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The impact of salient labels and choice overload on sustainability judgments: An online experiment investigating consumers' knowledge and overconfidence

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ABSTRACT

Previous research suggests that contextual factors can affect the perception of food products, however, we still know little about how consumers evaluate these items in terms of sustainability. This research investigates how well shoppers can rate food items in the matter of their environmental impact, whether they are overconfident in their knowledge of food sustainability, and whether labels on packaging and great availability of choice can affect their judgment. Through an online behavioural experiment, we test the impact of salient truthful and untruthful green labels, and of choice overload on people's perceptions of the environmental quality of food products. We find that choice overload is detrimental to consumers' judgment, but that truthful labels can help shoppers correctly identify sustainable items. However, untruthful labels can negatively impact consumers' judgments with choice overload, even if shoppers have greater prior knowledge of sustainability. These findings suggest that truthful and untruthful salient labels and choice overload can have an impact on shoppers' perceptions of food products. We find that overconfidence in one's sustainability judgment is negatively correlated to judgment accuracy. Hence, great care should be taken in presenting food products to consumers to make the most environmentally friendly items stand out.

1. Introduction

1.1. Food consumption and the environment

The Food and Agriculture Organization of the United Nations (FAO, 2020) estimates that the global emissions associated with agriculture in 2018 were 9.3 billion tonnes of CO_2 equivalent (CO_2e). More than a quarter of the total greenhouse gas (GHG) emissions comes from the food system, and 70 % of freshwater is used in food production (Behavioural Insights Team, 2020; Richie et al., 2022). However, different food categories vary in how their production contributes to these emissions and freshwater usage. Excluding information on product packaging and variations within the same food category, it is possible to identify the most and least polluting food items for CO_2 emissions and freshwater withdrawals. At the high end of the impact scale, there is beef, which is responsible for 36.44 kgCO2e per 1000 kcal. Moreover, 2,714 L of water are required to produce 1 kg of beef (dairy herd). On the lower end of the scale, potatoes, for example, are responsible for only 0.63kgCO2e per 1000 kcal and require 59 L of freshwater per kg (Poore & Nemecek, 2018; Richie et al., 2022).

1.2. Current diets in the UK and in Italy

According to the EAT-Lancet Commission, consumption of red meat should decrease globally by more than 50 % for a sustainable and healthy food system to be achieved. The EAT-Lancet Commission diet estimates a CO_2e production of 740 kg/person/year (Willett et al., 2019). The current Italian diet is responsible for a CO_2e production of 1465 kg/person/year. The consumption of beef and pork meat, animal fat and sugar should be reduced by 60–90 %, and of dairy products and eggs by 50 % (Vitale et al., 2021). However, in Italy in 2020, sales of beef increased by 8.2 %, and sales of cheese and milk increased by 9.7 % and 3.9 % respectively (ISMEA, 2021). Between 2008/9 and 2018/9, the UK average daily meat consumption fell by 17.4 g/day per capita, with a 30 % reduction in beef consumption (Stewart et al., 2021). This is significant, but still far from the necessary reduction of 89 % (Springmann

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et al., 2018; Stewart et al., 2021).

Not all consumers are aware of the actual impact that food has on the environment, especially that of livestock (Van Bussel et al., 2022). It is therefore crucial to consider what factors can influence consumers' choices to find ways to steer them towards more sustainable items.

1.3. What can influence food consumption?

Contextual factors can influence people's decisions when grocery shopping. Products displayed at eye-height, at the end of supermarket aisles or at checkouts generally sell more than the other ones (Behavioural Insights Team, 2020). Moving vegetarian products to meat aisles in supermarkets can increase sales of those products, whilst not reducing sales of meat (Piernas et al., 2021). Vegetarian dishes are also chosen more when they compose most of the menu (75 %) compared to when there are fewer vegetarian choices available (25 %) (Parkin & Attwood, 2022). However, too many options can sometimes discourage from buying at all (Iyengar & Lepper, 2000).

The way a dish is described can also be influential in the decision-making process: The same dish is chosen more often when labelled as "chef's recommendation" than when it is labelled as "vegetarian" (Bacon & Krpan, 2018). A traffic-light coloured labelling system can be successful in shifting food choices: In a student catering facility, sales of green labelled meat dishes increased by 11.5 %, whereas sales of red meat dishes decreased by 4.8 % (Brunner et al., 2018). Different labelling can also change people's perceptions of certain products: The organic label can create an "halo" effect by which the organic product is thought of being superior in terms of nutrition, safety, brand attitude and trust, compared to the standard alternative (Ellison et al., 2016). The nature of the product itself may interact with the label: Healthy foods benefit from being labelled as organic, whereas vice foods do not (Parker et al., 2021). Vegetarian dishes seem to be more appealing when described with meat-related adjectives: A "cauliflower steak with cheese sauce" is more popular than a "cauliflower slice with cheese sauce" (Marshall et al., 2022).

1.4. Research theme, questions, and hypotheses

The present research explores how well consumers can rate food products in terms of sustainability, defined with the criteria of greenhouse gas emissions, freshwater and scarcity-weighted water usage, and land usage (see 2.2.). We use the term "judgment accuracy" thereafter to indicate how well respondents can answer the experiment questions. The aim of our experiment is to test what can influence participants' judgment accuracy, answering the following research questions.

1.4.1. Salience of labels

Do labels affect people's judgment accuracy? And can consumers recognise when labels accurately describe a product as sustainable and when they do not? We investigate the impact of salience of labels on judgment accuracy. Salience, defined as novel, relevant and attention-drawing information, can affect our thinking and actions (Kahneman & Thaler, 2006; Dolan et al., 2012). For example, brand name may be used as a proxy for quality when motivation to form an accurate judgment is low (Maheswaran et al., 1992), and calorie posting on menus can reduce the average calories per transaction (Bollinger et al., 2011). In this case, we are testing whether adding a green label on the product affects people's perception of it in terms of sustainability. We are differentiating between those labels that accurately indicate the most sustainable item out of the available ones and those that do not. We refer to the former case as "salience" and to the latter case as "distractor" when describing our treatments. We predict that respondents will trust the label in both cases, hence:

H1. Salience will lead to greater judgment accuracy.
H2. Distractor will lead to lower judgment accuracy.

1.4.2. Choice overload

Does the number of available products affect consumers' judgment accuracy? This question tests the impact of choice overload, defined as a wider range of available options, on judgment accuracy. Because previous research suggests that accuracy does not necessarily change with more information (Castellan, 1977), and it may in fact decrease (Arkes, 1981), we predict that:

H3. Choice overload will lead to lower judgment accuracy.

1.4.3. Interactions between treatments

The treatments of salience and choice overload will produce opposite effects on judgment accuracy. No prediction is made on which effect will prevail, leaving this as an exploratory question. On the other hand, the treatment of distractor and choice overload are both predicted to have a negative effect on judgment accuracy, hence:

H4. The treatments of distractor and choice overload together will diminish judgment accuracy.

1.4.4. Overconfidence

Are consumers overconfident in their knowledge of product sustainability? Is there a relationship between their overconfidence and their judgment accuracy? Is there a link between their overconfidence and the impact of external factors such as salience, distractor, and choice overload? Griffin and Varey (1996) define being overconfident as either overestimating the likelihood that one's preferred outcome will occur or overestimating the validity of one's judgment. In this research, we use the second definition for overconfidence. Being overconfident may limit information search (Cooper et al., 1995; Harvey, 1994; Mahajan, 1992), and may reduce decision accuracy (Zacharakis & Shepherd, 2001). We therefore predict that:

H5. Overconfidence in one's food sustainability knowledge will be correlated to lower judgment accuracy.
H6. Overconfidence in one's performance when determining food sustainability in the experiment will be correlated to lower judgment accuracy.

1.4.5. Interactions between treatments and overconfidence

As the amount of relevant information increases, confidence tends to increase as well (Oskamp, 1982), but not as much as judgment accuracy (Tsai et al., 2008). Therefore:

H7. Overconfidence will be higher when the treatments of salience and distractor are activated.

The effects of overconfidence and salience will compete against each other, with overconfidence being associated with lower judgment accuracy and salience with higher judgment accuracy. The effect of overconfidence will be greater, hence:

H8. Judgment accuracy will be lower when both salience and overconfidence are present.

The effects of overconfidence and distractor will both be negative on judgment accuracy, hence:

H9. The treatment of distractor and the presence of overconfidence together will be related to a lower judgment accuracy.

Because choice overload may result in lower motivation to choose and lower satisfaction with the chosen option (Iyengar & Lepper, 2000), or in the consumer avoiding choosing altogether (Samuelson & Zeckhauser, 1988), we expect that:

H10. Overconfidence will be lower when the treatment of choice overload is activated.

H11. The treatment of choice overload and the presence of overconfidence together will be related to a lower judgment accuracy.

1.4.6. Demographics and other personal information

It is predicted that being vegetarian (H12), vegan (H13), the primary shopper in one's household (H14), and buying organic food (H15) will be associated with higher judgment accuracy. Information on respondents' age, gender, education, income, employment status, household size, country of residence (Italy or UK) and preferred place for grocery shopping is also collected to explore their relationship with judgment accuracy.

2. Method

2.1. Study design

The current experiment had a within-subject design with 6 experimental sections: control, salience, distractor, choice overload, salience plus choice overload, and distractor plus choice overload. In the control section participants were asked to select the most sustainable item out of 4 shown products. In the treatment of choice overload participants had to judge between 8 products (Fig. 1). The treatment of salience consisted in adding a green symbol on the most sustainable item amongst the shown products (Fig. 2). The treatment of distractor similarly consisted in adding a green symbol but on a product that was not the most sustainable one in the group (Fig. 3).

2.2. Materials

The experiment was conducted in the form of a quiz. The quiz was made up of 5 parts: self-assessment, experiment, symbol, consumer attitudes, demographics. The self-assessment part contained two questions to determine participants' overconfidence about their general knowledge of food sustainability. The experiment comprised of 6 sections: Each of these contained four questions about food products and their sustainability characteristics, plus two questions that asked participants to estimate how well they answered each section. Every respondent completed all 6 experimental sections:

- Section 1: control
- Section 2: choice overload
- Section 3: salience
- Section 4: salience and choice overload
- Section 5: distractor
- Section 6: distractor and choice overload

The sustainability questions of the experiment and their relative correct answers were defined using data from Richie and Roser (2020). As the environmental sustainability of a product can be described in different ways depending on what is being assessed, such as greenhouse gas emissions or water usage during production, the questions specified the criteria the respondent should use when selecting the most sustainable product. Different questions made use of different criteria including: greenhouse gas emissions across the supply chain; greenhouse gas emissions per 100 g of protein or per 1000 kcal; freshwater or scarcity-weighted water usage per kg of product or 1000 kcal; land usage per kg or 1000 kcal. To allow respondents to focus on the food products only, information on type of product packaging and country of origin is defined as irrelevant in the survey.

The symbol used in the salience and distractor treatments depicted a hand holding a plant with two leaves (Fig. 4). This symbol can be found in Microsoft Office packages, and was used in the following colour schemes so that it could be visible on different coloured packaging.

Because the respondents were either from Italy or the UK, it was decided to use a neutral symbol that is not found on packaging in either country but could be recognised by both as related to sustainability. The symbol part of the quiz included a manipulation check question that asked participants to indicate whether they could see the green symbol on some of the products in the experimental sections.

The part on consumer attitudes contained 5 questions about the respondents' food consumption preferences: whether they are vegetarian, or vegan; if they oversee grocery shopping for their household; where they generally go grocery shopping; what percentage of their groceries is organic. Finally, the last section of the experiment, demographics, contained questions about the participants' age, gender, education, income, employment status, household size, and country of residence (Italy/UK).

2.3. Measures and model

2.3.1. Judgment accuracy

Each experimental section of the quiz was either worth 16 or 32 points, depending on whether the treatment of choice overload was present: If participants had to choose between 4 products (no choice overload), getting the correct answer would give them 4 points; If they had to choose between 8 products (with choice overload), getting the correct answer would give them 8 points. If the respondents picked the second-best alternative, they would score either 3 (no choice overload)

Fig. 1. Choice overload treatment.

Fig. 2. Salience treatment.

Fig. 3. Distractor treatment.

Fig. 4. Green symbols used in the salience and distractor treatments. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

or 7 points (with choice overload), and suchlike. Following this logic, sections 1, 3, and 5 were worth 16 points in total, and sections 2, 4, and 6 were worth 32 points in total. The maximum score a participant could get in the quiz was 144 points. We computed our dependent variable, *judgment accuracy*, as the ratio of correct answers in points per each section.

2.3.2. Overconfidence

We differentiated between two forms of overconfidence: overconfidence in one's sustainability knowledge and overconfidence in one's performance. Thereafter we will refer to overconfidence in one's sustainability knowledge as self-assessment, and to overconfidence in one's performance as overprecision.

2.3.2.1. Self-assessment. Self-assessment was measured through two questions in the quiz, the answers to which were coded as the variables *selfassessment1* and *selfassessment2*. Both variables are continuous and were recorded through a slider ranging from 0 to 100. *Selfassessment1* represents how much participants think they know about sustainability, where 0 corresponds to "I don't know anything about sustainability", 50 to "I know about half of what there is to know", and 100 to "I know everything about sustainability". *Selfassessment2* represents how much participants believe to know about sustainability in comparison to other people in their country, where 0 means "I know nothing compared to other people", 50 means "I know more or less the same as other people", and 100 means "I know everything compared to other people. A correlation between these two measures is suspected and will be checked during data analysis; if that is the case, a combined measure of the two, *selfassessment*, will be used thereafter.

2.3.2.2. Overprecision. Overprecision was measured in two ways, *overprecision1* and *overprecision2*, as described below. The computations that follow are our own adaptation of the Reported Error Method described in Bosch-Rosa, Kassner, and Ahrens et al. (2021).

Overprecision1 was calculated as the difference between a participant's actual error and their estimated error, which is derived from the participants' estimations of their own scores for each section of the experiment.

Overprecision2 was calculated as the difference between a participant's actual error and their predicted error. Participants' answers to the question "How many questions do you think you got wrong in this section?" were recorded and then converted into participants' predicted errors calculated in points.

A high correlation between *overprecision1* and *overprecision2* is expected and will be checked during data analysis.

An individual will be described as overconfident if their overprecision measures are greater than 0; the further away from 0, the more overconfident. On the other hand, if their overprecision is smaller than 0, then the individual is underconfident.

2.3.3. Model of judgment accuracy

The following model of judgment accuracy is tested:

$$accuracyratios_i = b0 + b1*selfassessment_i + b2*organic_i + b3*age_i + b4*vegetarian_i + b5*vegan_i + b6*primaryshopper_i + b7*country_i + b8*education_i + b9*earnings_i + b10*householdsize_i + b11*overconfidenceinsections_i + b12*salience + b13*choiceoverload + b14*distractor + b15*salience*choiceoverload + b16*distractor*choiceoverload + b17*salience*overconfidenceinsections_i + b18*choiceoverload*overconfidenceinsections_i + b19*distractor*overconfidenceinsections_i + C*X_i + D*Y_i + E*Z_i$$

Where *salience*, *choice overload*, and *distractor* are dummy variables indicating the experimental treatments. *Overconfidence in sections* is a measure of overconfidence derived from overprecision (see 3.1.3.2.). X_i, Y_i, and Z_i are vectors: X_i represents the individual's preferences for food stores or markets; Y_i is their gender; Z_i represents their employment status. The variables vegetarian, vegan, primary shopper, and country are dummies; education, earnings and household size are ordinal.

2.4. Participants

336 participants completed the study, with 166 people from the UK (49.4 %) and 165 from Italy (49.1 %), and the remaining preferring not to say or not answering. Participants were, on average, 32 years old ($M = 32.88$, $SD = 11.244$), with the minimum reported age being 18 and the maximum being 76. 60.1 % were male and 37.2 % were female. 1 person preferred to self-describe as non-binary, and 1 as gender-fluid. 5 people preferred not to disclose their gender. Participants were recruited through Amazon Mechanical Turk and gave their informed consent before taking part in the study. They had a maximum of 1 h to submit their answers and were compensated with $0.50 for their time spent on the experiment. Participants were given a code during the study which they had to provide on Amazon M. Turk after submitting their answers to validate their participation; 5 participants were excluded from recruitment for not providing the code.

2.5. Ethics

This study received ethical approval from The Bartlett School of Environment, Energy and Resources Ethics Committee.

2.6. Data analysis

The following data analysis, agreed before data collection, is performed. Descriptive statistics are calculated first. A model-testing analysis follows, with a focus on answering the research questions described in 1.4. Firstly, a linear regression is computed. Secondly, a Tobit regression is performed to check if the same results hold. Thirdly, a quantile regression is performed to assess whether our variables have a different impact on judgment accuracy depending on how low or high participants' scores are. Adjustments to the variables used in our model are made where appropriate to avoid issues such as that of multicollinearity.

3. Results

3.1. Descriptive statistics

3.1.1. Consumers' preferences and household size

Participants reported, on average, that less than half of their food shopping is organic (organic: $M = 42.8$, $SD = 23.3$). 14.9 % ($N = 50$) of the participants said to be vegetarian, and 5.7 % ($N = 19$) to be vegan. 81 % ($N = 272$) of the participants reported to be the primary food shopper in their household. When asked to indicate where they do their grocery shopping, the majority (46.1 %, $N = 155$) reported to go to their local supermarket, followed by a big chain store (38.1 %, $N = 128$). Only 11.1 % of the participants ($N = 37$) said they shop at their local market, and 3.3 % ($N = 11$) at specialty food stores.

25.6 % ($N = 86$) of the participants had a household of 4, and 25.0 % ($N = 84$) a household of 3. 24.1 % had a household of 2, and 12.2 % of 1. 7.1 % had a household of 5, 2.4 % of 6, 1.2 % of 7, and 0.3 % of 8.

3.1.2. Participants' information

38.7 % of the participants ($N = 130$) had a Bachelor's degree or an Italian Laurea Triennale. 22.6 % completed up to the final exam of secondary school in Italy, and 19.3 % had a Master's degree or the equivalent Specializzazione in Italy. 10.1 % completed A-levels in the UK, and 2.7 % completed GCSE. 1.2 % achieved a PhD or the equivalent Dottorato. 1.2 % completed middle school in Italy, and 0.3 % only primary school in Italy. Both the Italian and British sub-samples reported higher levels of education compared to their respective country's populations (see Table 1).

43 % of the participants ($N = 147$) reported to be employed full-time and 18.5 % ($N = 62$) to be employed part-time. 7.1 % were unemployed but looking for work, and 1.5 % unemployed and not looking for work. 3 % reported to be unemployed and not looking for work for personal reasons, and 19.9 % were students. 2.1 % were retired.

12.5 % of the participants reported to be earning £37,000 or more (€42,977 or more), 17.6 % to be earning £24,000 to £36,999 (€27,877 – 42,976), 13.7 % to be earning £17,000 to £23,999 (€19,746 – 27,876), 11.3 % to be earning £12,000 to £16,999 (€13,938 – 19,745), 8.9 % to be earning £8,000 to £11,999 (€9,292 – 13,937), 5.7 % £4000 to £7,999 (€4,646 – 9,291), and 9.8 % £1-3,999 (€1 to 4,645). 3.9 % reported not to be earning.

3.1.3. Overconfidence

3.1.3.1. Self-assessment. Participants reported, on average, that they know more than half of what there is to know about sustainability (*selfassessment1*: $M = 56.5$, $SD = 19.7$), and that they know more than others (*selfassessment2*: $M = 60.9$, $SD = 17.6$). The two measures were found to be statistically correlated ($r(334) = 0.67$, $p < .001$), but a paired samples *t*-test suggested their means to be statistically different ($t(335) = -5.25$, $p < .001$). Hence, a new combined measure (*selfassessment*) was created by computing their average and is used thereafter for model testing.

3.1.3.2. Overprecision. It was found that participants were, on average, underconfident: The average scores of overprecision were negative in each experimental section (Fig. 5). Therefore, participants estimated on

Table 1
Employment status and education level of the sample compared to national averages (Istat, 2021, 2023; ONS, 2022, 2023).

Country	Italy		UK	
Sample/Population	Sample	Population	Sample	Population
Employment: full-time and part-time	46.7 % (from 18yo)	60.3 % (from 15yo)	78.3 % (from 18yo)	75.6 % (from 16yo)
Education: Secondary school (At least. For Italy: at least a Diploma. For UK: level 3 and level 4 qualifications.)	91.5 %	62.9 %	90.4 %	50.7 % (England and Wales).
Education: Bachelor's degree (At least. For Italy: Laurea. For UK: level 4 qualification.)	49.7 %	20.1 %	69.3 %	33.8 % (England and Wales).

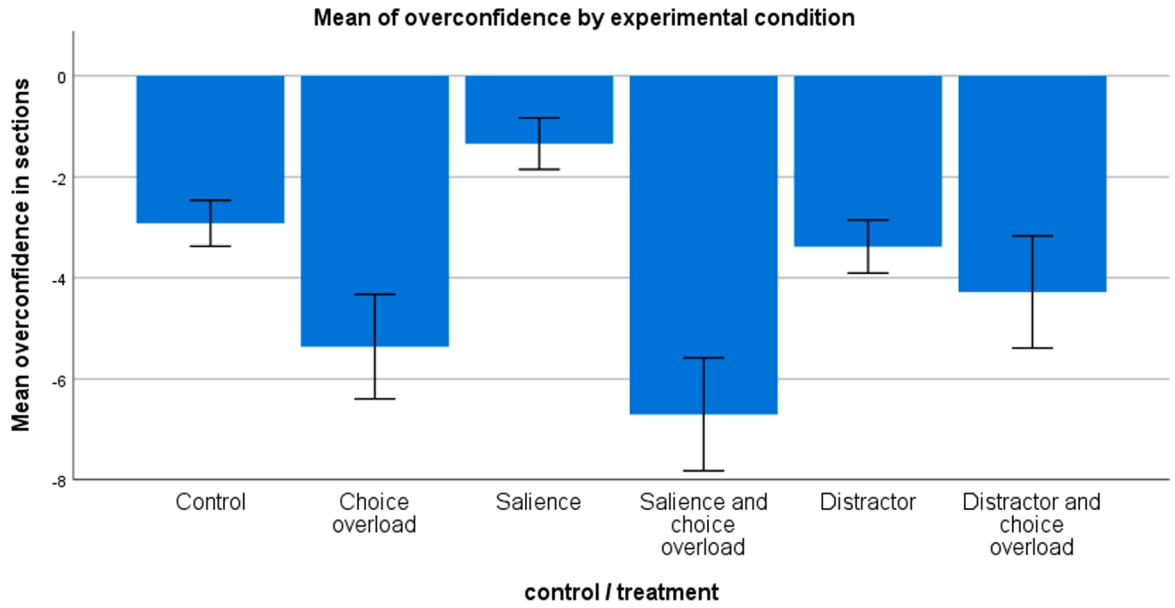

Fig. 5. Mean overconfidence in sections by treatment. Error bars: +/- *2 SE*. Tested with 336 participants, 32 years old on average.

average to have performed worse than they did across the experiment.

Overprecision1 was the lowest, on average, in section 4 ($M = -6.7$, $SD = 10.2$), and the highest in section 3 ($M = -1.3$, $SD = 4.6$). The highest measure of overprecision1 was found in section 4 (with a value of 26), and the lowest in sections 4 and 6 (with a value of − 30). Similar results were found for *overprecision2*, being the lowest in section 4 ($M = -6.7$, $SD = 10.1$), and the highest in section 3 ($M = -2.2$, $SD = 4.8$). These findings show that, despite participants being underconfident on average, there was great variation in overconfidence levels, with some participants being very overconfident and others very underconfident.

The two measures of overprecision were found to be statistically correlated in each section. Moreover, the two measures had non-statistically different means in sections 4, 5, and 6 of the experiment. Therefore, only *overprecision1* is used thereafter for the purpose of model testing to avoid the issue of multicollinearity, and is recoded as *overconfidence in sections*.

3.1.4. Judgment accuracy

Participants' judgment accuracy was, on average, at least 64 %, with the highest average accuracy rate being 76.97 % in section 5 (distractor), and the lowest average accuracy rate being 64.76 % in section 6 (distractor, choice overload) (Fig. 6).

3.1.5. Symbol and manipulation check

When answering the question "Could you easily see or spot the symbols below on the packaging in some of the photos?", most participants ($N = 51$) selected "Sometimes could be seen, sometimes could not be seen", which corresponded to a value of 50 on the slider ranging from 0 ("Could not be seen at all") to 100 ("Could very easily be seen"). The average response was *symbol* ($M = 46.3$, $SD = 29.8$), which suggests great variation amongst participants. Hence, it seems like it was harder for some to spot the symbols on the packaging than for others, and this is considered in the discussion.

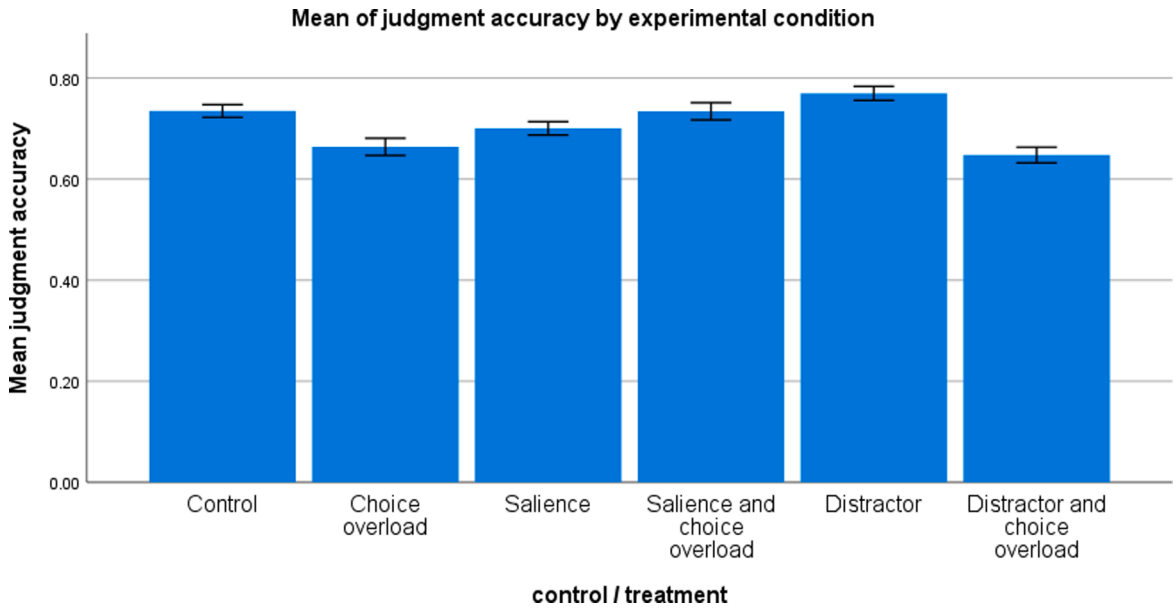

Fig. 6. Mean judgment accuracy by treatment. Error bars: +/- *2 SE*. Tested with 336 participants, 32 years old on average.

Table 2
The effects of treatments and overconfidence on judgment accuracy. Significance: *** for P ≤ 0.001.

Model	Unstandardized Coefficients	
	B	Std. Error
Salience	-0.008	0.011
Choice Overload	-0.060***	0.011
Distractor	0.035***	0.011
Salience X Choice Overload	0.064***	0.016
Distractor X Choice Overload	-0.053***	0.015
Overconfidence-In-Sections	-0.013***	0.001
Salience X Overconfidence-In-*Sec.*	-0.001	0.001
Choice Overload X Overconfidence-In-*Sec.*	0.006***	0.001
Distractor X Overconfidence-In-*Sec.*	0.000	0.001

3.2. Further analysis

3.2.1. Model testing

The model can explain 30.1 % ($R^2 = 0.30$) of the variance in accuracy ratios ($F(32, 1491) = 20.10$, $p < .001$). The variables of self-assessment, age, vegan, primary shopper, local market in *X*, overconfidence in sections, choice overload, distractor, and the interactions of salience and choice overload, distractor and choice overload, and choice overload and overconfidence in sections, were found to be significantly related to accuracy ratios (see Table 2).

A post-hoc power analysis was conducted using the software G-Power 3.1 (Faul et al., 2007). Considering a sample size of 336 and 28 predictors, α set at 0.05, and a large effect size ($f^2 = 0.43$) (two tails), a Power equal to 1 was obtained.

3.2.1.1. Hypotheses testing. The treatment of salience (H1) did not have a significant impact on judgment accuracy ($t(1491) = -0.69$, $p = .489$). The treatment of distractor had a significant impact on judgment accuracy, with accuracy increasing by 0.035, contrary to expectations, when the distractor was present ($t(1491) = 3.18$, $p = .001$) (H2).

As predicted, the treatment of choice overload (H3) had a significant impact on accuracy, as when a high amount of information was present, the accuracy declined by 0.060 ($t(1491) = -5.27$, $p < .001$). Moreover, the interaction of distractor and choice overload was also significant: When both treatments were present this led to a decline in accuracy of −0.053 ($t(1491) = -3.46$, $p = .001$), as hypothesised (H4).

The variable self-assessment was positively linked to accuracy ratios ($b1 = 0.001$, $t(1491) = 5.74$, $p < .001$), contrary to what was hypothesised (H5). On the other hand, overconfidence in sections was negatively linked to accuracy as hypothesised ($b11 = -0.013$, $t(1491) = -10.65$, $p < .001$) (H6).

Using paired-samples t-tests, we checked whether participants' overprecision1 in sections 3 (salience) and 5 (distractor) were significantly different than their overprecision1 in section 1 (control) of the experiment. It was found that, on average, respondents' overprecision1 in the salience treatment ($M = -1.3$, $SD = 4.6$) was statistically different than the control measure ($M = -2.9$, $SD = 4.1$); [$t(335) = -6.70$, $p < .001$]. On the other hand, the measures of overprecision1 relative to section 1 and 5 ($M = -3.3$, $SD = 4.8$) were not found to be, on average, statistically different ($t(335) = 1.84$, $p = .065$). Hence, H(7) was only partially supported.

The interaction between salience and overconfidence in sections (H8) was not significant ($t(1491) = -0.59$, $p = .554$), and neither was the interaction between distractor and overconfidence in sections (H9) ($t(1491) = 0.46$, $p = .641$).

By comparing participants' overprecision1 in the control section ($M = -2.9$, $SD = 4.1$) and in the choice overload treatment section ($M = -5.3$, $SD = 9.4$) with a paired-samples *t*-test, it was found that the two are statistically different ($t(335) = 5.53$, $p < .001$). Hence, H(10) was supported.

Unexpectedly, the interaction between choice overload and overconfidence (*H*11) was found significant and positively related to accuracy ($b18 = 0.006$, $t(1491) = 5.25$, $p < .001$).

Being vegetarian was not significantly related to judgment accuracy (H12) ($t(1491) = -0.53$, $p = .593$), however, being vegan was linked to a decrease in judgment accuracy of −0.033 ($t(1491) = -2.16$, $p = .031$), in opposition to the hypothesis that being vegan would lead to greater knowledge of sustainability characteristics of products which would in turn mean higher judgment accuracy (H13).

Being the primary shopper of a household was related with an increase in judgment accuracy of 0.026 ($t(1491) = 2.76$, $p = .006$), which is consistent with hypothesis (H14).

No significant relationship was found between buying organic food and judgment accuracy (H15) ($t(1491) = -1.24$, $p = .214$).

3.2.1.2. Exploratory analysis. The interaction of salience and choice overload was significant: When both treatments were present this led to an increase in accuracy of 0.064 compared to when neither treatment was present ($t(1491) = 4.10$, $p < .001$).

The variable age was also positively linked with accuracy ratios ($t(1491) = 2.34$, $p = .019$) suggesting that an increase in age of 1 years old was linked to an increase of 0.001 in accuracy.

The variable for local market (in X) was also significant ($t(1491) = 1.97$, $p = .048$), with shopping at the local market being linked with a 0.022 increase in accuracy.

Overconfidence was not significantly different between countries ($t(1953) = -0.930$, $p = .352$).

No significant relationship was found between gender, education, income, employment status, household size, and country of residence, and judgment accuracy.

3.2.2. Tobit regression

A Tobit regression was performed to check if considering the scores as having a minimum and a maximum value would change the results of the hypotheses testing analysis. No changes in the overall significance or signs of the coefficients of the treatment variables and overconfidence variable were found (see Table 3).

3.2.3. Quantile regression

Finally, a quantile regression was performed to test whether the impact of our treatments, of the interactions between treatment variables, and of the interactions between treatment variables and overconfidence, on accuracy was different depending on participants' scores. These were divided using the quantile points 0.25, 0.50, and 0.75. It was found that this model best predicts lower scores ($q = 0.25$, $R^2 = 0.181$) compared to higher scores ($q = 0.5$ and $q = 0.75$, $R^2 = 0.179$).

Table 3
The effects of treatments and overconfidence on judgment accuracy (Tobit regression). Significance: *** for P ≤ 0.001.

Model	Unstandardized Coefficients	
	B	Std. Error
Salience	-0.007	0.011
Choice Overload	-0.060***	0.011
Distractor	0.037***	0.011
Salience X Choice Overload	0.064***	0.015
Distractor X Choice Overload	-0.055***	0.015
Overconfidence-In-Sections	-0.013***	0.001
Salience X Overconfidence-In-*Sec.*	-0.000	0.001
Choice Overload X Overconfidence-In-*Sec.*	0.006***	0.001
Distractor X Overconfidence-In-*Sec.*	0.000	0.001

Overconfidence in sections had an impact of – 0.012, − 0.014, and – 0.015 respectively on judgment accuracy, with higher scores being affected the most. Choice overload and overconfidence in sections had an impact of 0.004, 0.007 and 0.007 respectively, again affecting the highest scores the most. Choice overload was the most detrimental on the lower scores, with an impact of − 0.086 on lower scores, and of − 0.048 and of − 0.040 on middle and higher scores. Distractor had an impact of 0.014 on lower scores, and of 0.046 and 0.048 on higher scores. The interaction of distractor and choice overload only affected the middle and high scores. The interaction of salience and choice overload had an impact of 0.074 and 0.073 on low and middle scores, and of 0.080 on high scores. The interaction of distractor and choice overload had an impact of − 0.032 on low scores, and of − 0.065 and − 0.074 on middle and high scores.

Age was not a significant factor in affecting the lower scores but was significantly related to the middle and higher scores of judgment accuracy. Vegan was only a determining factor for the lower scores. Being the primary shopper, and employment status, were determining factors for the lowest and highest scores. Education was a factor in all quartiles, but at different levels: The highest level of education that was found to be significantly correlated with low accuracy scores was completion of high school; whereas for middle and high scores it was completion of a bachelor's degree. Country only significantly affected high scores, however, there was not a significant difference between the countries' mean scores ($t(1984) = -0.250$, $p = .803$). The directions and possible interpretations of these correlations are considered in the discussion section.

4. Discussion

4.1. Labels

Our analysis suggests that salience did not have an impact on consumers' judgment accuracy. However, when the label was used as a distractor, it had an unexpected positive relationship with participants' scores (in middle and high-score groups). This is a surprising finding as previous research suggests that greater knowledge is correlated with higher involvement with labels (Karakaya and Saracli, 2018). However, the context of that finding is different: Karakaya and Saracli (2018) were investigating how consumers interact with nutrition labels, and found that when consumers were aware of the negative impact of certain nutrients, they would pay more attention to labels. On the other hand, we found that consumers with greater sustainability knowledge may ignore those labels which are untruthful. This finding could be interpreted in multiple ways. It is possible that participants trust their own knowledge more than labels, thereby ignoring additional information placed on packaging. Alternatively, participants who scored well in the quiz may know enough about food sustainability to be able to identify a misleading label on packaging.

4.2. Choice overload

As expected, choice overload decreased sustainability judgment accuracy. This means that when presented with multiple options, consumers may find it harder to pick the sustainable one (even if they want to). This effect was greater on lower scores, suggesting that the judgment accuracy of those who do not know much about product sustainability is affected the most.

The interaction between choice overload and distractor also had a negative effect on accuracy, suggesting that assessing many options whilst evaluating label information into the judgment can be challenging for consumers. Importantly, the effect of the interaction was found to affect middle and high scores, but not low scores. This means that, independently of someone's knowledge of sustainability, the combination of choice overload and a label acting as a distractor is detrimental for judgment formation.

Salience did not have a significant effect on judgment accuracy on its own, however the interaction between salience and choice overload positively affected judgment accuracy. The effect of this was greater on higher scores. Overall, this finding suggests that consumers may rely more on labels when more options are available, therefore improving their judgment when labels are truthful.

Choice overload was detrimental for sustainability judgment accuracy, and brought consumers to trust both truthful and untruthful labels more. The negative impact of choice overload on consumers' choice was already suggested by Iyengar and Lepper (2000), who found that customers would choose to buy a jam more frequently when they only had to choose between six rather than twenty-four alternatives. The authors suggested that too much choice can decrease motivation to make a choice. Similarly, our finding suggests that too much choice can be bad for consumer judgment.

4.3. Overconfidence

Respondents believed to know more than half of what there is to know about sustainability, and to know more than others. However, higher self-assessment ratings were positively correlated to judgment accuracy, possibly suggesting that a greater level of knowledge corresponded to a higher level of confidence.

When overconfidence was measured as overprecision, participants were, on average, underconfident: They believed they had scored worse than they did. However, this measure showed great variation, with some participants being overconfident and some underconfident. When analysing the relationship between their overconfidence-in-sections and judgment accuracy, a negative relationship was found. This is in line with previous literature that suggests that being overconfident about one's knowledge or ability relates to a lower performance (Zacharakis & Shepherd, 2001). Moreover, the effect of overconfidence-in-sections was found to be negative and bigger in absolute terms as judgment accuracy increases.

When comparing overconfidence-in-sections measures across treatments, it was found that participants' overprecision was higher in the salience treatment than in control, despite both measures showing underconfidence on average. This may suggest that labels increase participants' confidence, however, no significant relationship was found between salience and scores. On the other hand, participants' overprecision in the distractor treatment was not found to be statistically different to the control measure.

No significant interaction was found between salience and overconfidence-in-sections or distractor and overconfidence-in-sections. This suggests that there is no combined effect of overconfidence and interpreting new information such as labels on accuracy. This is different to the previous finding that being overconfident would lead people to consider less information and therefore be less accurate (Zacharakis & Shepherd, 2001).

Participants' overconfidence-in-sections with choice overload was statistically lower than the control measure, despite both being on average smaller than 0 (indicating underconfidence). This finding shows that a high amount of information reduces consumers' confidence in their product sustainability knowledge. However, the interaction between overconfidence-in-sections and choice overload was found to have a positive and statistically significant impact on judgment accuracy, possibly suggesting that higher overconfidence can help in the decision-making process when it is hindered by many options. The effect of this interaction was found to be bigger on middle and high scores.

4.4. Demographics and consumers' preferences

Age was positively linked to accuracy (mostly with higher scores), indicating that more experience with grocery shopping leads to greater knowledge of food product sustainability.

Employment status seemed not to have an effect when the general

model was tested. However, our quantile regression analysis showed it affected low and high scores. Looking for work was negatively related to low scores but positively related to high scores. Education was not significantly correlated to scores in the general model but was surprisingly a negative factor in our quantile analysis at different levels across quantile groups. Completion of high school was the highest level of education significantly related to low scores, whilst completion of a bachelor's degree was the highest level related to middle and high scores. Therefore, the overrepresentation of highly educated people in our sample compared to the general population has likely not led the judgment accuracy scores of the sample to be higher than those of the population.

Being vegetarian did not seem to be related to judgment accuracy. However, being vegan was negatively related to participants' accuracy. This finding is contrary to our prediction that being vegan would lead to greater knowledge of food sustainability and therefore higher scores. This suggests that consumers may choose to be vegan for other reasons (ethical, rather than environmental). Alternatively, vegan consumers may not be informed about the environmental impact of food products such as meat and fish simply because they do not consume them. Because this negative effect was only present in the lower scores group, the first explanation seems more plausible. Participants may be vegan for reasons other than being environmentally friendly, and may not be interested in sustainability. However, being vegan per-se does not imply a lack of food sustainability knowledge. Similarly, no relationship was found between buying organic food and judgment accuracy, suggesting that consumers may buy organic products for reasons other than the environment, such as personal health.

Being responsible for the household's food shopping was positively related to judgment accuracy. Further analysis suggests that this effect applies to low and high scores, but not middle scores. Those who shop more often may have a greater knowledge of food products. Shopping at the local market was positively linked to accuracy, which may be an indicator of caring for the environment and looking for more environmentally conscious produce.

Participants were recruited from the UK and Italy. These two countries were chosen for having similarly developed economies but different food cultures. By testing our general model, we found no correlation between country of residence and participants' judgment accuracy scores. The quantile regression found country to only be significantly related to high scores, with UK scores being 0.018 higher than Italian scores. Overall, no significant difference in scores was found between the two countries, suggesting that consumers' decision-making varies little across these two cultures.

4.5. Implications for retailers and policymakers

The findings from this study suggest that labels do have an impact on consumers' perception of food products, especially when there are many goods to choose from. If labels truthfully describe a sustainable product as such, the consumers will then be able to identify the most environmentally friendly items, and buy them, if they wish. However, if labels are untruthful, shoppers will be misled. It is therefore important for retailers and policymakers to recognise the value of salient labels to help consumers eat more sustainably. Retailers should take great care in making sure that sustainable food products stand out. Policymakers should make certain that quality checks are performed to ensure that companies do not mislead their customers by placing their own green label on a product that is not actually environmentally friendly. As research shows that mandatory calorie posting can be effectful in reducing the average calorie consumption per purchase (Bollinger et al., 2011), the introduction of a mandatory green label on food products may be considered.

4.6. Limitations

Participants were recruited on Amazon Mechanical Turk. There is a debate as to whether responses collected through this platform are reliable enough (Buhrmester et al., 2011; Rouse, 2015), which could represent a limitation of the current sample. However, a code was used as a method for screening candidates (see 2.4.). Moreover, Amazon Mechanical Turk allowed for recruitment of participants from two different countries at the same time, which would have not been possible had the study been conducted in a laboratory setting, therefore positively contributing to the diversity of the sample.

The study was advertised as a questionnaire on food consumption and sustainability. Those who decided to participate and completed the study may not be representative of the general population as they may have an interest in the topic, and hence their average accuracy score may be higher.

The green symbol that was used in the salience and distractor treatments may not have been identified by all participants (see 3.1.5.). However, as not all the experimental sections had products with a symbol on their packaging, it is not clear whether participants could not identify the symbol because it was not present or because they could not see it when it was present. Further research could test the impact and recognisability of different symbols on product packaging to identify which logos are more easily seen and associated with environmental sustainability.

Participants were explicitly asked to identify the most sustainable item amongst the ones presented to them. Therefore, this experiment gives us insights into how well consumers can distinguish between the most and least environmentally friendly food products when they wish to do so. However, being able to identify sustainable food products does not necessarily translate into willingness to purchase them. Therefore, the results from this experiment should be used in conjunction with findings from behavioural studies aimed at encouraging consumption of sustainable products to inform retailers.

This experiment had a within-subjects design. Therefore, it may have presented a limitation that is common to studies with this design: Treatments may have become progressively less effective as participants got used to them. However, participants never saw the same combinations of products. Because sustainability, in this piece of research, was evaluated in comparative terms, not in absolute terms, each question was therefore unique, despite certain items being shown to participants multiple times in the experiments. Therefore, participants had to answer each question individually, and could not rely on their previous answers.

As this study was conducted online, respondents could only see photos of the food products. This design may be more representative of online shopping than an in-person grocery shopping scenario. Moreover, participants were presented with images of different food products, such as meat and vegetables, next to each other. This is not generally the case when shopping online or in-person, as products tend to be grouped in categories. Further research may test possible differences between online and in-person shopping scenarios, and between different food products layouts.

Finally, only 8 products were showed to the participants in the choice overload treatment. However, in a real-life shopping scenario, there are generally many more alternatives consumers can choose from. Further research may investigate whether increasing the number of available products linearly worsens judgment, or whether the effect of choice overload eventually plateaus.

5. Conclusion

This research shows the impact that salient labels and choice overload can have on consumers' judgment of food products and sustainability. We learn that choice overload can negatively affect judgment accuracy, but that truthful labels may counteract this effect by helping consumers pick the most environmentally friendly option available.

Because shoppers tend to trust labels, these, if untruthful, can also be misleading. For these reasons, great attention should be given to the way food is displayed and labelled in grocery stores and online shops to encourage consumption of environmentally friendly products.

Author contributions

Arianna Buratto originated the study idea and design, set up the experiment, performed data collection and analysis, and led the writing. Lorenzo Lotti supervised and provided support for the study design, data analysis, and writing the manuscript. The work conducted by Arianna Buratto was undertaken for her PhD thesis as part of the PhD Sustainable Resources programme at University College London.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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