Anchoring climate-friendly food options: Interventions and mechanisms

Pre-analysis plan

11.09.2024

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1. Background

One of Danny Kahneman's significant contributions to the field is his research on **anchoring effects** and **attention**, and how these factors influence decision-making (Kahneman, 1973; Gilovich et al., 2002). He demonstrated that individuals heavily rely on initial pieces of information (anchors) when making estimates or judgments, often insufficiently adjusting from these starting points, which leads to biases in their decisions. This aligns with his broader framework of "fast and slow" thinking where fast thinking (System 1) is automatic and relies on heuristics, while slow thinking (System 2) is deliberate and analytical.

Food-delivery platforms have become more prominent in recent years, offering unique opportunities to design user interfaces that harness **anchoring effects** (or 'first offer effects') to encourage customers to choose meals that are healthy and have a smaller carbon footprint. Supporting this, Lohmann et al. (2024) find that repositioning menus in order of sustainability is a particularly effective intervention. In contrast, carbon footprint labels, which may direct attention toward the issue of carbon emissions and improve knowledge, were less effective on average. Lohmann et al. (2024) further show that **inattention** may be an important mechanism amplifying anchoring effects. They find that treatment effects are substantially larger for participants who ordered their meals in less than a minute, in both labelling and repositioning conditions. However, this exploratory analysis relied on endogenous measures of attention (i.e. time spent on the platform), which does not allow for a causal interpretation. Nor does it provide insights into the decision-making process.

In this study, we aim to uncover the decision-process underlying food choices under different food policy interventions by exogenously varying attention using a **continuous time-pressure choice-process elicitation mechanism**. If our research confirms the initial findings, it would have profound implications for the design of sustainable food policies that, on the one hand, leverage inattention and inertia (such as repositioning or defaults) or, on the other hand, rely on sufficient attention (such as carbon labelling). Our findings will have practical implications for the work of behavioural designers and policymakers.

2. Research questions

R1: ANCHORING AND CLIMATE FRIENDLY FOOD CHOICE:

Can anchoring be employed to increase climate-friendly food choices? Specifically, can repositioning interventions and labels (i.e. changes in the online choice architecture) causally impact the carbon footprint of food choices on food delivery apps?

R2: LIMITED ATTENTION AND TIME PRESSURE

Is limited attention (due to time pressure) the key mechanism underlying ***anchoring*** *(or* ***"first offer effects"****)? How does the decision making process unfold on food delivery platforms under continuous time-pressure? Do we initially observe intuitive "System 1" behaviour which is driven by the context. How do participants' choices change when they are given more time to revise their choices.*

R3: WILLIGNESS TO PAY

What are participants willing to pay for a menu repositioned in order of sustainability/menu that displays carbon footprint labels?

3. Experimental Design

We will conduct an online randomised controlled trial using an **incentive-compatible simulated food delivery platform**. The platform was developed and validated in previous research (Lohmann et al. 2024). The platform closely mimics real world food delivery apps such as Deliveroo and Just Eat and is representative of the UK food delivery landscape. Choices on the platform are incentivised using a **random incentive mechanism**, to encourage accurate and honest behaviour. The experiment will be implemented via Predictiv, the Behavioural Insight Team's policy testing platform, which includes a large and diverse participant pool. We will recruit a sample representative of UK food delivery app users.

Participants in the experiment will view different versions of the food delivery platform based on random assignment to one of several experimental conditions that leverage (in)attention in different ways: (1) control condition, (2) menu repositioning intervention, (3) carbon footprint labels intervention. Two additional conditions will be used to elicit the willingness to pay for menu repositioning and carbon footprint labels (see section 3.5).

The design of the carbon footprint labels was pre-tested with a sample of 200 participants from the UK, recruited via Prolific in August 2024. Three alternative label designs were evaluated, with participants rating them on various criteria, including the quality of information provided, clarity, conciseness, comprehensibility, trustworthiness, visual appeal, and suitability for food delivery apps. The label with the highest overall score was selected for use in the main experiment.

To causally investigate effect of attention, we will implement a **continuous time-pressure choice-process elicitation mechanism** adapted from Crosetto & Gaudeul (2023) and originally proposed by Caplin et al. (2011). The method applies a random stopping mechanism, which generates continuous time pressure as participants do not know at what point in time their choice will be taken into account. The implementation of this mechanism is detailed below.

We will further utilise an adapted **Becker–DeGroot–Marschak (BDM) mechanism** to estimate to elicit willingness to pay (WTP) for the choice architecture intervention – the repositioned menu – and the carbon footprint label. The implementation of this mechanism is detailed below.

Pre- and post-intervention surveys will be used to elicit perceived autonomy and control as well as a range of individual level characteristics and preference variables.

3.1 Experimental Setting

The experiment will be conducted using a simulated food delivery platform. The platform includes nine restaurants that are based on real-world equivalents and offer a variety of popular cuisines. For this study, each restaurant's menu is limited to main meals, adapted so that they can be considered a "full meal" (e.g. burger with fries), and the prices have been adapted to market prices of July 2024. The prices were then slightly adjusted to align with the £20 incentivisation budget and to improve balance between the restaurants. To encourage honest choices and prevent over-ordering, participants are limited to selecting one main meal only. Prices are calibrated so that any main meal can be bought within the £20 budget, even if participants in the WTP elicitation conditions are willing to forgo £1 of their budget to view the intervention. The platform's functionality and pricing were fine-tuned in one round of pre-testing in August 2024.

3.2 Conditions

1. **Control condition:** Random order of restaurants and meals. No information shown.
2. **Repositioning:** The full menu is repositioned in order of carbon footprint. Users remain unaware of repositioning.
3. **Carbon footprint labels:** The menu includes carbon footprint information on all menu items. Random order of restaurants and meals.
4. **WTP Elicitation Repositioning:** Before viewing the food delivery app, participants first complete a WTP elicitation task to view a repositioned menu using a BDM mechanism. The choice is consequential and the menu will be implemented based on a random draw and the Willingness to Pay.
5. **WTP Elicitation Labels:** Before viewing the food delivery app, participants first complete a WTP elicitation task to view the carbon labels using a BDM mechanism. The choice is consequential and the menu will be implemented based on a random draw and the Willingness to Pay.

3.3 Incentivising Food Choices

Participants are provided with a virtual budget which they can spend on their online food order. Choices will be made incentive-compatible using a random incentive mechanism: One in thirty participants (3.3%) will be randomly selected to receive their food choice from the experiment (or the closest possible match), after completion of the survey. They will subsequently be asked to choose a date and time (from a selection of dates) on which they would like to receive their meal. Meal orders will be placed by the research team using Deliveroo (or equivalent). Any remaining budget will be paid out to participants via an email payment. Email-addresses are collected at the end of the experiment. Winners are then re-contacted separately and asked to provide address details so that the chosen meal can be ordered to their homes. Alternatively, winners are given the option to donate the value of their meal to a UK-based food bank.

3.4 Time Pressure Mechanism

We employ a continuous time-pressure choice-process elicitation mechanism adapted from Crosetto & Gaudeul (2023) and originally proposed by Caplin et al. (2011). The method applies a random stopping mechanism, drawn ex-post, which generates continuous time pressure as participants do not know at what point in time their choice will be taken into account.

Implementation:

1. Participants have 90 seconds to choose a meal on an online food delivery platform by adding it to their basket. They can change their selection anytime during these 90 minutes but cannot check out early. They are informed that they cannot check out before the time is up.
2. At the end of the task, a random second is selected:
    a. If a meal was chosen at that second, it becomes the meal that is ordered.
    b. If no meal was chosen at that second, participants won't receive any meal or financial payoff if selected through the random draw.
3. The data collected from each participant is a record of all choices made during the task.

This mechanism encourages participants to make a meal choice as soon as they believe they have a found a better option than receiving no meal at all.

3.5 Eliciting WTP for Interventions (Exploratory analysis)

Two groups (n~500 per group) complete a Becker–DeGroot–Marschak (BDM) mechanism before proceeding to the main food choice task. One group states their willingness to pay (WTP) for 'carbon labelling' and the other for 'menu repositioning'. The choice is consequential and the menu will be implemented based on a random draw and their WTP. The BDM mechanism implementation can be summarised as follows:

1. (Q1) Participants first choose between a sustainability-ordered menu or a standard menu.
2. (Q2) Participants state how much they are willing to pay (WTP) of their virtual budget to view their preferred menu if it is not randomly selected. In steps of £0.25 between £0 and £1,00.
3. A random draw (50:50) determines whether their preferred menu or the default (alternative) option is chosen.
4. If the randomly selected menu matches their preferred menu:
    - The preferred menu is shown at no cost.
5. If the randomly selected menu does not match their preferred menu:
    - A random price between £0.00 and £1.00 (in £0.25 increments) is drawn.
    - If the participant's WTP is equal to or higher than the drawn price:
        - The preferred menu is shown, and the difference in price is deducted from their virtual budget.
    - If the participant's WTP is lower than the drawn price:
        - The less-preferred menu is shown.

This process involves random selection and price determination, ensuring flexibility in the menu display based on participants' preferences and willingness to pay.

3.6 Survey data

A pre-intervention survey (~1-2 minutes) will be used to measure additional participant characteristics. A post-intervention survey (2~3 minutes) will be used to measure self-reported

satisfaction with participants' food choice, self-reported reasons for their choice and support for sustainable food policy interventions, including those tested in this study.

3.7 Measured Variables

Raw outcome data:

1. The data obtained from each subject are a **vector containing all the choices** added to the basket over a period of T = 90 seconds, $C_i = \{c_{it} \mid t = \dots T\}$. From this data, we will extract the following food choice outcomes at any given time.

Food choice outcomes:

1. Sum of greenhouse gas emissions intensity of all items in the basket in kilograms CO_2 equivalent per serving.
2. Choice probabilities for ordinal outcome variables of carbon intensity corresponding to the label impact score (A-E), restricted to main dishes only.
3. Choice probabilities for meal types (vegan, vegetarian, fish, meat), restricted to main dishes only.

4. Hypotheses

Hypotheses H1, H2 and H3 are guided by exploratory analysis in Lohmann et al. (2024).

H1: [Between-subject hypothesis] The anchoring effect is higher in the "repositioning" and "labelling" conditions, relative to control. This is reflected by a lower basket carbon footprint in the two treatment conditions, compared to control.

H2: [Within-subject hypothesis] The anchoring effect in the "repositioning" and "labelling" conditions is largest under high time-pressure ('fast thinking') and diminishes if participants are given time to refine their choices ('slow thinking').

H3: The anchoring effect is higher in the 'repositioning', compared to the labelling condition, under "slow" thinking, but not under "fast" thinking.

5. Exploratory Analysis

1) Willingness to Pay for Interventions (see above)
2) Measures of perceived autonomy, choice-satisfaction, perceived threat to freedom of choice, and objection to the choice architecture.
3) Public support for food policy interventions on food delivery platforms
4) Heterogeneity analysis for additional subgroups of interest (e.g. age, gender, education)

6. Sampling Plan

6.1 Recruitment

We aim to recruit a large sample of the UK population whose characteristics (age, gender, income, socio-economic status, location, ethnicity) are broadly representative of general internet/smartphone users. Eligible participants will be regular users of food delivery apps. The experiment will take approximately 10 minutes to complete.

6.2 Sample size

- Recruitment sample size: 4000 individuals
- Sample size main experiment by experimental condition: 1000

6.3 Sample size rationale

Sample size rationale is based on data from a previous study using the food delivery platform in identical configuration (see Lohmann et al. 2024). For a continuous dependent variable capturing the sum of the carbon footprint per serving of the basket at checkout (in kg of CO2e): In Lohmann et al. 2024, we observed an average carbon footprint of 2.55kg CO_2e per serving and a standard deviation of 2.12kg CO_2e per serving in the control group. To be able to detect a small effect size (Cohen's d = 0.15) equivalent to an approximate change of 0.32kg CO_2e per serving, at 80% power, with an alpha of 0.016 (Bonferroni adjusted for three hypotheses), we would require 900 participants per treatment arm.

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7. Analysis Plan

7.1 Descriptive analysis

- We will first conduct descriptive analysis of participants' aggregate choice and revision patterns.
- Specifically, we will plot the basket greenhouse gas emissions at checkout, and the choice shares by impact rating (A/E) and meal type.
- We will distinguish between first choices (first clicks) and subsequent revisions (all clicks).

7.2 Individual-level estimations of choice and time patterns

- We will determine two cut-points to estimate differences between comparatively "fast" and "slow" decisions between conditions.
    - "Fast" decisions are compared when 80% of participants have made their first choice. As alternative measures, we will compare "fast" decisions at 30 seconds and after 100% of participants have made their first choice. We will report all three measures.
    - "Slow" decisions are compared at 90 seconds.

7.3 Data exclusion

Participants who have never used an online takeaway do not meet the eligibility criteria and will be

excluded at the pre-screening phase (i.e. this will not affect overall sample size). To minimise insufficient effort responding, we will exclude participants who fail an attention check or complete the experiment abnormally fast prior to analysis (4^{th} percentile).

7.4 Missing data

We do not expect there to be missing data. We will only include observations which provide complete information. Concerning attrition, we will check that there is no differential uptake for different trial arm assignments using a Chi-squared test.

8. Ethical Approval

Ethical approval was granted on 7 August 2024 by the Cambridge Judge Business School Ethics Review Group. Ref Number: 24-22

References

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