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RESEARCH ARTICLE

Preferences, enablers, and barriers for 1.5°C lifestyle options: Findings from Citizen Thinking Labs in five European Union countries

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ABSTRACT

The Horizon 2020 project EU 1.5°C Lifestyles aims to mainstream lifestyles aligned with the aspirational target of the Paris Agreement. The project analyzes lifestyle perspectives at the household level and links them to studies of relevant political and socio-economic structures at various levels of government. Within this project, Citizen Thinking Labs were organized in five EU countries to explore the acceptance of and motivations and barriers to changes that could lead to lifestyles compatible with the 1.5°C target. Through a unique mixed-methods approach, including an exploratory board game (the Climate Puzzle), this research generated insights into citizen acceptance by exploring motivations and barriers associated with the acceptance of key lifestyle changes toward 1.5°C. The results confirm previous research in that citizens are more accepting of lower-impact lifestyle options requiring financial investment (e.g., changing lighting and using efficient devices) than higher-impact options that require more substantial behavior changes. Citizens were also motivated by perceived co-benefits for example, concerning health. The research developed insight into the conditions underlying the acceptance of the least preferred options that included plant-based eating and smaller housing. The results also indicated that citizens' acceptance could be shaped by discussing options with other citizens. Thus, we note the important role citizens may play in devising solutions for overcoming barriers to the acceptance of less-preferred lifestyle options in various contexts. While this study focused on individuals, the findings also underscore the limitations of individual and household agency and the importance of modifying the socio-technical context that shapes behavioral patterns and environmental impacts.

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Introduction

In 2015, 196 governments adopted the Paris Agreement, setting the goal of "limit[ing] global warming to well below 2, preferably to 1.5°C above pre-industrial levels" to mitigate the worst effects of the climate crisis (UNFCCC n.d.). The target was re-discussed in 2022 at the 27th Conference of the Parties to the United Nations Convention on Climate Change (COP27), where countries further stressed the urgency of accelerating action, recognizing that the impacts of warming are already being felt in all parts of the world and that carbon budgets consistent with achieving the Paris Agreement goal are now small and depleting rapidly (United Nations 2022).

Despite consensus about the relevance of the 1.5°C target, climate-mitigation strategies are often framed around the goal of reducing emissions to achieve carbon neutrality. However, strategies for carbon neutrality or net-zero goals tend to be narrowed to technological solutions and efficiency improvements in production processes and products while downplaying the need for reductions in overconsumption and other lifestyle changes (Alfredsson et al. 2018).

Carbon emissions directly related to lifestyles are estimated to account for around 70% of global emissions, including life cycle emissions from housing, transport, food, and other goods and services (Ivanova et al. 2016; Hertwich and Peters 2009). Even if it involved massive socio-economic

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transformation, industrial decarbonization alone would be insufficient to limit warming to 1.5°C. Demand-side emissions reductions by individuals and households realized through lifestyle changes will be necessary. Recent modeling suggests that while developing and deploying green technologies across the economy can substantially reduce the emissions of EU countries, Europe would overshoot the carbon budget associated with the 1.5°C threshold by an average of 2.2 tons of carbon-dioxide equivalent per capita (tCO_2e/cap) by 2030 and 3.1 tCO_2e/cap by 2050 without lifestyle changes (Cap et al. 2024). Furthermore, inequality in greenhouse-gas (GHG) emissions suggests that wealthier individuals should reduce their footprints by a larger share. For example, in 2019, the super-rich 1% were responsible for 16% of global GHGs, the same proportion as the poorest 66% of humanity (5 billion people) (Khalfan et al. 2023). Further, to achieve the necessary societal change shifts in values and social norms, changes in aspirations regarding low-carbon lifestyles, and so forth, all segments of society need to be involved (Watabe and Yamabe-Ledoux 2023).

Accordingly, achieving the 1.5°C target implies substantial changes in lifestyles, including a fair transition toward low-carbon consumption options and more sustainable consumption (Akenji et al. 2021). To realize this transition, it is crucial to identify evidence-based pathways and day-to-day activities that empower households to reduce their carbon footprints while also considering the responsibility of policymakers, businesses, and other actors that may enable or constrain the adoption of lifestyle choices (see, e.g., Alfredsson et al. 2018).

Research on low-carbon lifestyle changes often focuses on the key household-consumption areas of food, housing, mobility, and leisure (e.g., Moberg et al. 2021; Koide et al. 2021). Previous studies have examined the emission-reduction potential of key changes in these domains (Ivanova et al. 2020; Koide et al. 2021). Others have also investigated the perception of citizens of what changes are needed and preferred by individuals, communities, and societies to reduce emissions (e.g., Moberg et al. 2021; Tvinnereim et al. 2017) and to what extent perceived environmental and climate-change risks translate into concerns that may contribute to the regulation of individual behaviors in favor of more sustainable consumption (Zheng, Zheng, and Naz 2023). The impact of framing health benefits to motivate such changes has also been addressed (Herrmann et al. 2017; Amelung et al. 2019). Some studies have focused more on the acceptance of public policies that influence lifestyles (e.g., Bothner et al. 2019; Thorman, Whitmarsh, and Demski 2020); others have addressed the relevance of combining citizens' preferences for lifestyle options with their suggestions for policy- and business-related measures (Lettenmeier et al. 2020; Watabe and Yamabe-Ledoux 2023). Researchers have also examined how acceptance is shaped by contextual and structural factors, in addition to social factors like values and norms (e.g., Clayton et al. 2015; Helferich, Thøgersen, and Bergquist 2023; Laakso et al. 2021; Sahakian et al. 2021), as well as environmental knowledge and information (Neef et al. 2023; Ritcher et al. 2023).

Scientific discourse points to the need to develop effective communication strategies that can guide individuals and communities toward more sustainable behavior (Butler et al. 2020; Ritcher et al. 2023). Developing alternative educational interventions can help increase the perception of behavioral control and the intention of modifying behavior (Neef et al. 2023). The latter is a fundamental aspect of individual behavior as it refers to the effort the individual is willing to make to engage in specific forms of behavior, the general assumption being that stronger intentions lead to a higher likelihood of performance (Ajzen 1991, cited in Neef et al. 2023). Furthermore, discussion and deliberation in a group setting increase the motivation and willingness to change (e.g., Heiskanen et al. 2010).

The European Investment Bank (EIB) has undertaken representative surveys of EU citizens annually since 2018 to understand their attitudes toward climate change and related action. The 2022/2023 survey found that most EU citizens favor stricter climate policies (EIB 2023). The EIB survey in 2020/2021 (EIB 2021), in particular, asked about citizens' preferences regarding what action(s) they are most willing to take to address climate change and those they would find more difficult. However, the surveys did not ask individuals to explain their motivation for the latter or further elaborate on their answers.

Bothner et al. (2019) note that previous research, largely based on surveys, suggests that households would rationally prefer carbon-mitigation activities associated with larger economic benefits, higher CO_2e-reduction potential, and related health benefits that do not require notable behavioral changes. This indicates some of the motivating factors. However, the authors also note that these factors are rarely simultaneously present in relation to the activities households could potentially undertake. Bothner et al. (2019) used a mixed-methods study in four European Union (EU) countries that asked citizens to rate their preferences for carbon-reduction activities. They found that citizens were most likely to implement those related to food or recycling as long as the latter did not involve substantial behavioral

change. Benefiting economically was not a precondition for action. However, there were no clear pathways in other consumption domains, and the study confirmed previous ones that found that significant behavior changes and large financial costs tended to decrease acceptance. Accordingly, there is still a gap in understanding whether attractive carbon-reduction pathways exist in all consumption domains. Further, there is a lack of understanding of the motivations underlying the acceptance of lifestyle changes and what conditions modify the preferences for and acceptance of less preferred options.

Considering that sustainability transitions require significant changes in behavioral and social norms, the engagement of citizens is crucial in putting low-carbon practices into action and developing strategies to facilitate such transitions. Specifically, ensuring citizen participation in sustainability research may enhance citizen engagement and knowledge of sustainability practices. Furthermore, this provides an opportunity for citizens to participate in collective research and action that may challenge prevailing social norms and values (Huttunen et al. 2022).

Stimulating citizens' thinking by increasing their knowledge about environmental threats and their possible solutions contributes to greater environmental concern and, thus, a stronger intention to act in favor of more responsible consumption (Zheng, Zheng, and Naz 2023). Systematic engagement with the future helps people to make better decisions in the present, shaping future scenarios that involve action relevant to sustainable development (e.g., climate-change adaptation and mitigation measures) and generating important learning space (Ritcher et al. 2023). Using social learning methods ensures individuals' engagement and active participation in climate change-related issues, which facilitates the learning process of individuals and empowers them to develop sustainable lifestyles (Batkai et al. 2023; Van Epp and Garside 2019). Furthermore, they play an important part in co-creating knowledge and contributing to research. Nielsen et al. (2021) suggest focusing on understanding how high-impact behaviors can be changed by better understanding the determinants of such behavior.

The EU Horizon 2020 project EU 1.5°C Lifestyles has aimed to mainstream lifestyles aligned with the aspirational target of the Paris Agreement. The project has analyzed lifestyle perspectives at the household level and linked them to relevant political and socio-economic structures at various levels of government. While prior research in the project has identified many structural barriers and enablers associated with 1.5°C lifestyles (Hirth et al. 2023), there is still a need to better understand citizens' perspectives in relation to accepting and considering implementing lifestyle changes, specifically in the context of the 1.5°C goal. The current research framed choices clearly within the context of this latter goal. The Citizen Thinking Labs (CTLs) were organized in five EU countries to explore citizen[1] acceptance of adopting lifestyle changes compatible with 1.5°C. We define Citizen Thinking Labs as workshop formats in which small groups of citizens come together to work on specific questions or problems and co-create results that are then analyzed and utilized in projects. The term was coined for this project, but shares features with a similarly termed approach used in public policy-making, specifically regarding the fact that the labs are viewed as "'islands of experimentation' for applying innovative methods to address public problems" (McGann, Blomkamp, and Lewis 2018, 250). In the CTLs, we worked with citizens using a unique mixed-methods approach, including a serious game (the Climate Puzzle – see Nielsen 2020). Furthermore, using such an approach encouraged individuals to specify the motivation for their choices and explicitly identify disincentives and barriers, with a view to constructively discussing the conditions for the acceptance of less preferred lifestyle changes. These insights can be built on in later stages of research; in other words, they can be used as a basis for discussion with stakeholders with the overall objective of better understanding and influencing the context.

Materials and methods

Following the social learning approach (Van Epp and Garside 2019; Xavier, Jacobi, and Turra 2019), we conducted CTLs in five countries representing different European regions (Germany, Hungary, Latvia, Spain, and Sweden) during September and October 2022. We aimed to address collective and innovative solutions associated with the acceptance of 1.5°C-coherent lifestyles at the household level in the main consumption areas of nutrition, mobility, housing, and leisure. For our methodology, we selected the social learning approach, as this can effectively boost socio-ecological transformation, fostering the participation of real-world agents and promoting their engagement through interactive exercises (such as gamification), leading to a deeper understanding of climate change-related issues compared to top-down research methods. The approach also facilitates the identification of customized solutions through knowledge-sharing processes (Batkai et al. 2023; Van Epp and Garside 2019). For our focus, we selected the aforementioned four key

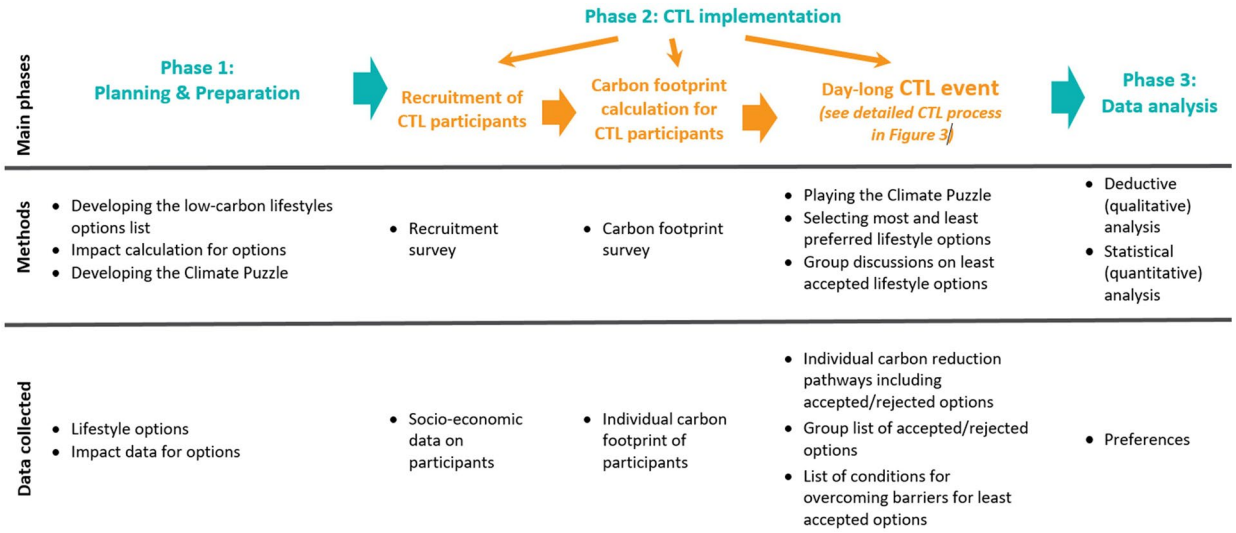

Figure 1. Main phases of the CTL process, including an overview of methods and data collected.

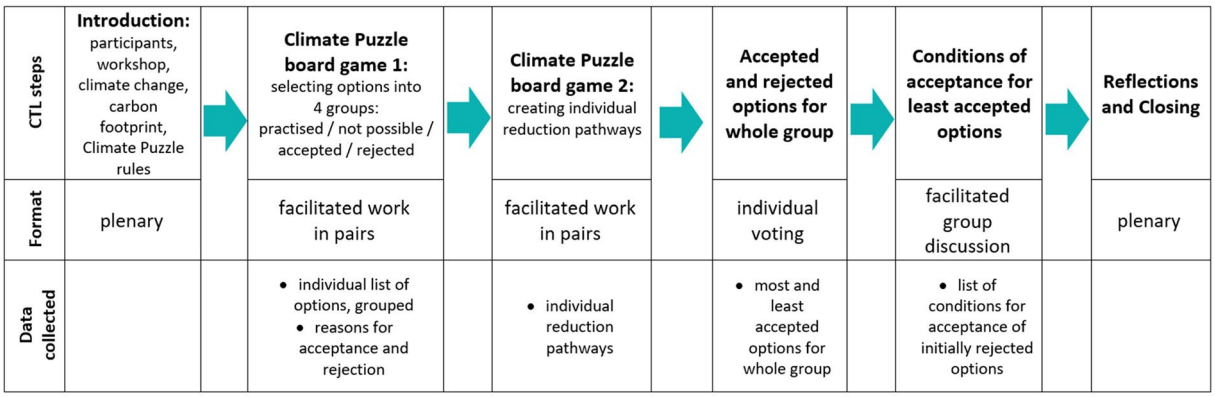

Figure 2. Steps of the CTL event.

consumption domains since they have the highest environmental impacts throughout their life cycle (Koide et al. 2021; Vita et al. 2020).

The CTL process and method consisted of three main steps: (1) Planning and preparation, (2) Thinking Lab implementation, and (3) Data analysis (Figure 1). In this process, the CTL event itself is merely one of the (sub-)steps. Since it is a complex step in itself, Figure 2 below provides more details of its implementation.

Planning and preparation: the climate puzzle and carbon footprint-reduction potential of lifestyle options

We implemented CTLs to facilitate the main dimensions of the social learning approach, specifically knowledge-sharing, collaborative learning, and the co-creation of citizen experiences, to help researchers understand the main motivations associated with 1.5°C lifestyle changes (Van Epp and Garside 2019). To this end, we embraced gamification, which is used in climate change and sustainability research to learn about and motivate real-life behavior (Wu and Lee 2015; Flood et al. 2018). The Climate Puzzle used in this research is a board game (building on the game described by Nielsen 2020) adapted for the purpose of the project to actively engage citizens in creating and visualizing their carbon footprint-reduction pathways while learning about their preferences. The board (see Supplementary Material II) indicates the desired carbon footprint in line with the specified climate target (2.5 tons of carbon-dioxide equivalent per capita per year (tCO_2e/cap/yr) by 2030; UNEP 2020); the personal starting footprint can be flexibly determined, and puzzle pieces are used to fill the gap between the two. Thus, individual reduction pathways are created. The Puzzle includes pieces for 44 lifestyle options, the size of which reflects the magnitude of the potential carbon-footprint reduction. The options were selected based on a mixed-methods research process, the details of which, including the list of lifestyle options, can be found in Supplementary Material I (Sections A–C).

The carbon footprint-reduction potential of low-carbon lifestyle options was calculated using an

environmentally extended multiregional input-output (MRIO) model (Leontief 1970). Input-output analysis allows for attributing environmental impacts to sectors and products, accounting for their global supply chains, and then the impacts of the respective activities on household consumption in a specific region (Miller and Blair 2009). For this study, we used MRIO tables for 2015 from EXIOBASE version 3.8 (Stadler et al. 2021). The emission-reduction potential of the lifestyle options was modeled by defining change factors for each lifestyle modification that represents a lifestyle change in the MRIO model, in line with the framework of Wood et al. (2018). For example, a shift from using a conventional vehicle to public transportation involved eliminating household expenditure on goods and services linked to a personal passenger car and transferring this to public transport activities.

Thinking Lab implementation

The CTL method involves the active participation of citizens – understood as any member of the population – with diverse backgrounds, exchanging their knowledge and experience to identify pathways for adopting lifestyle options that reduce GHG emissions. It also addresses the main challenge of encouraging the adoption of the least preferred low-carbon lifestyle options through iterative learning processes (Batkai et al. 2023; Van Epp and Garside 2019). Compared to traditional top-down approaches (such as structured interviews), the CTLs enabled us to actively involve citizens in understanding the main sources of motivation underlying the acceptance of behavior changes, including the conditions for acceptance, through creating a supportive and safe space for sharing knowledge and problem-solving. The latter process also supports interaction between diverse ideas and, therefore, creates innovative solutions (Batkai et al. 2023). Moreover, as a spillover effect, CTLs may empower citizens to engage in behavior change through capacity building that leads them to consider the environmental impacts of their own lifestyles and motivates them to take action (Batkai et al. 2023; Huang and Harvey 2021). During the CTLs, however, we focused on learning about the favored low-carbon lifestyle options and the (more structural) conditions of acceptance for the least preferred ones rather than studying how and why individual behavior changes.

Accordingly, selecting participants for the CTLs involved using a stratified random sampling method to ensure adequate representation of the population of each case country. We sought diversity in terms of key socio-economic and demographic factors (e.g., age, education, place of living, employment, income) in the five case countries. To further increase diversity and better represent the population, questions on interest and activity related to environmental issues were also included in the recruitment survey (see Supplementary Material III, Sections A and B for the recruitment survey and quota plan and Section C for participant data). Professional recruitment agencies implemented recruitment in Germany, Latvia, Spain, and Sweden, while the local project partner managed the process in Hungary. We overrecruited in all countries to compensate for potential dropouts. Citizens were compensated for their time, as we asked for a whole day of engagement. As shown in Supplementary Material III, Section C, 113 individuals participated in the CTLs (22 in Germany, 24 in Hungary, 22 in Latvia, 24 in Spain, and 21 in Sweden), which focused on gathering descriptive data and qualitative information from them. To ensure success, it was crucial to create a trusting environment where participants felt comfortable and willing to share their private beliefs and perceived problems openly and honestly. Thus, the sample was deliberately kept small but diverse to reflect the demographic composition of the population in each country as much as possible.

The carbon-footprint calculation for each CTL participant determined the starting point for the Climate Puzzle activity and the gap that needed to be filled with the puzzle pieces to meet the 2.5 t CO_2e/cap/yr climate target by 2030 (UNEP 2020). The data for calculating carbon-footprints was collected through an online survey, with questions about each individual's current lifestyles (Supplementary Material III, Section D). We developed the questions based on the list of lifestyle options also used for the Puzzle. For the calculation, a per-capita baseline per country was established for each survey question. Participant responses were compared to the country-level baseline to derive a scaling factor for each lifestyle option that represented its partial or full implementation, excess consumption compared to the national average, or no implementation of a lifestyle option. These scaling factors were applied to the lifestyle-modeling parameters, which were then multiplied with the relevant coefficients in the MRIO tables. When relevant, options were allowed to interact, such as household electricity from solar panels with electric vehicle use. We used the adjusted MRIO tables, downscaled based on the population, to calculate the per-capita footprint for each participant (see Figure 3 for the average, highest and lowest footprints for each country).

To ensure that the CTLs had comparable outcomes, implementation was guided by a shared methodology co-developed by the consortium. For further standardization, we organized training

workshops for national implementers. The foundations of the methodology can be found in gamification (Wu and Lee 2015; Flood et al. 2018) and facilitated pair and group work that builds on the principles of democratic deliberation, as in mini-publics and citizen-climate assemblies (Dryzek and Niemeyer 2019; Boswell, Dean, and Smith 2023). Discussion was a key component of the process, building on the insight that interpersonal discussion of climate change positively influences acceptance (see Goldberg et al. 2019). The daylong CTL event moved from a plenary session to facilitated pair work, followed by moderated small group (4–7 people) discussions to a closing plenary reflection (Figure 3, see Supplementary Material III, Section E for the schedule). In this process, participants were first introduced to the project, one another, climate change, and the carbon-footprint concept. We also explained to them how the outcomes of the day would be used to support further research and policymaking. They were then invited to engage in the Climate Puzzle in pairs, with participants having similar carbon footprints working together to facilitate mutual learning and avoid finger-pointing. In the first step of playing the Puzzle, they were asked to select and record which lifestyle options they already pursue, are unable to pursue, and which they would ("accept") or would not ("reject") engage in and why. Then, they planned their individual carbon footprint-reduction pathways by selecting options from the Puzzle pieces, taking turns, and supporting each other throughout this facilitated process. The Climate Puzzle activity was followed by participants voting for their five most and least acceptable options using green and red dots on a low-carbon lifestyle-options list that was provided. The facilitated group discussions that followed focused on finding out under which conditions participants might change their views about the least accepted options. In each case, they discussed only individual, selected lifestyle options, which were not necessarily the same in each country. To close the day, the CTL participants gathered together again and reflected on their experience of the whole process. Please refer to Supplementary Material III, Sections E and F for further details of the CTL event, Supplementary Material III, Sections E and F for the program and picture illustration, and Supplementary Material III, Section G for the templates used to record data.

The method and processes for data collection were developed and standardized as part of the CTL development and implementation process. Data were collected at several points during the CTLs. We first assembled participant socio-economic and demographic data during the recruitment process, followed by data for calculating individual carbon footprints. Both were gathered through online surveys. Templates were used to record data during the CTLs (see Supplementary Material III, Section G). On some of the templates, we recorded individual data; on others, we aggregated group data, both with the active involvement of participants. Concerning individual data, the lifestyle-option preferences of each participant were collected, including their reasons for selecting or not selecting them, which provided insights for analyzing the acceptance rates. This was followed by recording acceptance/rejection items on large lists of options that we provided to see which of the latter were most accepted/rejected by the group overall. In addition, the CTLs included extensive and anonymized photo documentation to record participants' choices of lifestyle options and the

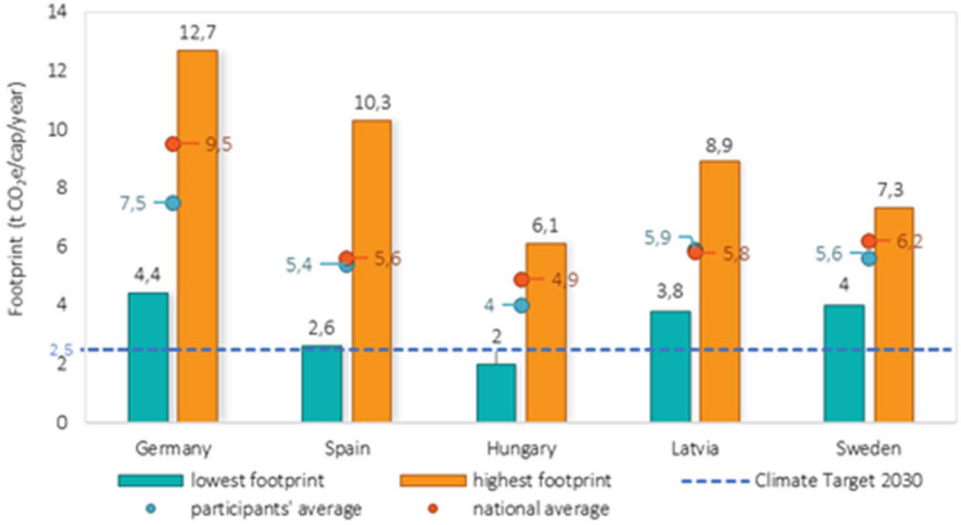

Figure 3. Average, highest, and lowest carbon-footprint data according to case county.

individual reduction pathways they had planned for using them. The reduction pathway was built up of two "puzzle-pieces arrangements": the first is the selection of lifestyle options (represented by puzzle pieces) that individuals would use to reduce their current carbon footprint to the 2030 target, and the second is the implementation plan for the latter, the options/puzzles pieces arranged on a timeline (see examples in Supplementary Material II). Finally, the content of the small group discussions was recorded by notetakers and summarized by moderators on large boards. Refer to Supplementary Material III, Sections E and F for further details and an illustration of these steps.

Data analysis

We assessed citizens' overall preferences across consumption domains, main types of investment, and impact levels. We classified options by investment type based on a qualitative assessment of whether the lifestyle change "mainly" depended on behavior change or financial investment, recognizing that most options require both, at least to some degree. An example of a real behavior-dominant change is lowering the room temperature at home in colder climates or raising it in warmer climates because this implies adjusting to living in a cooler/warmer residence. In contrast, installing solar panels is an example of a financial investment-dominated change – this involves monetary expense and a one-off installation process, but grid-connected solar photovoltaics can generate comparable amounts of electricity for the same household purposes without requiring behavior change. To distinguish lower- and higher-impact options, we first averaged the potential per-capita reductions in carbon footprints (as a percentage) under conditions of full adoption across countries and then applied the average across the lifestyle options as the boundary between low- and high-impact options. An overview of the lifestyle options categorized according to these criteria can be found in Supplementary Material I, Section E.

We built contingency tables and performed generalized Cochran-Mantel-Haenszel (CMH) tests using the function CMHtest from the R package vcdExtra (Friendly 2023) to test the significance of a general association between acceptance vs. rejection and the different categorizations (consumption domains, main investment types, and impact levels) outlined above. The CMH test allows for more than two levels per factor and the consideration of strata (for which we designated the participants). Since we performed three tests in total for the three categorizations (consumption domains, actual lifestyle changes vs. investments, and low- vs. high-impact options), we adjusted the resulting p-values using the Bonferroni correction.

To assess the strength of the association, we used Cramér's V, as this is appropriate for applying to nominal variables and contingency tables larger than 2×2. A value of "0" indicates no association, while "1" indicates complete association. We calculated the value for each stratum (i.e., participant) and then averaged the values. Strength was interpreted in line with Table 2 by Akoglu (2018), according to which a value larger than 0.15 indicates a strong association and a value larger than 0.25 indicates a very strong association.

Table 1. Significance and strength of association between acceptance *vs.* rejection and different categorizations.

Categorization	*p*-Value	Significance	Cramér's *V*	Strength
Consumption domain	≪0.01	Yes	0.36	Very strong
Main investment type	≪0.01	Yes	0.18	Strong
Impact level	≪0.01	Yes	0.19	Strong

Note: The significance is the interpretation of the *p*-value, and strength is the interpretation of Cramér's *V*. The categorizations represent those shown in Figure 4. See also the section above on Data analysis.

Results

In this section, we highlight overall preferences and the top five most/least preferred options in aggregated form for all case countries. The reasons for the high/low acceptance rates given by participants are presented, as well as the conditions of acceptance discussed in the CTLs for the options with a low acceptance rate.[2] Tables that include the acceptance rates for all options by country can be found in

Table 2. The five lifestyle options with the highest (above 90%) acceptance rates (see Supplementary Material I, Section E for average acceptance rates for all options).

	Most preferred options			
Lifestyle options	Consumption domain	Acceptance rate (all countries)	Below (B)/Above (A) average impact	Mainly financial investment (FI)/Mainly behavior change (BC)
1. I will install efficient lighting	Housing	100%	B	FI
2. I will switch to using energy-efficient household devices	Housing	97.8%	B	FI
3. I will avoid food waste at home	Nutrition	96.3%	B	BC
4. I will eat only as much food as I need to stay healthy	Nutrition	95.4%	B	BC
5. I will insulate my house	Housing	92.7%	A	FI

Supplementary Material I, Sections C and E. A table showing the acceptance conditions discussed during the afternoon session can be found in Supplementary Material I, Section F.

In our presentation of results, we focus on a limited number of options to provide more detailed insight into the motivations, barriers, and conditions for acceptance mentioned by the participants. Doing this for more options would extend beyond the scope of the current article. Furthermore, based on the list of the acceptance rates for options, the number of options associated with a cross-national average acceptance rate of over 90% was identified. Correspondingly, the same number of least accepted options were presented.

Preferences based on levels of acceptance

For all types of categorizations we considered, there is evidence for their association with the proportions of acceptance vs. rejection ($p \ll 0.01$, Table 1). The strength of the associations can be considered strong (investment, impact) to very strong (domain) (Table 1). Participants preferred housing and leisure options more than mobility and nutrition options. They also favored options that did not require behavior changes, and above-average-impact options were less appealing (Figure 4).

Green tiles indicate that the observed frequency was greater than expected under conditions of independence (i.e., that acceptance or rejection is independent of the consumption domain, so all items would be associated with the same shares of acceptance and rejection). Red tiles indicate that the observed frequency was less than expected. The area of the tiles is proportional to the frequency of the combination of the preference and the lifestyle-option category.

Motivations for favoring the most preferred options

The five most preferred lifestyle options belong to the consumption domains "housing" and "nutrition." With the exception of "I will insulate my house" (above-average impact option), the most preferred options shown in Table 2 align with the results presented in Figure 4: they indicate a general preference for (or greater acceptance of) lower-impact alternatives.

Three of the top five most strongly accepted options are associated with the housing domain and mainly require financial investment rather than behavior change. For example, installing efficient lighting and more efficient household devices relies more on financial investment than behavior change and offers the benefit of reducing lifecycle costs through energy savings. The remaining two options

Figure 4. Mosaic plots illustrating frequencies of the acceptance of lifestyle options across (a) consumption domains, (b) main investment types, and (c) impact levels.

are in the nutrition domain and involve changes in behavior but also offer additional benefits.

Considering first the three most accepted options in the consumption domain of housing, financial reasons were dominant in motivating participants' choices. Based on our data, their most acceptable housing options were switching to energy-efficient household devices and lighting, both of which have a below-average impact and require hardly any behavior change. These two options were accepted by all participants present in the CTLs. Based on information from participants, the primary reason for this was saving energy, mainly to reduce costs.

The other two options in this group are from the nutrition domain: "I will avoid food waste at home" and "I will eat only as much as I need to stay healthy." These were associated with above 90% acceptance rates despite the (minor) behavior change required for their implementation. This might be because of additional perceived benefits; participants reported that feeling less guilty about wasting food and the positive health effects associated with not overeating (e.g., maintaining a healthy weight) were the main motivators for their acceptance, along with economic factors (e.g., lower expenses on food).

To summarize, the stronger preference for the five options can be attributed to several key factors, including economic incentives (e.g., monetary savings), convenience-related considerations, health-related motivations, and a good feeling (better conscience) resulting from wasting fewer resources.

Motivations and conditions associated with the acceptance of the least preferred options

The five least preferred lifestyle options are distributed across the consumption domains of nutrition, housing, and leisure (Table 3). These findings align with some of the patterns observed in Figure 4. These options mainly involve behavior change (rather than financial investment), and three out of the five options are categorized as having an above-average impact. The two below-average impact lifestyle options were: "I will switch to a vegetarian diet and eat no more meat or fish," and "I will get a smaller pet if I get a new one."

Participants provided several reasons for the high rejection rates for these five options. These include both personal barriers and structural barriers. Personal barriers reported by participants included concerns related to health, the potential reduction in quality of life (pertaining to convenience, personal space, daily routines, and independence), and financial limitations. The structural barriers were identified as a lack of governmental regulations and perceived societal injustice. Furthermore, some participants questioned the need for change when other members of society continued to engage in such behaviors and could afford to do so. To address this concern, they suggested the implementation of regulations that address all citizens fairly.

In the consumption domain of nutrition, the two least preferred options were "I will switch to a vegan diet" and "I will switch to a vegetarian diet and eat no more meat or fish." These options require behavior changes and were primarily rejected for personal reasons. Participants associated meat consumption with their quality of life and well-being and perceived that avoiding meat was restrictive and associated with privation. Health concerns and financial constraints, particularly the perceived costliness of meat substitutes, also contributed to the rejection of these options. Meat is a central ingredient of the meals of many participants, and they expressed a lack of familiarity with suitable substitutes. Accordingly, they showed reluctance to consider alternatives (e.g., vegan or vegetarian diets).

With regard to the two most strongly rejected options in the domain of nutrition, in the moderated group discussions, participants suggested two main conditions for accepting these dietary changes. The first was increasing social awareness of the environmental footprint associated with different foods. The second was improving education and knowledge about nutrients and practical cooking methods associated with vegan and vegetarian diets, increasing the ease of preparation and enjoyability (in terms of taste).

Table 3. The five lifestyle options with the lowest acceptance rates (see Supplementary Material I, Section E for average acceptance rates for all options).

Least preferred options				
Lifestyle options	Consumption domain	Acceptance rate (all countries)	Below (B)/Above (A) average impact	Mainly financial investment (FI)/ Mainly behavior change (BC)
1. I will switch to a vegan diet	Nutrition	14.4%	A	BC
2. I will choose shared housing	Housing	20.6%	A	BC
3. I will switch to a vegetarian diet and eat no more meat or fish	Nutrition	25.1%	B	BC
4. I will give up excess square meters (i.e., have a smaller home)	Housing	28.6%	A	BC
5. I will get a smaller pet if I get a new one	Leisure	34.9%	B	BC

In the domain of housing, the above-average impact lifestyle option of sharing housing was often rejected due to reasons related to everyday habits and convenience, reflecting personal barriers. Participants expressed worries about issues like intimacy, privacy, and potential conflicts arising from sharing living spaces and household devices. Notably, Hungarian participants emphasized that owning one's house or apartment was a fundamental life goal, highlighting the important role that cultural or societal norms and personal values play in participants' choices.[3] Giving up excess square meters was the other most strongly rejected option within the housing domain.[4] In addition to concerns linked to giving up comfort and space (personal barriers), moving to a smaller apartment was rejected primarily because of the economic challenges posed by the housing market. In larger cities, finding an apartment to rent was perceived by participants as exceptionally difficult and often unaffordable, even if the apartment was smaller. Thus, this represents a structural barrier, as it is a systemic issue that extends beyond individual control. Access to an adequate supply of affordable housing is well-recognized in research and in particular even for the case countries (see e.g., Merheim-Eyre 2022; Granath Hansson 2019).

In the group discussion, participants identified two main conditions for accepting these housing options. The first condition would be to make the process of changing apartments easier by reducing the administrative and economic burden, especially concerning the housing density in their respective cities. They suggested that making it easier to change apartments (perhaps through "apartment-exchange platforms") and streamlining bureaucratic processes, along with ensuring stable rents (avoiding significant increases with each move), would make them more willing to consider (accepting) this lifestyle option. To accept giving up excess square meters, participants suggested that creating more public spaces, such as community areas or gardens, as well as additional co-working spaces, could facilitate this change. They thought that co-working spaces could potentially eliminate or at least reduce the need for a personal office within one's house or apartment, for example.

In the consumption domain of leisure, the option "I will get a smaller pet if I get a new one" was the subject of particularly strong reactions in all countries, but most notably among Spanish and Hungarian participants. Based on their comments, we observed that individuals can have strongly individualized emotional preferences for larger pets. Participants also expressed their commitment to ensuring the well-being of an (adopted) animal, regardless of its size. They did not suggest any conditions for accepting this change. It seemed that their rejection of this below-average impact option primarily stemmed from personal barriers related to convenience and adherence to societal norms.

Discussion

Reflection on results

Our results elaborate on previous findings in the literature (e.g., Bothner et al. 2019) and fill key gaps in understanding the motivations underlying the acceptance of behavior changes as well as the conditions for their acceptance. The latter conditions, in turn, give us insights into the policy, social, and economic approaches required to increase the uptake of sustainable lifestyles among individuals and households. In our discussion and analysis, the objective was to explore general trends without breaking them down (into smaller socio-economic groups) for deeper analysis due to the small sample size. Our findings revealed that the more impactful lifestyle options were also often those least preferred by citizens (e.g., shifting to a vegan diet, sharing, or significantly reducing housing space). Sköld et al. (2018) also found that the greater the CO_2e-reduction potential of the mitigation action, the less the household's willingness to implement it. Lettenmeier et al. (2020) also reported that the most popular options for lifestyle change coherent with meeting the 1.5°C goal were modest regarding both the carbon footprint-reduction potential and behavior change required.

Perhaps not surprisingly, citizens in the CTLs expressed greater acceptance of lifestyle options associated with perceived positive synergies with health (e.g., eating the right amount of food) and saving money but less acceptance of perceived sacrifices like foregoing meat entirely (changing to a vegetarian or vegan diet), despite the latter having the greatest potential footprint reduction in most cases. Also, the link between health and less meat was less well-recognized than the link between health and avoiding overeating.

However, concerns about health and price were also barriers, along with cultural- and identity-related reasons. This finding aligns with earlier research, for example, the EIB Survey found stopping eating meat to be the least acceptable action for citizens in Hungary (EIB 2021), and the research of Collier et al. (2021) identified barriers to decreasing meat consumption among Swedish citizens related to uncertainty (including about price), skepticism,

identity (including culture), and health concerns. We identified similar issues with the participants from the five countries, confirming there are a variety of barriers to behavior change. However, it is notable that individuals' perceived barriers were sometimes challenged or mitigated when they were invited to discuss them in the facilitated group setting, emphasizing the role of groups and deliberation in this context, confirming earlier similar research (Heiskanen et al. 2010, and discussed further below). For example, participants began exchanging and discussing health concerns and identified examples of nutritional substitutes, becoming more focused on the need for education and information. Collier et al. (2021) suggested a variety of structural enablers but noted that while information provision is often one of the proposed remedies, information needs to be targeted, and its effect may still be limited, particularly with regard to changing norms. The latter suggests that normalizing eating less meat (e.g., meat-free days or months, supported by significant engagement) may be a more effective approach.

In Hungary, a representative survey by Csurgó et al. (2023) found that people reduce meat consumption in response to food-price inflation. In addition, although the population is generally not open to switching to an entirely vegetarian or vegan diet, about 50% of respondents reported being willing to reduce their meat consumption. Lacroix and Gifford (2020) found that targeted interventions tailored to the motivations and stages of individual behavior change are apt to be more successful in changing meat-consumption habits. We also found that the more restrictive the option (e.g., no meat rather than less meat), the less the acceptance. This indicates that citizens may react negatively to absolute restrictions but be open to the idea of modifying their behaviors in smaller ways (e.g., meat-free days or the reduction of meat consumption). This suggests that policies that involve flexibility are more likely to be deemed feasible and acceptable.

Reflection on mixed-game methods

The Climate Puzzle effectively engaged citizens with lifestyle options and their different impacts. The chosen actions were clearly identified on the board and planned along a timeline for implementation. Playing the Puzzle in pairs provided additional insights as players had to explain their choices to their partners. This was an opportunity for citizens to appreciate the diversity of lifestyle choices and led to some discussions, which have been shown to influence acceptance positively (see Goldberg et al. 2019). This may be an advantage of using physical games: The group dynamics of the game setting may more effectively shape behavior change than employing individual game approaches, such as online simulations (e.g., Agusdinata et al. 2023).

In fact, several studies point to the benefits of working with approaches that promote a feeling of global connection, communication with other people, and experimentation with future scenarios that are close to the reality of each individual. Heiskanen et al. (2010) concluded that social norms may be challenged and new ones created in groups, where members can also support one another in overcoming a feeling of helplessness in the face of global challenges. Ritcher et al. (2023) propose deploying educational strategies that (1) elicit emotions and relevant mental imaginaries; (2) are made comprehensible through narratives and visual elements; (3) are temporally, spatially, and linguistically meaningful for the people they target; and (4) are co-created with people with whom locally relevant solutions may be achieved. Along similar lines, Helferich, Thøgersen, and Bergquist (2023) conclude in their meta-analysis that interventions in which emotions (e.g., pride or anticipated guilt) surface more deeply affect the intention to make changes in pro-environmental behaviors and the changes that are actually made than those based on purely social norms (i.e., those that are made to achieve social approval and/or obtain socially adaptive information).

In addition, the combination of recording individual motivations and barriers with later group discussions showed that participants' acceptance of options was theoretically malleable, as participants who had rejected specific lifestyle options were able to state the conditions of acceptance, and group discussions were constructive. This highlights two important factors: the social aspect of lifestyle changes, on one hand, and the importance of involving citizens in policy design on the other. Regarding the former, the group discussions also demonstrated that participants were not disinclined from challenging some perceived barriers. One example is the assumption that eating meat is necessary for health reasons – this conception was confronted in the group discussions, again reflecting the important role of interpersonal interactions in changing acceptance, as also discussed by Goldberg et al. (2019). This observation focuses attention on the dynamic nature of preferences in interaction with other factors, such as culture and social norms, and suggests the potential for the evolution of preferences through active engagement.

However, there are limitations to this research. The acceptance rates of the small sample should not be considered representative of members of the EU

generally or the case countries. Instead, they offer preliminary insights that could be validated with a larger survey that uncovers differences between demographically and socio-economically distinct groups. For example, with regard to the Puzzle pieces that were not chosen, some participants had different interpretations of which options were "impossible" or "possible but not preferred." In addition, they made their choices about accepting (or not/deeming irrelevant) lifestyle options before actually playing the Puzzle; in other words, they discounted certain alternatives before fully understanding the gap between their personal lifestyle-carbon footprint and the 1.5°C target in the context of the Climate Puzzle. Further, while some participants moved pieces back into play when dealing with the gap that needed to be filled to reach the target, others simply assessed that they could not complete the game. Since this was a game with no penalty for non-completion, they were able to do this, even though facilitators did their best to encourage everyone to reach the 1.5°C target. The framing of the game and 1.5°C target was also considered influential (i.e., the importance and urgency of finding a pathway to 2.5 tons CO_2e/cap/yr). Requiring participants to choose options directly related to their personal footprint-reduction requirement might have increased the acceptance and choice of options of higher impact.

Conclusion

The research highlights the importance of understanding not only static measurements of citizens' acceptance and preferences but also how these can be shaped and changed. The dynamic nature of preferences was observed, but the specific factors that influence preferences, such as cultural and social norms, were not a focus of this study. More precisely understanding the role of contextual and structural factors and social norms in terms of evolving preferences may be an important focus of future research (e.g., Hirth et al. 2023; Laakso et al. 2021; Sahakian et al. 2021). Future iterations of the research could also include developing a better understanding of participants' motivations and beliefs before and during the game to understand how these interact with acceptance and preferred actions.

Similar to previous studies, our analysis indicates that financial actions are preferred to changing behavior. There was also a disinclination for options perceived as too restrictive. In theory, this suggests deploying more informative and market-based approaches that offer information and financial incentives while avoiding more restrictive bans – provided the former are sufficient to meet climate targets. However, it should be noted that market-based instruments already dominate the policy landscape for the lifestyle domains with the highest mitigation potential in the EU (Moberg et al. 2021). The latter authors suggest that market-based instruments can be made more effective by pricing carbon-intensive behaviors highly enough to induce change (i.e., internalizing the externalities of climate change using prices closer to the estimated social cost of carbon) and complementing the latter with feasible alternatives (e.g., public transport as an alternative to higher-priced private car use). For future research, it would be interesting to investigate how far prices can be raised and if there is a point when the higher cost becomes a barrier. Citizens also indicated that there are currently areas where price incentives (and disincentives) are lacking – notably with air travel vs. alternative modes of leisure travel. Moberg et al. (2021) also note the gap in adequately addressing air travel. They suggest that transport and housing involve significant infrastructure planning and support, meaning more regulatory approaches, as well as public investment, might be needed.

In relation to housing, we note both a research and policy gap relating to the impactful, but at the same time mostly rejected options of giving up excess square meters and sharing in the housing domain. Although some research is available (e.g., Huebner and Shipworth 2017; Sandberg 2018) that indicates positive impacts related to energy saving as well as social benefits, the discussion concerning these options appears to have (re-)started fairly recently (e.g., Nelson 2018; Cohen 2019, 2020). The barriers identified by both CTL participants and researchers mention the administrative burden of realizing moves and the shortage of suitable smaller homes. Furthermore, Sandberg (2018) noted the importance of prevailing social norms connected to the size of homes and the process of downsizing itself, and how these norms could be renegotiated to normalize smaller-space living.

Another policy gap identified by Moberg et al. (2021) concerns sustainable diets. Diet is an area where relatively quick change is possible (Bothner et al. 2019). In our research, one source of motivation often indicated by citizens in the domain of nutrition was health benefits. This coupling of climate and health benefits in diets has been noted in previous research (e.g., Mózner and Csutora (2013), and can be utilized more in framing informative and other policy instruments. For instance, Amelung et al. (2019) found that providing information about health benefits can increase the acceptability and adoption of lifestyle changes, particularly in relation to food and leisure domains.

The lab results confirmed that the highest impact behaviors and domains (e.g., reducing meat and dairy consumption, giving up square meters) remain the least preferred ones. However, policymakers and researchers should focus on facilitating high-impact lifestyle changes (Bergquist et al. 2023; Ivanova et al. 2020; Koide et al. 2021; Moberg et al. 2021; Nielsen et al. 2021). The policy implications of this are similar to those identified in previous studies that have gauged public opinion about climate change and the role of individuals – namely, that it is necessary to move beyond quick, low-cost, or convenient changes and address the most significant mitigation actions using coordinated bottom-up and top-down approaches (Bothner et al. 2019; Lorenzoni and Pidgeon 2006).

Concerning the latter, we note the important role citizens may play in helping to devise solutions for overcoming barriers to the acceptance of less-preferred and rejected low-carbon lifestyle options in various socio-economic and cultural contexts. We found that in a facilitated group setting, citizens were able to creatively think of and develop ideas for policies, technologies, cultural change, and other types of solutions for overcoming barriers to the uptake of lifestyle options. This strongly suggests that (so far) less frequently used policy options that build on community participation, community management, and participatory planning approaches should be considered and subjected to more active research (e.g., Jackson 2004, 2006; Watabe and Yamabe-Ledoux 2023).

While this study focused on individuals and households, the findings will support further research on how the context or structures could better facilitate change. The findings, together with those from the project's research involving stakeholders (Hirth et al. 2023; Lehner et al. 2024), underscore the limitations of individual and household agency and the critical importance of modifying the socio-technical context that shapes dominant behavioral patterns and environmental impacts. Enabling conditions for sustainable living include engendering pro-sustainability attitudes, facilitating access to sustainable options, increasing the cost of engaging in unsustainable ones, and making available the appropriate infrastructure and product options for sustainable living. This suggests that interventions for mainstreaming sustainable lifestyle change should address the attitude/knowledge-behavior gap often observed in relation to individuals and households and the lack of suitable policies, social and market mechanisms that address all the factors (citizens and macro-level technological and physical factors) that lock individuals, businesses, and other pro-sustainability actors into behaving unsustainably.

Notes

1. Note that in this article we use the term "citizen" in a generic sense, in other words, to refer to any member of the population without any political or legal sanctions.
2. The acceptance rate denotes the proportion (%) of participants who had either already incorporated a particular lifestyle option into their lifestyles or indicated in the CTLs that they would incorporate that lifestyle option from now on.
3. It is important to note that from among the five case countries, the home ownership rate is highest in Hungary (90.1%), followed by Latvia (83.1%), Spain (76.0%), Sweden (64.2%), and Germany (46.5%). Data source: Eurostat (2023).
4. Part of the reason for the low acceptance rate for reducing per capita living space may be that in some countries the current average living space is already fairly low, e.g., 29.6 square meters (m^2) in Latvia, 33.9 m^2 in Hungary, and 36.6 m^2 in Spain, with Germany and Sweden both being above 45 m^2 (45.8 and 48.7 m^2, respectively). Data from from 2018 and derived from the Odyssee-Mure Database. See Lehner et al. (2024).

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Ethical approval

The research in this paper is interdisciplinary. Regarding the ethical considerations related to the design and implementation of Thinking Labs with citizens, we followed the International Sociological Association's code of ethics (https://www.isa-sociology.org/en/about-isa/code-of-ethics). The EU 1.5°C Lifestyles project received ethical clearance based on the information provided in the proposal on ethics and security. Case-country partners checked and ensured compliance with local rules for ethics approval. As described in the methods section, the labs were intended to identify citizens' views on general lifestyle changes, not to make interventions in their lifestyles. Informed consent was obtained from all participants, including consent to use the data for research and publication as well as photographs, audiorecordings, and other documentation (see Supplementary Material IV for the consent form that was used). In Germany, Latvia, Sweden, and Spain, recruitment agencies were used to ensure a range of citizens were invited to attend, while in Hungary, the local partner implemented recruitment (see the sample-quota guide in Supplementary Material III, Section B). All data collected in the labs, including survey data, were handled according to the EU's General Data Protection Regulation (GDPR) rules and as defined in the Statement of Ethics and Data Handling Guidelines of the

EU 1.5°C Lifestyles project (see https://onepointfivelifestyles.eu). The information collected from participants has been encrypted to protect their identity and prevent identification by third parties. The information is stored securely, and only authorized persons have access to it.

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References

Agusdinata, D., H. Lukosch, M. Hanif, and D. Watkins. 2023. "A Playful Approach to Household Sustainability: Results from a Pilot Study on Resource Consumption." *Simulation & Gaming* 54 (1): 104–130. doi:10.1177/10468781221138583.

Ajzen, I. 1991. The theory of planned behavior. *Organizational behavior and human decision processes* 50(2): 179–211.

Akenji, L., M. Bengtsson, V. Toivio, M. Lettenmeier, T. Fawcett, Y. Parag, Y. Saheb, et al. 2021. *1.5-Degree Lifestyles: Towards a Fair Consumption Space for All*. Berlin: Hot or Cool Institute. https://hotorcool.org/wp-content/uploads/2021/10/Hot_or_Cool_1_5_lifestyles_FULL_REPORT_AND_ANNEX_B.pdf

Akoglu, H. 2018. "User's Guide to Correlation Coefficients." *Turkish Journal of Emergency Medicine* 18 (3): 91–93. doi:10.1016/j.tjem.2018.08.001.

Alfredsson, E., M. Bengtsson, H. Brown, C. Isenhour, S. Lorek, D. Stevis, and P. Vergragt. 2018. "Why Achieving the Paris Agreement Requires Reduced Overall Consumption and Production." *Sustainability: Science, Practice and Policy* 14 (1): 1–5. doi:10.1080/15487733.2018.1458815.

Amelung, D., H. Fischer, A. Herrmann, C. Aall, V. Louis, H. Becher, P. Wilkinson, and R. Sauerborn. 2019. "Human Health as a Motivator for Climate Change Mitigation: Results from Four European High-Income Countries." *Global Environmental Change* 57: 101918. doi:10.1016/j.gloenvcha.2019.05.002.

Batkai, M., J. Hugé, D. Huitema, J. Semeijn, W. Lambrechts, and J. Stoorvogel. 2023. "Social Learning as a Catalyst for Building Resilience among Smallholder Farmers: Exploring Its Role in Promoting Transformations." *NJAS: Impact in Agricultural and Life Sciences* 95 (1): 1. doi:10.1080/27685241.2023.2278906.

Bergquist, M., M. Thiel, M. Goldberg, and S. van der Linden. 2023. "Field Interventions for Climate Change Mitigation Behaviors: A Second-Order Meta-Analysis." *Proceedings of the National Academy of Sciences* 120 (13): e2214851120. doi:10.1073/pnas.2214851120.

Boswell, J., R. Dean, and G. Smith. 2023. "Integrating Citizen Deliberation into Climate Governance: Lessons on Robust Design from Six Climate Assemblies." *Public Administration* 101 (1): 182–200. doi:10.1111/padm.12883.

Bothner, F., F. Dorner, A. Herrmann, H. Fischer, and R. Sauerborn. 2019. "Explaining Climate Policies' Popularity – An Empirical Study in Four European Countries." *Environmental Science & Policy* 92: 34–45. doi:10.1016/j.envsci.2018.10.009.

Butler, J., A. Bergseng, E. Bohensky, S. Pedde, M. Aitkenhead, and R. Hamden. 2020. "Adapting Scenarios for Climate Adaptation: Practitioners' Perspectives on a Popular Planning Method." *Environmental Science & Policy* 104: 13–19. doi:10.1016/j.envsci.2019.10.014.

Cap, S., A. de Koning, A. Tukker, and L. Scherer. 2024. "(In)Sufficiency of Industrial Decarbonization to Reduce Household Carbon Footprints to 1.5°C-Compatible Levels." *Sustainable Production and Consumption* 45: 216–227. doi:10.1016/j.spc.2023.12.031.

Clayton, S., P. Devine-Wright, P. Stern, L. Whitmarsh, A. Carrico, L. Steg, J. Swim, and M. Bonnes. 2015. "Psychological Research and Global Climate Change." *Nature Climate Change* 5 (7): 7. doi:10.1038/nclimate2622.

Cohen, M. 2019. "Reforming Local Public Finance to Reduce Resource Consumption: The Sustainability Case for Graduated Property Taxation." *Sustainability Science* 14 (2): 289–301. doi:10.1007/s11625-018-0598-6.

Cohen, M. 2020. "New Conceptions of Sufficient Home Size in High-Income Countries: Are We Approaching a Sustainable Consumption Transition?" *Housing, Theory and Society* 38 (2): 173–203. doi:10.1080/14036096.2020.1722218.

Collier, E., L.-M. Oberrauter, A. Normann, C. Norman, M. Svensson, J. Niimi, and P. Bergman. 2021. "Identifying Barriers to Decreasing Meat Consumption and Increasing Acceptance of Meat Substitutes among Swedish Consumers." *Appetite* 167: 105643. doi:10.1016/j.appet.2021.105643.

Csurgó, B., L. Kőszeghy, L. Kristóf, B. Megyesi, and Z. Szabolcsi. 2023. *Fenntartható fogyasztás az élemiszer- és energiaválság árnyékában: A survey első eredményei [Sustainable Consumption in the Shadow of the Food and Energy Crisis: The First Results of the Survey]*. Budapest: Centre for Social Sciences, Hungarian Academy of Sciences. https://szociologia.tk.hu/uploads/files/2023/fenntarthato_fogyasztasPR.pdf

Dryzek, J., and S. Niemeyer. 2019. "Deliberative Democracy and Climate Governance." *Nature Human Behaviour* 3 (5): 411–413. doi:10.1038/s41562-019-0591-9.

EU 1.5°C Lifestyles Consortium. 2022. "Methodology for the Selection of Low-Carbon Lifestyle Options." *Zenodo*. doi:10.5281/zenodo.10513512.

European Investment Bank (EIB). 2021. *The EIB Climate Survey 2020-2021 – The Climate Crisis in a COVID-19 World: Calls for a Green Recovery*. Luxembourg: EIB. doi:10.2867/5219.

European Investment Bank (EIB). 2023. *The EIB Climate Survey: Government Action, Personal Choices and the Green Transition*. Luxembourg: EIB. doi:10.2867/055829.

Eurostat. 2023. *Housing in Europe*, 2023 Edition. Brussels: European Union. doi:10.2785/279048.

Flood, S., N. Cradock-Henry, P. Blackett, and P. Edwards. 2018. "Adaptive and Interactive Climate Futures: Systematic Review of 'Serious Games' for Engagement

and Decision-Making." *Environmental Research Letters* 13 (6): 063005. doi:10.1088/1748-9326/aac1c6.

Friendly, M. 2023. *vcdExtra: 'vcd' Extensions and Additions*. R package version 0.8-4. https://CRAN.R-project.org/package=vcdExtra

Goldberg, M., S. van der Linden, E. Maibach, and A. Leiserowitz. 2019. "Discussing Global Warming Leads to Greater Acceptance of Climate Science." *Proceedings of the National Academy of Sciences* 116 (30): 14804–14805. doi:10.1073/pnas.1906589116.

Granath Hansson, A. 2019. "City Strategies for Affordable Housing: The Approaches of Berlin, Hamburg, Stockholm, and Gothenburg." *International Journal of Housing Policy* 19 (1): 95–119. doi:10.1080/19491247.2017.1278581.

Heiskanen, E., M. Johnson, S. Robinson, E. Vadovics, and M. Saastamoinen. 2010. "Low-Carbon Communities as a Context for Individual Behavioural Change." *Energy Policy* 38 (12): 7586–7595. doi:10.1016/j.enpol.2009.07.002.

Helferich, M., J. Thøgersen, and M. Bergquist. 2023. "Direct and Mediated Impacts of Social Norms on Pro-Environmental Behavior." *Global Environmental Change* 80: 102680. doi:10.1016/j.gloenvcha.2023.102680.

Herrmann, A., H. Fischer, D. Amelung, D. Litvine, C. Aall, C. Andersson, M. Baltruszewicz, et al. 2017. "Household Preferences for Reducing Greenhouse Gas Emissions in Four European High-Income Countries: Does Health Information Matter? A Mixed-Methods Study Protocol." *BMC Public Health* 18 (1): 71. doi:10.1186/s12889-017-4604-1.

Hertwich, E., and G. Peters. 2009. "Carbon Footprint of Nations: A Global, Trade-Linked Analysis." *Environmental Science & Technology* 43 (16): 6414–6420. doi:10.1021/es803496a.

Hirth, S., H. Kreinin, D. Fuchs, N. Blossey, P. Mamut, J. Philipp, and I. Radovan. 2023. "Barriers and Enablers of 1.5° Lifestyles: Shallow and Deep Structural Factors Shaping the Potential for Sustainable Consumption." *Frontiers in Sustainability* 4. doi:10.3389/frsus.2023.1014662.

Huang, Y.-S., and B. Harvey. 2021. "Beyond Indicators and Success Stories: An Emerging Method to Assess Social Learning in Large-Scale Transdisciplinary Research Programs." *Frontiers in Sociology* 6: 649946. doi:10.3389/fsoc.2021.649946.

Huebner, G., and D. Shipworth. 2017. "All about Size? – The Potential of Downsizing in Reducing Energy Demand." *Applied Energy* 186 (2): 226–233. doi:10.1016/j.apenergy.2016.02.066.

Huttunen, S., M. Ojanen, A. Ott, and H. Saarikoski. 2022. "What about Citizens? A Literature Review of Citizen Engagement in Sustainability Transitions Research." *Energy Research & Social Science* 91: 102714. doi:10.1016/j.erss.2022.102714.

Ivanova, D., J. Barrett, D. Wiedenhofer, B. Macura, M. Callaghan, and F. Creutzig. 2020. "Quantifying the Potential for Climate Change Mitigation of Consumption Options." *Environmental Research Letters* 15 (9): 093001. doi:10.1088/1748-9326/ab8589.

Ivanova, D., K. Stadler, K. Steen-Olsen, R. Wood, G. Vita, A. Tukker, and E. Hertwich. 2016. "Environmental Impact Assessment of Household Consumption." *Journal of Industrial Ecology* 20 (3): 526–536. doi:10.1111/jiec.12371.

Jackson, T. 2004. "Negotiating Sustainable Consumption. A Review of the Consumption Debate and Its Policy Implications." *Energy & Environment* 15 (6): 1027–1051. doi:10.1260/0958305043026573.

Jackson, T. 2006. "Challenges for Sustainable Consumption Policy." In *The Earthscan Reader in Sustainable Consumption*, edited by T. Jackson, 107–126. London: Earthscan.

Khalfan, A., A. Nilsson Lewis, C. Aguilar, J. Persson, M. Lawson, N. Dabi, S. Jayoussi, and S. Acharya. 2023. *Climate Equality: A Planet for the 99%*. Oxford: Oxfam International.

Koide, R., M. Lettenmeier, L. Akenji, V. Toivio, A. Amellina, A. Khodke, A. Watabe, and S. Kojima. 2021. "Lifestyle Carbon Footprints and Changes in Lifestyles to Limit Global Warming to 1.5°C, and Ways Forward for Related Research." *Sustainability Science* 16 (6): 2087–2099. doi:10.1007/s11625-021-01018-6.

Laakso, S., C. Jensen, E. Vadovics, E.-L. Apajalahti, F. Friis, and A. Szőllőssy. 2021. "Towards Sustainable Energy Consumption: Challenging Heating-Related Practices in Denmark, Finland, and Hungary." *Journal of Cleaner Production* 308: 127220. doi:10.1016/j.jclepro.2021.127220.

Lacroix, K., and R. Gifford. 2020. "Targeting Interventions to Distinct Meat-Eating Groups Reduces Meat Consumption." *Food Quality and Preference* 86: 103997. doi:10.1016/j.foodqual.2020.103997.

Lehner, M., J. Richter, H. Kreinin, P. Mamut, E. Vadovics, J. Henman, O. Mont, and D. Fuchs. 2024. "Living Smaller: Acceptance, Effects and Structural Factors in the EU." *Buildings & Cities* 5 (1): 215–230. doi:10.5334/bc.438.

Leontief, W. 1970. "Environmental Repercussions and the Economic Structure: An Input-Output Approach." *The Review of Economics and Statistics* 52 (3): 262–271. doi:10.2307/1926294.

Lettenmeier, M., J. Kolehmainen, S. Lahtinen, S. Nielsen, and S.-L. Sihto-Nissilä. 2020. "Kohtuullisuus Kulutusvalinnoissa – Havaintoja Kestävien Elämäntapojen Kiihdyttämöstä (Reasonability in Consumption Choices – Observations from the Accelerator for Sustainable Lifestyles)." *Futura* 2020 (3): 10–29.

Lorenzoni, I., and N. Pidgeon. 2006. "Public Views on Climate Change: European and USA Perspectives." *Climatic Change* 77 (1–2): 73–95. doi:10.1007/s10584-006-9072-z.

McGann, M., E. Blomkamp, and J. Lewis. 2018. "The Rise of Public Sector Innovation Labs: Experiments in Design Thinking for Policy." *Policy Sciences* 51 (3): 249–267. doi:10.1007/s11077-018-9315-7.

Merheim-Eyre, I. 2022. "Addressing the Consequences of Russian Aggression Towards Ukraine: The Case of Affordable Housing in Central and Eastern Europe." *European View* 21 (2): 124–131. doi:10.1177/17816858221137422.

Miller, R., and P. Blair. 2009. *Input-Output Analysis: Foundations and Extensions*. Cambridge: Cambridge University Press.

Moberg, K., B. Sovacool, A. Goritz, G. Hinojosa, C. Aall, and M. Nilsson. 2021. "Barriers, Emotions, and Motivational Levers for Lifestyle Transformation in

Norwegian Household Decarbonization Pathways." *Climatic Change* 165 (1–2): 3. doi:10.1007/s10584-021-03018-y.

Mózner, Z., and M. Csutora. 2013. "Designing Lifestyle-Specific Food Policies Based on Nutritional Requirements and Ecological Footprints." *Sustainability: Science, Practice and Policy* 9 (2): 48–59. doi:10.1080/15487733.2013.11908114.

Neef, N., S. Fußwinkel, C. Roos, L. Franck, K. Shihepo, and I. Richter. 2023. "Optimistic Narrative Future Visions: A Communication Tool for Promoting Sustainable (Plastic) Behavior." *Frontiers in Psychology* 14: 1252895. doi:10.3389/fpsyg.2023.1252895.

Nelson, A. 2018. *Small is Necessary: Shared Living on a Shared Planet*. London: Pluto Press.

Nielsen, K., V. Cologna, F. Lange, C. Brick, and P. Stern. 2021. "The Case for Impact-focused Environmental Psychology." *PsyArXiv*, January 24. doi:10.31234/osf.io/w39c5.

Nielsen, S. 2020. "Initiating Transitions Towards 1.5-Degree Lifestyles: An Action Research Study on a Design Game." Master's thesis, Aalto University.

Ritcher, I., E. Gabe-Thomas, A. Queirós, S. Shepapard, and S. Pahl. 2023. "Advancing the Potential Impact of Future Scenarios by Integrating Psychological Principles." *Environmental Science & Policy* 140: 68–79. doi:10.1016/j.envsci.2022.11.015.

Sahakian, M., H. Rau, E. Grealis, L. Godin, G. Wallenborn, J. Backhaus, F. Friis, et al. 2021. "Challenging Social Norms to Recraft Practices: A Living Lab Approach to Reducing Household Energy Use in Eight European Countries." *Energy Research & Social Science* 72: 101881. doi:10.1016/j.erss.2020.101881.

Sandberg, M. 2018. "Downsizing of Housing: Negotiating Sufficiency and Spatial Norms." *Journal of Macromarketing* 38 (2): 154–167. doi:10.1177/0276146717748355.

Sköld, B., M. Baltruszewicz, C. Aall, C. Andersson, A. Herrmann, D. Amelung, C. Barbier, M. Nilsson, S. Bruyère, and R. Sauerborn. 2018. "Household Preferences to Reduce Their Greenhouse Gas Footprint: A Comparative Study from Four European Cities." *Sustainability* 10 (11): 4044. doi:10.3390/su10114044.

Stadler, K., R. Wood, T. Bulavskaya, C.-J. Södersten, M. Simas, S. Schmidt, A. Usubiaga, et al. 2021. "EXIOBASE 3 (Dataset) Version 3.8.2." *Zenodo*. doi:10.5281/zenodo.5589597.

Thorman, D., L. Whitmarsh, and C. Demski. 2020. "Policy Acceptance of Low-Consumption Governance Approaches: The Effect of Social Norms and Hypocrisy." *Sustainability* 12 (3): 1247. doi:10.3390/su12031247.

Tvinnereim, E., K. Fløttum, Ø. Gjerstad, M. Johannesson, and Å. Nordø. 2017. "Citizens' Preferences for Tackling Climate Change: Quantitative and Qualitative Analyses of Their Freely Formulated Solutions." *Global Environmental Change* 46: 34–41. doi:10.1016/j.gloenvcha.2017.06.005.

United Nations Environment Programme (UNEP). 2020. *Emissions Gap Report 2020*. Nairobi: UNEP.

United Nations Framework Convention on Climate Change (UNFCCC). n.d. "The Paris Agreement." https://unfccc.int/process-and-meetings/the-paris-agreement

United Nations. 2022. "Decision -/CMA.4, Sharm el-Sheikh Implementation Plan, Advance Unedited Version." https://unfccc.int/sites/default/files/resource/cop27_auv_2_cover%20decision.pdf

Van Epp, M., and B. Garside. 2019. "Towards an Evidence Base on the Value of Social Learning-Oriented Approaches in the Context of Climate Change and Food Security." *Environmental Policy and Governance* 29 (2): 118–131. http://doi-org.accedys.udc.es/ doi:10.1002/eet.1835.

Vita, G., D. Ivanova, A. Dumitru, R. García-Mira, G. Carrus, K. Stadler, K. Krause, R. Wood, and E. Hertwich. 2020. "Happier with Less? Members of European Environmental Grassroots Initiatives Reconcile Lower Carbon Footprints with Higher Life Satisfaction and Income Increases." *Energy Research & Social Science* 60: 101329. doi:10.1016/j.erss.2019.101329.

Watabe, A., and A. Yamabe-Ledoux. 2023. "Low-Carbon Lifestyles beyond Decarbonisation: Toward a More Creative Use of the Carbon Footprinting Method." *Sustainability* 15 (5): 4681. doi:10.3390/su15054681.

Wood, R., D. Moran, K. Stadler, D. Ivanova, K. Steen-Olsen, A. Tisserant, and E. Hertwich. 2018. "Prioritizing Consumption-Based Carbon Policy Based on the Evaluation of Mitigation Potential Using Input-Output Methods." *Journal of Industrial Ecology* 22 (3): 540–552. doi:10.1111/jiec.12702.

Wu, J., and J. Lee. 2015. "Climate Change Games as Tools for Education and Engagement." *Nature Climate Change* 5 (5): 413–418. doi:10.1038/nclimate2566.

Xavier, L., P. Jacobi, and A. Turra. 2019. "Local Agenda 21: Planning for the Future, Changing Today." *Environmental Science & Policy* 101: 7–15. doi:10.1016/j.envsci.2019.07.006.

Zheng, Z., W. Zheng, and S. Naz. 2023. "Can Environmental Knowledge and Risk Perception Make a Difference? The Role of Environmental Concern and Pro-Environmental Behavior in Fostering Sustainable Consumption Behaviour." *Sustainability* 15 (6): 4791. doi:10.3390/su15064791.