulgaria, Romania, Slovenia, Croatia, Greece, Republic of Cyprus, Malta, Italy, Spain and Portugal.



endorsed the role of an actor. One of the twelve categories referred to “consumers”. The covariates in the analyses were gender, age and level of education (eight categories, from primary, secondary to long tertiary level).

### 2.3. Data analyses

All calculations were made by SPSS 26 for Windows. From a statistical perspective, the country-based sample design means that the 27,237 respondents cannot be treated as independent observations. The present study takes this into account by following the strategy to pool the data within each region and calculate the analyses, while controlling for additional country differences by including a multi-level categorical variable for country or country-specific intercept dummy variables (see Bryan & Jenkins, 2016).

To explore whether nutrition and environment can be considered as different components of the beliefs about healthy and sustainable eating, a principal component analysis (PCA) was used. Instead of standard PCA, an optimal-scaling approach, Categorical Principal Components Analysis or CATPCA, was applied, which is also appropriate for nominal variables (Linting & van der Kooij, 2012; Meulman, Van der Kooij, & Heiser, 2004). The analysis aims to reduce the fifteen beliefs (all nominal variables) into a smaller set of uncorrelated components that explain as much as possible of the variance in the data, thereby revealing relational structures among the observed variables, which are positioned nearer together or farther apart in a smaller dimensional space. CATPCA was applied in each region separately to examine the relational structures by quantifying the variables in a way that is optimal (in a statistical sense) for the PCA goal. CATPCA output is comparable to PCA output, and includes a) eigenvalues, indicating the variance accounted for (VAF) by each principal component; b) component loadings, reflecting correlations between the quantified variables and the principal components; c) communalities, reflecting the contributions of the quantified variables to the total VAF; and d) component scores for each case in the data set (Linting & van der Kooij, 2012). The number of components to be retained in the solution was derived from the scree criterion. A rotated solution was chosen with Varimax rotation. Based on

the eigenvalues, Cronbach's alpha was calculated, which provides information about the internal consistency of the items and the interpretability of summated scores (Cronbach, 1951; Sijtsma, 2009).

The analysis also used the feature that CATPCA allows for passive (supplementary) variables. Passive variables do not influence the components but are projected into the variance space created by the active variables. In this way, it was possible to inspect whether the country dummies and the interview mode could have made a significant difference. The same analysis was applied to the answers of the question about the actors who have a role to play in making our food systems sustainable. The component scores were used to calculate correlations between the components of dietary thinking, the components of actor orientations and the covariates, controlling for country dummies.

## 3. Results

### 3.1. Beliefs about healthy and sustainable eating

The participants were free to select as many of the fifteen items as they wanted. Many chose about five items, but overall the numbers varied between zero and fifteen. The percentage of times each item was selected is presented in Table 2, together with the main output of CATPCA. The most popular items were “Eating a variety of different foods, having a balanced diet” and “Eating more fruits and vegetables.” The item “Eating meat less often” was in the middle between the more popular and the less popular items, slightly higher (7th) in the NW region and lower (12th) in the E & S region. “Eating foods with a low carbon footprint” was chosen less often, especially in the E & S region, and “Eating vegetarian or vegan” was the least chosen item.

In both regions, three components were retained, which accounted for more than 40% of the variance. The components revealed three patterns of chosen items, which can be described in terms of 1) nutrition-focused thinking, 2) “light green” thinking, and 3) “deeper green” thinking, respectively. Nutrition focused-thinking involves items with recommendations that are typical for dietary guidelines (e.g. “Eating more fruit and vegetables” and “Eating fish more often”). “Light green” thinking and “deeper green” thinking refer to pro-environmental choices

**Table 2**

Items of dietary thinking: Item popularity (%) and component loadings<sup>a</sup>, based on CATPCA with Varimax rotation, in each region.

	NW countries (N = 10,569)				E & S countries (N = 16,668)			
	%	Component loadings			%	Component loadings		
		1	2	3		1	2	3
<i>Nutrition-focused thinking</i>								
Eating more fruit and vegetables	54%	<b>0.68</b>	0.10	0.07	61%	<b>0.63</b>	0.30	−0.13
Eating fish more often	28%	<b>0.65</b>	0.08	0.07	37%	<b>0.70</b>	0.05	0.09
Eating more wholegrain, high-fibre foods	32%	<b>0.62</b>	0.20	0.18	30%	<b>0.47</b>	0.18	0.34
Not eating too many calories	24%	<b>0.60</b>	0.05	0.16	29%	<b>0.47</b>	0.11	0.32
Not too much food high in fat, sugars and/or salt	37%	<b>0.57</b>	0.11	0.19	40%	<b>0.41</b>	0.31	0.19
Eating more home-cooked meals	45%	<b>0.40</b>	0.36	0.00	43%	0.38	<b>0.44</b>	−0.04
<i>Light green thinking</i>								
Avoiding wasting food	52%	0.15	<b>0.67</b>	0.11	35%	0.00	<b>0.67</b>	0.16
Eating seasonal, local	50%	0.01	<b>0.65</b>	0.25	44%	0.13	<b>0.59</b>	0.15
Eating a variety of different foods, having a balanced diet	66%	0.21	<b>0.55</b>	−0.24	56%	0.12	<b>0.59</b>	0.02
Little or no pesticides	39%	0.28	<b>0.45</b>	0.33	43%	0.25	<b>0.49</b>	0.25
<i>Deeper green thinking</i>								
Eating vegetarian or vegan	13%	0.10	−0.11	<b>0.69</b>	10%	0.18	−0.18	<b>0.64</b>
Eating foods with a low carbon footprint	31%	0.02	<b>0.42</b>	<b>0.61</b>	18%	0.07	0.31	<b>0.67</b>
Eating organic food	25%	0.18	0.15	<b>0.59</b>	27%	0.20	0.15	<b>0.54</b>
Eating meat less often	38%	0.30	0.12	<b>0.50</b>	27%	<b>0.56</b>	−0.03	0.33
Eating foods produced by companies that protect workers' social rights	24%	0.13	<b>0.49</b>	<b>0.43</b>	14%	0.02	0.32	<b>0.63</b>
<i>Passive variables</i>								
Country variable		0.24	0.08	0.10		0.28	0.04	0.05
Interview mode (online = 1)		−0.21	−0.06	−0.09		−0.09	−0.06	−0.08
Cronbach's alpha		.73	.70	.68		.71	.69	.68
Eigenvalue		2.42	2.05	1.98		2.13	2.06	2.05
% of Variance		16.1%	13.7%	13.2%		14.2%	13.8%	13.7%

<sup>a</sup> Component loadings higher than 0.4 are highlighted in bold.

that may require just a few compromises on points such as time, costs or effort (e.g. “Avoiding wasting food” and “Eating seasonal, local”) or much more than that (e.g. “Eating vegetarian or vegan” and “Eating organic food”). The Cronbach’s alphas of the components were adequate (a typical threshold is 0.70 (Linting & van der Kooij, 2012)). Each item loaded at least 0.40 on a component. Several items loaded 0.30 or higher on more than one component (i.e. cross-loadings), which is not surprising, given the background of certain items. In the NW countries, the meat reduction item mainly loaded (0.50) on “deeper green” thinking and lowly (0.30) on nutrition-focused thinking; in the E & S countries, the loadings were 0.33 on “deeper green” thinking and 0.56 on nutrition-focused thinking. In contrast, the item about vegetarian or vegan eating only loaded on “deeper green” thinking in both regions. Some cross-loadings were found between “light green” and “deeper green” thinking, in particular regarding items with a broad appeal, such as “Eating foods with a low carbon footprint” and “Eating foods produced by companies that protect workers’ social rights”. These items can be interpreted either in a “light” or in a “deeper” green way.

The passive variables had low loadings; the participants who were interviewed online chose a lower number of items than the participants who were interviewed by an interviewer, which led in particular to somewhat lower scores on the nutrition-focused items. Table 2 shows that the variable Interview mode had a loading of  $-0.21$  on the first component in the NW region (i.e. it correlated  $r = -0.21$  with this component). Although interview mode was confounded with the country variable (see Section 2.1), this result suggests that personal contact with the interviewer stimulated the participants to give more answers to the question.

### 3.2. Actors with a role in making our food systems sustainable

The question about the actors who have a role to play in making our food systems sustainable also resulted in a variety of items chosen. In this case, there was a maximum of twelve items. On average, the participants in NW countries chose 5 items and in E & S countries 4. Small percentages of the participants selected them all (7% in NW countries and 4% in E & S countries). The percentage of times each item was selected is presented in Table 3, together with the main output of CATPCA. In both regions, three components were retained, which accounted for more than 50% of the variance. The components revealed

three patterns of items, which can be described in terms of orientations to different aspects of the value chain, namely 1) food chain actors (“Producers (farmers, fishers)” and “Food manufacturers”), 2) supporting actors (“Non-governmental organizations” and “Cities/local authorities”), and 3) governmental actors (“EU Institutions” and “National governments”) respectively. The Cronbach’s alphas of the components were adequate. Each item loaded at least 0.40 on a component. Several items loaded 0.30 or higher on more than one component. In both regions, “Shops and retailers” loaded on the food chain actors orientation and the supporting actors orientation. Also, “Regional governments” loaded on governmental actor orientation and supporting actor orientation. The loadings of the passive variables were rather low. Table 3 also shows that the responsibility of “Producers” (74% and 64%) and “Food manufacturers (65% and 61%) was mentioned more often than that of “National governments” (52% and 43%) and “EU institutions” (46% and 33%). The item that gives a role to consumers loaded on the food chain actors orientation, but it was more popular (58%) and loaded higher (0.61) in the NW countries than in the E & S countries (popularity 34%; loading 0.49). Hence, the perceived role of consumers was relatively large, in particular in the NW countries, together with that of producers and food manufactures.

Table 4 presents the (partial) correlations between the components of dietary thinking, the components of actor orientations and the covariates, controlling for country dummies in each region. In both regions, it appeared that the food chain-oriented component, which included consumers themselves, was distinctively correlated with “light green” thinking ( $r = 0.40$  and  $r = 0.41$ ), but not with “deeper green” thinking ( $r = 0.07$  and  $r = 0.03$ ). “Deeper green” thinking was more associated with the supporting actors-oriented component ( $r = 0.29$  and  $r = 0.31$ ). As will be discussed below, this might be typical for certain visions on sustainability. Governmental actor orientation had small correlations with both “light” and “deeper” green thinking. The covariates gender, age and level of education had very small correlations with the component scores. In the NW countries, a higher age correlated with a higher score on nutrition-focused thinking ( $r = 0.13$ ), but a lower score on “deep green” thinking ( $r = -0.13$ ). Level of education correlated in both regions very weakly with “light green” ( $r = 0.08$  and  $r = 0.08$ ) and “deep green” ( $r = 0.10$  and  $r = 0.08$ ) thinking.

Focusing on the distinction between the participants who endorsed the role of consumers and those who did not, Table 5 shows the

**Table 3**  
Items of actor orientations: Item popularity (%) and component loadings<sup>a</sup>), based on CATPCA with Varimax rotation, in each region.

	NW countries (N = 10,569)				E & S countries (N = 16,668)			
	%	Component loadings			%	Component loadings		
		1	2	3		1	2	3
<i>Food chain actors orientation</i>								
Producers (farmers, fishers)	74%	−0.02	<b>0.73</b>	0.18	64%	−0.02	0.11	<b>0.74</b>
Food manufacturers	65%	0.14	<b>0.66</b>	0.07	61%	0.00	0.13	<b>0.70</b>
Consumers	58%	0.18	<b>0.61</b>	0.13	34%	0.33	0.07	<b>0.49</b>
Shops and retailers	47%	<b>0.51</b>	<b>0.42</b>	−0.15	36%	<b>0.47</b>	−0.12	<b>0.44</b>
<i>Supporting actors orientation</i>								
Non-governmental organizations	17%	<b>0.72</b>	0.03	0.23	13%	<b>0.65</b>	0.24	−0.05
Cities/local authorities	24%	<b>0.69</b>	0.03	0.31	25%	<b>0.52</b>	0.37	−0.02
Hospitality and food services (hotels, restaurants, canteens, hospitals ...)	29%	<b>0.68</b>	0.32	−0.05	24%	<b>0.59</b>	−0.04	0.38
Investors/banks/financial institutions	19%	<b>0.63</b>	0.03	0.29	11%	<b>0.66</b>	0.20	−0.01
Education providers (schools etc.)	28%	<b>0.58</b>	0.28	0.16	17%	<b>0.61</b>	0.16	0.28
<i>Governmental actors orientation</i>								
EU Institutions	46%	0.21	0.16	<b>0.73</b>	33%	0.15	<b>0.68</b>	0.16
National Governments	52%	0.18	0.17	<b>0.77</b>	43%	0.04	<b>0.78</b>	0.14
Regional Governments	33%	<b>0.56</b>	0.05	<b>0.43</b>	26%	0.37	<b>0.61</b>	−0.04
<i>Passive variables</i>								
Country variable		−0.10	0.21	0.13		0.01	0.01	0.29
Interview mode (online = 1)		−0.02	0.06	0.08		−0.04	−0.08	−0.10
Cronbach’s alpha		.78	.63	.66		.71	.61	.57
Eigenvalue		2.89	1.76	1.65		2.34	1.76	1.74
% of Variance		24.1%	14.7%	13.7%		19.5%	14.7%	14.5%

<sup>a</sup> Component loadings higher than 0.4 are highlighted in bold.

**Table 4**

Partial correlations between the components of dietary thinking, the components of actor orientations and the covariates, controlling for country dummies in each region.

Variables	NW countries (N = 10,554)								E & S countries (N = 16,644)							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1 Nutrition-focused thinking																
2 Light green thinking	-.02								-.01							
3 Deeper green thinking	-.02	-.00							-.01	.02						
4 Food chain actor orientation	.17**	.40**	.07**						.21**	.41**	.03**					
5 Supporting actor orientation	.16**	.22**	.29**	.02					.10**	.18**	.31**	-.00				
6 Governmental actor orientation	.06**	.17**	.20**	-.02	.01				.12**	.18**	.20**	-.00	.00			
7 Gender (female = 1)	-.00	.08**	.05**	.06**	.04**	-.04**			.05**	.03**	.01	.01	.02*	-.02		
8 Age	.13**	.09**	-.13**	.11**	-.12**	-.06**	.03*		.07**	.05**	-.11**	.03**	-.07**	-.02	.08**	
9 Education	-.03*	.10**	.12**	.11**	.07**	.16**	-.05**	.00	.00	.08**	.08**	.07**	.05**	.08**	.03**	-.13**

\* $p < .01$ , \*\* $p < .001$ .

**Table 5**

Popularity (in %) of “Eating meat less often”, “Eating vegetarian or vegan” or “Avoiding wasting food” among participants who either or not endorsed the role of consumers in both regions.

Items	Endorsed the role of consumers in NW countries (N = 10,569)		Endorsed the role of consumers in E & S countries (N = 16,668)	
	Yes (N = 6148)	No (N = 4421)	Yes (N = 5631)	No (N = 11,037)
Eating meat less often	45%	29%	32%	24%
Eating vegetarian or vegan	15%	11%	12%	9%
Eating foods with a low carbon footprint	40%	18%	28%	12%
Avoiding wasting food	66%	32%	55%	24%

popularity of the three meat-related items and one of the popular “light green” items. The percentages confirm that the perceived role of consumers was more strongly related with “light green” items, such as “Avoiding wasting food”, and to a lesser extent “Eating foods with a low carbon footprint” than with the two “deeper green” meat-related items. However, the relationship with “Eating meat less often” in the NW countries should not be neglected, as it resulted in a difference between 45% and 29% item endorsement.

## 4. Discussion

### 4.1. Beliefs related to meat reduction

This paper has examined how the idea of meat reduction is currently perceived by consumers in the EU. The results were interpreted in terms of the literature on consumers and the environment, demonstrating the roles of both the persons and the choices they face, together with the material consequences and the cultural meaning of activities or practices (Peattie, 2001; Reckwitz, 2002). The latter two factors are particularly important when considering consumer beliefs about the nutritional and the environmental repercussions of food consumption, which now may include criticism of package waste, pesticide use and, to a certain extent, carbon emissions (Bostrom et al., 2012; Ditlevsen et al., 2019; Tobler et al., 2011). The study participants appeared to use nutrition and environment as organizing principles in answering the survey questions, with the additional distinction between “light” and “deeper” green items, the latter of which may involve more compromises. In other words, they had different degrees of affinity with nutrition-focused, “light green” or “deeper green” thinking, respectively. The three items that on face value relate to meat reduction (“Eating meat less often”,

“Eating foods with a low carbon footprint”, and “Eating vegetarian or vegan”) shared a link with “deeper green” thinking, although they also had slightly different positions in the relational structures among the items. “Eating vegetarian or vegan” had no cross-loadings, but was mentioned less often. “Eating foods with a low carbon footprint” was also linked to “light green” thinking, but this apparently did not involve meat.

“Eating meat less often” mainly loaded on “deeper green” thinking and lowly on nutrition-focused thinking in the Northwest, but the opposite pattern was found in the East and South. The fact that this item was to a certain degree related to nutrition-focused thinking, together with “Eating fish more often” (but not “Eating foods with a low carbon footprint”), agrees with dietary guidelines to limit the intake of red or processed meat (de Boer & Aiking, 2021b; Herforth et al., 2019) and the principles of a Mediterranean diet (Turmo, 2012). Hence, the results revealed that consumer beliefs about proper and improper food consumption to a certain extent included criticism of meat consumption, albeit in different forms depending on the history of their region in environmental awareness (Rootes, 2004) and culinary traditions (Turmo, 2012). The existing criticism of meat is in line with recent experiments showing that consumers are to some degree responsive to persuasive information about these issues and tend to adapt their meal choices accordingly (Lacroix & Gifford, 2020; Morren, Mol, Blasch, & Malek, 2021), in one study for up to twenty weeks after a lecture (Jalil, Tasoff, & Bustamante, 2020).

It should be emphasized that practical knowledge about proper and improper behavior (Reckwitz, 2002) is related to— but not equivalent to— technical knowledge about, for instance, differences in carbon emissions. This point is clearly demonstrated by the low popularity of the item that referred to food’s carbon footprint, on the one hand, and the higher popularity of eating seasonal or local, on the other hand. The literature shows that informing restaurant customers (Brunner, Kurz, Bryngelsson, & Hedenus, 2018) or supermarket shoppers (Feucht & Zander, 2018) by carbon labels may have some positive effects, but that consumers are largely incapable of making tradeoffs between different actions (e.g., the number of hamburgers that would be equivalent to a Trans-Atlantic flight in terms of climate impact) (Wynes, Zhao, & Donner, 2020). A similar point about the differing usefulness of detailed knowledge and practical guidelines was made by Lazzarini, Visschers, and Siegrist (2018) who, however, also noted that detailed knowledge will be crucial if certain misconceptions have to be cleared.

### 4.2. The role of consumers

Another important result is the key distinction between participants who either or not endorsed that consumers have a role to play in making food systems sustainable. This endorsement was much higher in the NW

countries than in the E & S countries, which may be related to the higher performance of these countries in terms of economic and social sustainability indicators (Cling et al., 2020). In both regions, the item was understood in relation with value chain thinking. It loaded on the food chain-oriented component of actor orientations, together with the responsibilities of food producers and food manufacturers which were mentioned most often. This dimension was distinctively correlated with “light green” thinking but not with “deeper green” thinking. The difference is important because “light green” thinking does not seem to include meat reduction. There may be different reasons for this, such as the nature of value chain-based business models. Support for the latter idea has come from a recent study among the retail sector in the United Kingdom, which focused on their marketing activities to promote “less and better” meat and dairy as a core component of sustainable diets. The study indicates that, while marketing strategies related to “better” meat and dairy are being adopted, no retailer is implementing interventions focused on reducing purchasing of meat products (Trewern, Chenoweth, Christie, Keller, & Halevy, 2021).

The perceived role of consumers was positively associated with the meat reduction item as such, although not as strongly as with the “light” item about waste reduction. The latter agrees with other studies finding that waste-related practices are still appealing to the largest number of consumers (Dubuisson-Quellier & Gojard, 2016; Gould, Ardoin, Biggar, Cravens, & Wojcik, 2016; Siegrist, Visschers, & Hartmann, 2015). However, this is not a strictly individual pursuit, as waste is part of many organizational initiatives, for instance, to normalize recycling. According to a broad review, this process has been influenced by changing attitudes, provision of facilities, information and communication campaigns and the influence of others’ behavior (Thomas & Sharp, 2013). In other words, perceived consumer effectiveness related to waste is a domain-specific belief affected by knowledge, personal experience, and the experiences of others (Ellen et al., 1991). Whether and how these elements can be generalized to further sustainability aspects, such as meat reduction, is an open question. Some experts in communication noted that in the case of sustainability responsible management at a collective level is required, also including consumers (Aubrun, Brown, & Grady, 2006). Such a wide-ranging vision of who has a role to play makes it understandable that in the present study “deeper green” thinking was distinctively associated with the supporting actor-oriented component and to a lesser degree with the governmental actor-oriented component of actor orientations.

#### 4.3. Policy implications

In recent EU policy-making, meat reduction has been carefully placed in a broader context of nutritional and environmental aspects of eating a healthy and sustainable diet. The results demonstrate that this approach matches the beliefs of many consumers about these issues. For policy-makers who aim to mainstream the reduction of animal protein consumption, it is important that both nutrition and environment can be motivating factors for consumers. From a psychological perspective, these factors may open the way for, on the one hand, non-moral strategies, and, on the other hand, moral strategies to involve consumers in the normalization process (see Lai, Tiroto, Pagliaro, & Fornara, 2020), taking into account that “deeper green” issues are seen as more demanding than “light green” ones.

The results also demonstrate that consumers were not keen on making distinctions between more important and less important sustainability aspects (see also Whitmarsh et al., 2011; Wynes et al., 2020). That is, the meat reduction item was often not considered of special importance; it was not very popular and it had not a salient component loading. This is noteworthy, given the outstanding position of meat reduction in fighting climate change (Ivanova et al., 2020) and biodiversity loss (Machovina, Feeley, & Ripple, 2015). Although the analysis of an earlier Eurobarometer has shown that climate change and species decline are distinct sources of consumer concern that may both support

more sustainable food choices (de Boer & Aiking, 2021a), they may not be sufficiently aware of the priority to be given to meat reduction. To improve their ability to make this type of distinctions, it may be wise not to provide them with lists of detailed information (see also Lazzarini et al., 2018), but to help them with developing a real systems view on food systems (Jaspaert, Van de Velde, Brône, Feyaerts, & Geeraerts, 2011). As noted by Aubrun et al. (2006), one way of raising engagement and improving decision making is to provide consumers with conceptual tools (e.g. metaphors, such as the “runaway food system”) that can help them think not like experts, but like “managers,” with a sufficient sense of the “big picture” that they can form reasonable opinions and act on a sense of collective responsibility.

Importantly, the EU itself has recently been criticized by its European Court of Auditors (2021) that it fails to achieve its environmental objectives. These require a substantial reduction of livestock production in the EU, in correspondence with reductions in meat consumption in order to prevent that the impacts of the reduced production level will be neutralized by higher imports (European Court of Auditors, 2021). According to the Court, the EU does not seek to limit livestock numbers; nor does it provide incentives to reduce them. Instead, its policy measures include promotion of animal products, the consumption of which has not decreased since 2014 (European Court of Auditors, 2021). Hence, much more effort has to be spent to achieve the objectives in the coming years.

#### 4.4. Limitations

An important limitation is that the study is about thinking and not acting, because the inclusion of actual behavior makes the analysis more realistic. The reason is that the study is based on a secondary analysis, which means that the work is limited to the questions asked by the original investigators, guided by EU policy development. On the one hand, this is a strength, because it might be assumed that the questions are policy relevant. On the other hand, it is a weakness because the set of variables is not under control of the authors. An additional strength is that the analyses were carried out separately in two large, but economically and culturally different, groups of countries. This approach revealed historically grown differences between the EU countries that have to be taken into account.

Another limitation is that the data cannot shed more light on the distinction between “light” and “deeper” green thinking. The question what consumers have in mind is not the same as the question whether they can report everything they do. It is well-known that pro-environmental practices significantly vary in the amount of behavioral difficulties (or costs) they incur. Analytically viewed, there could be a continuum that discriminates among individuals who put high value on the goal of environmental protection and are willing to bear high costs and individuals who value the goal much less and are only willing to do easy things (Campbell, 1963; Kaiser & Wilson, 2004). Using a Rasch-type model to mathematically model this continuum, Kaiser and Wilson (2004) showed that 50 environmentally-relevant behavioral items could be arranged along a single continuum; those persons who do the difficult things also do the easy ones (see also Kaiser, Hartig, Brügger, & Duvier, 2013). The distinction between “light” and “deeper” green may partly be a matter of item difficulty but also one of distinct cultural meanings around what it means to buy organic food or to eat vegetarian or vegan. In this area, more work needs to be done on the distinction between “light” and “deeper” green.

#### 5. Conclusions

Reducing the consumption of meat is an urgent and potentially controversial issue in the process of making food systems sustainable. This study revealed that many European consumers were able to communicate in a meaningful manner about what they think a healthy and sustainable diet involves and who has a role to play in making the



food system more sustainable. The analysis provided more insight into their affinities with nutrition-focused, “light green” or “deeper green” thinking and the position of meat reduction in this context. The analysis also provided more insight into consumers’ orientations to different types of actors in the value chain, such as food chain actors (which included consumers themselves), supporting actors, and governmental actors. The various relationships between the actor orientations and the affinities with nutrition-focused, “light green” or “deeper green” thinking underlined the importance of consumer awareness that they have a role to play in making food systems sustainable. In NW Europe, consisting of the 10 richest EU countries with the highest scores on economic and social sustainable development indicators, a majority of consumers saw a role for themselves in making the food system more sustainable and a large minority saw meat reduction as part of a healthy and sustainable diet. Both topics were much less common in the East and South. In the Northwest, meat reduction was relatively strongly related to “deeper green” thinking but also weakly to nutrition-focused thinking, whereas the opposite was found in the East and South. However, consumers were not keen on making distinctions between more important vs. less important aspects of sustainability. Meat reduction did not get a prominent position in their ideas about what “eating a healthy and sustainable diet” involves. For policy-makers, therefore, it is crucial that both nutrition and environment can be motivating factors for consumers to consider meat reduction, albeit to different degrees, depending on the history of their region.

## Author contributions

JdB and HA conceived and designed the article. JdB wrote the first draft. HA revised it critically. JdB and HA approved the final article.

## Ethical statement

The paper does not involve new human participants. The data were collected by Kantar in the 27 Member States of the EU at the request of the European Commission, Directorate-General for the Environment, and are publicly available.

## Declaration of competing interest

None.

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