PSL UNIVERSITÉ PARIS

THÈSE DE DOCTORAT
DE L'UNIVERSITÉ PSL

Préparée à l'Ecole Normale Supérieure

Psychological determinants of public support for environmental policies: a cognitive approach to enhance understanding of citizen preferences

Soutenue par
Mathilde MUS
Le 19 septembre 2024

Ecole doctorale n° 158
ED3C

Sciences Cognitives
Cerveau, cognition, comportement

Composition du jury :

Katheline SCHUBERT PU, Ecole d'Economie de Paris	*Présidente du jury* Examinatrice
Malcolm FAIRBROTHER Professor, Uppsala University	*Rapporteur*
Ghozlane FLEURY-BAHI PU, Université de Nantes	*Rapportrice*
Ulf HAHNEL Professor, University of Basel	*Examinateur*
Mariam CHAMMAT Cheffe de projet, DITP	*Examinatrice*
Hugo MERCIER DR, Ecole Normale Supérieure	*Co-directeur de thèse*
Coralie CHEVALLIER DR, Ecole Normale Supérieure	*Co-directrice de thèse*

ENS | PSL

Acknowledgements

This PhD has been shaped by many social relationships for which I feel extremely grateful. First of all, I would like to say a huge thank you to my two supervisors Hugo Mercier and Coralie Chevallier. You gave me your trust to choose research topics that I longed to explore, and always encouraged me to pursue my ideas throughout each project. I am also grateful for our stimulating discussions and your sustained guidance during this PhD. Secondly, I would like to thank the two amazing interns who actively participated in the projects presented in this dissertation, Sophie de Rouilhan and Ana Hadjes. Your competence and kindness, as well as the amount of time you dedicated to my research projects, have been very valuable to me and I will gladly follow your future work in applied research. I would also like to thank all the members of the Evolution and Social Cognition team of the Jean Nicod Institute among whom I worked over the past five years, for their inspiring research, their insightful feedback on my projects and our rich discussions at the lab. A special thanks goes to my great environmental psychology team-mates Aurore Grandin and Mélusine Boon-Falleur. I also want to thank the Ecole Normale Supérieure de Paris and the Department of Cognitive Studies, the Jean Nicod Institute and PSL University for the excellent training I received, and for offering me many professional opportunities.

Many people outside my immediate work environment also greatly contributed to the advancement and dissemination of the results presented in this PhD. I first want to thank the two members of my thesis monitoring committee Ulf Hahnel and Fanny Henriet for their relevant insights and recommendations about my work. I would also like to thank my PSL mentor Christelly Hély for her kindness and her very useful

advice on various topics related to my PhD. I am also extremely grateful to Mariam Chammat and Stéphan Giraud from the DITP Behavioral Science Team for their sustained interest in my work and all the opportunities they provided me to share my research outside the academic world.

I would now like to thank all of the people from my personal life who have made this adventure possible. My parents, first of all, who passed on to me their love of science and gave me their constant support throughout the years. Mom, thank you for being my rock under any circumstances, and for listening to all my ups and downs over the years. You are the constant emotional support that made this PhD possible. Dad, I know you would have been very proud to see me finish my PhD, and I would like to dedicate this thesis to you in remembrance of all the beloved moments we spent together. I also warmly thank the rest of my family and especially my aunts and uncle, for their loving support and sustained interest in my work, as well as for the delicious food they always prepare to give me a “boost”!

My deepest gratitude also goes to all of my friends, who provided me with the greatest smiles, hugs, discussions, game nights and jokes one could hope for. A special thanks goes to Marguerite and Cécile, who were present every step of the way, and whose friendship brought a lot of joy in my life during these three years. I also want to thank Laudine, Romain and Jeanne, with whom I lived during this PhD, for making my daily life lighter and easier, as well as for our long discussions on so many topics, including my work.

These last three years, in addition to conducting my PhD, I had to face two very difficult situations: the loss of a parent and a chronic pain condition. I would like to end these acknowledgements by expressing my profound gratitude to the many therapists

who have accompanied me through these hardships. I would especially like to thank Pierre I., Marie B., François T., Pierrick C., Jérémy M., Léa V., Joanna D., Rita L.B., and the pain center of the Bicêtre hospital.

Abstract

Widespread and ambitious environmental public policies are increasingly required in order to address the environmental crisis. One critical element for the implementation of such policies in democratic countries is public support. However, public support is not always aligned with assessed policy effectiveness, as made salient by the strong opposition to carbon taxation worldwide. A deeper understanding of the determinants of public acceptability judgments is thus crucial for policy-making. In this perspective, the present thesis studies the psychological origins of citizens' acceptability judgments in relation to three environmental policy domains: a) climate policy, b) energy policy, and c) biodiversity protection and nature conservation policy.

Chapters 1 and 2 use experimental research designs to test the causal impact of various cognitive mechanisms on environmental policy support. In both chapters, a cross-cultural approach is adopted such that all experiments are conducted in France and in the UK, using representative samples of the population with regards to age and gender. Chapter 1 investigates acceptability judgements towards different scenarios of carbon taxation, an effective climate policy for which public support heavily depends on how tax revenues are used. This chapter provides evidence that mental accounting theory can both explain systematic patterns in citizens' preferences, such as the support for environmental earmarking (i.e. using carbon tax revenues for environmental purposes), and help design a carbon tax scheme that is both acceptable and socially fair. In Chapter 2, the acceptability of four government countermeasures in response to the energy crisis is studied. This chapter first provides evidence that citizens prefer energy subsidies to cash transfers, and

especially universal energy subsidies, despite their negative social and environmental impacts. These preferences are then shown to be causally related to widespread misperceptions about policy cost and impact, as demonstrated by the presence of correction treatment effects in most of the conducted experiments.

Chapter 3 is a systematic scoping review aiming to identify the various psychological factors associated with public support for biodiversity protection and nature conservation policies. Among the different psychological factors investigated in the 66 reviewed sources, representational factors (i.e. beliefs, perceptions) have received the most attention from scholars. Moreover, wildlife value orientations, knowledge about environmental and conservation issues, as well as general policy attitudes, are the psychological factors most robustly associated with conservation policy support.

Keywords: public support; environmental policies; psychological factors; citizen preferences; cognitive science

Table of contents

General introduction

The need for ambitious environmental policies

The continuous emission of greenhouse gases, predominantly carbon dioxide (CO2) resulting from the combustion of fossil fuels, has caused an alarming increase in global average temperatures since the dawn of the Industrial Revolution. This escalation in temperature has led to a multitude of consequences that pose serious threats to both ecosystems and human livelihoods. Among the most significant of these consequences are the rising sea levels and the increased frequency and severity of extreme weather events (Calvin et al., 2023). Concurrently, we are witnessing severe biodiversity loss caused by human activities such as deforestation, pollution, and the over-exploitation of natural resources, which threatens the survival and balance of ecosystems, and the critical services they provide to humanity (Cowie et al., 2022; Díaz et al., 2019).

Given the alarming trends in global warming and the rapid decline in biodiversity, there is a growing need for widespread and ambitious mitigation policies to address these pressing environmental challenges (Dubois et al., 2019; Zhang et al., 2023). However, the latest report from the Intergovernmental Panel on Climate Change (IPCC) highlights a significant discrepancy between the emission reductions projected from the policies currently in place and the levels required to achieve the established climate goals, across all sectors and regions (Calvin et al., 2023). The report thus calls for an intensified global effort to develop and implement political strategies that can effectively curb emissions and mitigate the impacts of climate

change, as well as for promoting the preservation and restoration of natural ecosystems.

The importance of public support

Among the various elements needed to implement more widespread and more ambitious environmental policies worldwide, public support is key. First, in democratic countries, policy implementation is often conditional on citizens' support (Stadelmann-Steffen, 2011). Analyzing six road pricing policy implementation cases around the world, Vonk Noordegraaf and colleagues (2014) found that political and public support were the most prominent determinants of policy implementation across all cases. Another example comes from the case of Switzerland where many environmental policies are decided by public vote, such as the Energy Strategy 2050 which was adopted by referendum in May 2017 (Duygan et al., 2022). Moreover, even after environmental policies have been implemented, public support remains key to ensure compliance and ultimately policy impact (Heidtmann & Selck, 2024).

Public support is thus an essential component for the successful implementation of environmental policies. However, the existence of an "effectiveness-acceptability gap" in environmental policy has been documented, such that some policies assessed as environmentally effective by experts do not enjoy a high level of support among the population, and conversely some policies lacking environmental effectiveness sometimes receive strong public support (Cherry et al., 2012). One of the main examples of this discrepancy is the case of carbon taxation. Despite its assessed effectiveness for curbing CO2 emissions, this instrument has

encountered strong public opposition worldwide (Carattini et al., 2018; Douenne & Fabre, 2022). This opposition was made particularly salient in the French context with the emergence of the Yellow Vest movement. Originating from a rise in fuel prices in 2018, the movement rapidly gained momentum drawing nearly a million participants to mass demonstrations in the streets, ultimately leading to policy changes such as the canceling of the fuel tax rise (Yildiz, 2024). Another example highlighting the opposite trend is the case of subsidies (e.g. renovation subsidies, electric vehicle subsidies), which have shown limited effectiveness in reducing energy consumption and mitigating CO2 emissions but often gather more support than other policy instruments (Cherry et al., 2012; Dubois & Allacker, 2015; Nordlund et al., 2018). It should be noted that the effectiveness-acceptability gap is not specific to the environmental domain. The widespread public opposition to the taxation of inheritance (Gross et al., 2017; Stark & Kirchler, 2017), as well as the resistance to vaccination programs (McClure et al., 2017), are notable examples of this phenomenon in the social and health domain respectively.

Determinants of public support: the role of psychological factors

Given the documented effectiveness-acceptability gap with regards to environmental measures, one may worry that decision-makers could be left with very limited options to design and implement policies which are both environmentally effective and aligned with citizen preferences. However, a large body of literature provides evidence that policy support is a dynamic and multifactorial phenomenon (Klenert et al., 2018; van Wee et al., 2023). This gives rise to the hope that, in many cases, there are situations and conditions under which environmental effectiveness and acceptability dimensions

can in fact align. Developing a deeper understanding of the determinants of public support is therefore crucial to be able to design policies that respect citizens' preferences without jeopardizing environmental effectiveness.

A comprehensive review investigating the different types of factors influencing environmental policy support found that sociodemographic factors such as age, gender, education, and income generally have small effects on acceptability (Ejelöv & Nilsson, 2020). A recent meta-analysis specifically conducted on public opinion towards climate change taxes and laws across 33 countries reinforced this result by showing that sociodemographic variables have only weak or close to zero effects on policy support (Bergquist et al., 2022). On the other hand, psychological factors were found to play a major role in shaping acceptability judgments towards environmental policies across domains (Drews & van den Bergh, 2016; Ejelöv & Nilsson, 2020; Huijts et al., 2012). The present thesis therefore focuses on these determinants, using a broad definition of psychological factors that includes all individual-level processes which involve cognitive, affective and/or behavioral components (Fabrigar & Petty, 1999; Ostrom, 1969; Valtchanov & Ellard, 2015). In the following sections, I review the main psychological determinants of environmental policy support identified in the literature. These determinants can be divided in two categories: domain-general psychological factors and policy-specific factors.

Domain-general psychological factors

In this section, I first review psychological factors that apply across domains, independently of the perception of specific policy characteristics. Normative factors have been shown to play an important role in relation to environmental policy support. For instance, personal norms, which reflect internalized moral obligations and a

feeling of personal responsibility, have been identified as positive predictors of public support in various domains such as transport policy, energy policy, and environmental taxation policy (Cools et al., 2011; Steg et al., 2005). Social norms, in the form of perceived environmental support by others, are also positive predictors of climate policy support (Drews & van den Bergh, 2016)

Affective factors are another category of factors that significantly influence people's attitudes towards environmental policies. Studies have demonstrated that feelings of guilt and worry about environmental issues are associated with greater support for policies aimed at mitigating climate change (Hignell et al., 2022; Smith & Leiserowitz, 2014). Feelings of hope, by fostering a sense of efficacy and positive engagement, were also found to increase support for environmental measures (Smith & Leiserowitz, 2014).

Trust-related factors can also impact acceptability judgments. For instance, trust in government, politicians and public institutions (i.e. political trust) is often associated with general support for government action to address environmental policies, but also with support for more specific policies such as wildlife conservation measures or environmental taxation (Connelly et al., 2022; Konisky et al., 2008). By experimentally manipulating the perception of public officials' honesty and integrity, one study conducted in the UK demonstrated the causal impact of political trust on participants' support for environmental taxes (Fairbrother, 2019).

Furthermore, greater awareness and understanding of environmental problems and of the importance of ecosystems tend to correlate with higher levels of policy support (Eriksson et al., 2006; Trung et al., 2020). Importantly, climate change risk perceptions are more predictive of support for climate policies than climate change

knowledge (Bergquist et al., 2022). Relatedly, people with more experience with extreme weather events tend to show greater support for climate adaptation policies (Gould et al., 2024; Ray et al., 2017).

Finally, values and worldviews are important factors to consider, as individuals with strong pro-environmental values, self-transcendent values or preservationist worldviews are more likely to endorse environmental policies (Dietsch et al., 2016; Harring et al., 2018). Relatedly, political ideology is a consistent predictor of environmental policy support across domains (Clayton, 2018; McCright et al., 2016; Wan et al., 2017), such that having a left-wing political orientation increases support for various environmental policies.

Policy-specific factors

In addition to these general psychological factors, policy-specific perceptions have been shown to play a significant role in environmental policy support. Research indicates that citizens are much more likely to support environmental policies they perceive as socially fair and capable of effectively addressing environmental issues (Maestre-Andrés et al., 2019; Nordlund et al., 2018). Perceived fairness and effectiveness have notably been shown to be the strongest predictors of public support for climate change taxes and regulations in the recent meta-analysis cited above (Bergquist et al., 2022). It must be noted that perceived fairness involves considerations of both distributive justice (i.e. the sharing of costs and benefits) and procedural justice (i.e. decision processes). Moreover, citizens are less likely to endorse environmental policies they perceive as more coercive and economically more costly for themselves (Drews & van den Bergh, 2016). Finally, perceived policy intent appears to play an important role in forming acceptability judgments. For

example, a choice experiment conducted in the UK found that acceptability of a carbon tax scheme can vary between 68% and 48% depending on whether collected revenues are to be used for specific purposes (“earmarking”) or to go directly to the general tax budget (Bristow et al., 2010).

Aims of this dissertation

This thesis aims to complement the existing literature on the psychology of environmental policy support by addressing some of its limitations. Most studies in the field are correlational, hence the reported associations between psychological variables and policy support are subject to omitted variable bias and endogeneity issues. By conducting studies with an experimental design, I aim to provide evidence for causal relationships between several psychological factors and environmental policy support. Second, many empirical studies in the field are conducted on a single population, limiting the generalizability of results and the detection of heterogeneous effects across countries and cultures. I try to address this limitation by systematically conducting cross-cultural studies comparing the effect of a given psychological mechanism in two different populations. Third, by applying theories originating from other cognitive science disciplines than environmental psychology (e.g. behavioral economics), this thesis aims to provide new theoretical frameworks centered on specific cognitive mechanisms to analyze environmental policy support. Finally, by investigating three different domains of environmental policy (climate, energy, and conservation policies), I aim to convey a comprehensive picture of environmental policy support and to reduce the imbalance in research focus within the environmental policy support field, characterized by a high concentration of climate policy studies.

The field of conservation policy support being particularly under-studied and thus less structured than the climate and energy policy support fields, I contribute to building a robust evidence synthesis in this field by conducting a systematic review of psychological factors associated with public support for biodiversity protection and nature conservation policies.

Policy-wise, this thesis aims to demonstrate that by gaining a deeper understanding of the psychological foundations of environmental policy support, it is possible to integrate citizen preferences into the policy-making process in order to better align environmental effectiveness and public acceptability dimensions. This can for example take the form of new environmental policy proposals that take into account specific cognitive mechanisms, or information-based interventions in cases where policy preferences are based on a lack of knowledge or objective misperceptions. Advocating for an early integration of citizen preferences into the policy-making process, the present thesis focuses on the study of public support before policy implementation (i.e. public acceptability), and not after implementation (i.e. public acceptance).

Structure of this dissertation

In Chapter 1, I empirically investigate variations in public support for different scenarios of carbon taxation. Despite its potential for curbing greenhouse gas emissions, carbon taxation encounters strong public resistance worldwide. However, it has been well documented that public acceptability depends on how tax revenues are used, with a strong preference for environmental earmarking (i.e. using carbon tax

revenues for environmental purposes). I hypothesize that mental accounting theory can both explain systematic patterns in citizens' preferences, such as the support for environmental earmarking, and help design a carbon tax scheme that is both acceptable and socially fair. Indeed, one feature of mental accounting is that revenue sources and personal expenses are processed thematically and grouped into distinct mental accounts, such that a policy design where environmental tax revenues fund environmental expenses may activate the mental accounting heuristic. To test this hypothesis, I conduct several experiments in the United Kingdom and in France where both the tax domain and the expenditure domain are experimentally manipulated to create congruent (e.g. a carbon tax where revenues are used for environmental purposes) and incongruent (e.g. a carbon tax where revenues are used for health purposes) scenarios. Experimental results show that there is an acceptability boost when the use of tax revenues matches the tax domain thematically. This result is consistent with the use of a mental accounting heuristic, and replicates for two other tax domains than carbon taxation: inheritance taxation and tobacco taxation. Moreover, the proportion of tax revenues earmarked for green projects plays a role in activating the mental accounting heuristic, as shown by varying acceptability judgments with earmarking levels. Finally, a redistributive carbon tax scheme created on the basis of mental accounting theory, in which most revenues are earmarked for green projects and the rest is redistributed to low-income households to be spent on sustainable expenses, receives most support among different tested options.

In Chapter 2, I empirically test the acceptability of government countermeasures during the energy crisis. In response to the drastic energy price shocks that have taken place since 2021, several governments implemented subsidies to lower energy prices for consumers. In France, for example, the

government introduced a universal fuel discount in April 2022 to offset the rise in fuel prices. However, there is strong agreement among experts that fossil fuel subsidies have negative impacts on environmental sustainability, social equality, and economic efficiency. Although targeted monetary transfers are more effective from a redistributive and environmental point of view than non-targeted fossil fuel subsidies (i.e. universal subsidies), they might not be favored by the population. Across several experiments conducted in the United Kingdom and France during the energy crisis, I first assess people's support for four energy policy scenarios based on real-world countermeasures, varying in policy instrument (energy subsidy or cash transfer) and policy target (universal or targeted towards vulnerable households). I find that citizens prefer energy subsidies to cash transfers, and especially universal energy subsidies, despite their negative social and environmental impacts. I then demonstrate that this preference for universal energy subsidies is partly due to widespread misperceptions about the cost, social impact, and environmental impact of this policy. Correcting these misperceptions lowers support for universal energy subsidies in the UK and increases relative support for the three other policies in France. Finally, I show that citizens misperceive the effectiveness of targeted cash transfers, a policy that is socially fairer and more environmentally-friendly than universal subsidies. Correcting this misperception increases support for targeted cash transfers in the UK but not in France.

In Chapter 3, I systematically review the psychological determinants of public support for biodiversity protection and nature conservation policies. In light of the current biodiversity crisis, broader and stricter conservation policies are increasingly required. As for other environmental policies, public support for conservation measures is a necessary condition for their success. Identifying which factors,

including psychological ones, are associated with citizens' support for conservation policies is thus crucial for policy-making. However, contrary to climate and energy policy fields where reviews of psychological factors associated with public support have already been conducted, such synthesis work does not exist in the conservation policy field. Hence, I conduct the first systematic scoping review of studies empirically investigating the effect of psychological factors on conservation policy support. To do so, I follow the standard framework of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for scoping reviews (PRISMA-ScR) to complete each stage of the review: search strategy, screening, data extraction, quality assessment, and data analysis. Results are synthesized using both a narrative approach and descriptive statistical analyses. Among the 66 reviewed sources, I find that representational factors (beliefs, perceptions) have received the most attention from scholars, and normative factors (moral and social norms) the least. Moreover, wildlife value orientations, knowledge about conservation and environmental issues, and general policy attitudes are the psychological factors most robustly associated with conservation policy support.

Chapter 1 - Designing an acceptable and fair carbon tax: the role of mental accounting

Corresponding article: *Mus, M., Mercier, H., & Chevallier, C. (2023). Designing an acceptable and fair carbon tax: The role of mental accounting. PLOS Climate, 2(10), e0000227. https://doi.org/10.1371/journal.pclm.0000227*

Abstract

Despite its potential for curbing greenhouse gas emissions, carbon taxation encounters strong public resistance. However, acceptability depends on how tax revenues are used. We test the hypothesis that mental accounting theory can both explain systematic patterns in citizens' preferences, such as the support for environmental earmarking, and help design a carbon tax scheme that is both acceptable and fair. Across six experiments conducted in the United Kingdom and in France (N_{total} = 7100), we show that: (a) There is an acceptability boost when the use of tax revenues matches the tax domain thematically (e.g., allocating carbon tax revenues to green projects), as demonstrated by an interaction effect between the tax domain and the expenditure domain on the level of tax support. This result is consistent with the use of a mental accounting heuristic, by which people create mental budgets where the origin of revenues is matched thematically with their domain of use. (b) Carbon tax acceptability varies with the proportion of tax revenues earmarked for green projects. (c) A mixed carbon tax scheme, in which most revenues are earmarked for green projects and the rest is redistributed to low-income households to be spent on sustainable expenses, receives most support among the

tested options. We also demonstrate the robustness of the mental accounting heuristic in two ways: by showing that the preference for environmental earmarking of carbon taxes is observed across all relevant subsections of the population, and that mental accounting also appears to shape preferences for health-related earmarking of tobacco taxes, and social-related earmarking of inheritance taxes.

Keywords: carbon taxation, earmarking, mental accounting, acceptability, public support, tax psychology, redistribution

1. Introduction

Despite its potential for curbing CO_2 emissions (Duff & Hsu, 2010; Dussaux, 2020; Rivers & Schaufele, 2015), carbon taxation encounters strong public resistance (Carattini et al., 2018; Douenne & Fabre, 2022; Dresner, Dunne, et al., 2006; Dresner, Jackson, et al., 2006), which greatly limits its actual impact. Several studies have demonstrated that the acceptability of carbon taxation can be significantly increased by the design of the policy (Bechtel et al., 2020; Beiser-McGrath & Bernauer, 2019; Brannlund & Persson, 2012; Hardisty et al., 2019; Klenert et al., 2018). In particular, people strongly prefer carbon taxation schemes in which revenues are earmarked for environmental purposes (Amdur et al., 2014; Baranzini & Carattini, 2017; Carattini et al., 2019; Douenne & Fabre, 2020; Gevrek & Uyduranoglu, 2015; Kallbekken & Aasen, 2010; Maestre-Andrés et al., 2019, 2021). Earmarking is a budgeting practice by which all or a portion of tax revenues is dedicated to a particular sector or program chosen in advance, rather than subjected to the typical budget procedure of revenue-pooling. However, not all earmarking is created equal, and public support

varies greatly depending on which earmarking scheme is implemented. Focus groups conducted among French citizens suggest that earmarking energy tax revenues for environmental purposes is seen as the most acceptable solution for almost all participants, whereas using tax revenues to reduce the VAT or labor taxes is perceived negatively in most groups (Deroubaix & Lévêque, 2006). Moreover, several quantitative studies showed that policy support is significantly higher when carbon tax revenues are earmarked for environmental purposes rather than redistributed to households (Amdur et al., 2014; Kotchen et al., 2017; Sælen & Kallbekken, 2011), although these earmarking preferences can vary across socio-demographic groups (Tatham & Peters, 2023).

Understanding why some types of expenditure domains lead to stronger public support than others is crucial to inform policy making, for the carbon tax in particular, and for tax policy more generally. Taking tax psychology into account, more acceptable tax policies can be designed. In the case of the carbon tax, two hypotheses can explain the variation in acceptability across expenditure domains. First, this variation may simply reflect people's preferences between different expenditure domains, independently of the revenue source (e.g., always preferring environmental expenses to other uses). Second, this variation may stem from a preference for tax designs in which there is a thematic correspondence between the revenue source (e.g., an environmental tax) and the expenditure domain (e.g., environmental projects). Here, we argue in favor of the second hypothesis, based on mental accounting theory. Mental accounting is a "set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities" (Thaler, 2011) that plays a significant role in the way people deal with their personal finances. One feature of mental accounting is that revenue sources and personal

expenses are processed thematically and grouped into distinct mental accounts. For example, when households are given a £100 cash transfer that they can spend freely, they spend £47 on average on fuel if the transfer is labeled as “Winter Fuel Payment”, whereas if the same transfer is named neutrally, only £3 is spent on fuel (Beatty et al., 2014). These results show that the source of revenue influences how people think revenues should be spent.

In this paper, we test the hypothesis that citizens apply the same type of mental accounting heuristic to the state budget. Importantly, we do not assume that the mental accounting heuristic would be the sole driver of the high acceptability of green earmarking of carbon tax revenue. Various factors influence the acceptability of earmarking schemes, making the optimal carbon tax scheme context-dependent (Klenert et al., 2018). Our point is to show that the mental accounting heuristic plays a significant role in explaining citizens’ preferences, and that it can be leveraged in different contexts to design a more acceptable carbon tax. The article is organized in four parts, each describing a set of experiments conducted in the United Kingdom and in France. We first show that, compared to a baseline condition in which revenues come from a generic tax, and thus cannot be matched thematically, people are more supportive of a tax scheme in which the earmarking domain matches the revenue source than of a tax scheme in which they do not (Studies 1A and 1B). Mental accounting can thus explain why people favor the earmarking of carbon taxes for green projects over the earmarking of the same taxes for unrelated goals (see also Hahnel et al., 2020). Using replication studies, we demonstrate that this finding is not specific to the carbon tax: mental accounting can also explain why people prefer tobacco taxes earmarked for health-related purposes and inheritance taxes earmarked for social projects (Studies 2A and 2A’). Returning to the carbon tax, we

then show that acceptability varies with the proportion of carbon tax revenues directed towards the environmental domain, but that support does not significantly drop when moving from full earmarking to a high proportion of earmarked revenues (Studies 3A and 3B). This could allow policy makers to use a fraction of carbon tax revenues to meet other policy goals such as compensating social inequalities created by the tax. Finally, we test participants' support for an innovative and more redistributive carbon tax scheme based on mental accounting theory, in which most revenues are earmarked for green projects, and the rest redistributed to low-income households for sustainable expenses. This carbon tax scheme, combining two thematic elements, garners most support across the tested policies (Studies 4A and 4B).

2. Study 1

Materials and methods

Ethics statement

All studies received ethical approval by the CER-Paris Descartes (N° 2019-03-MERCIER). Written formal consent was obtained for all studies.

Participants

We conducted pre-registered survey experiments on population samples recruited in two countries, the United Kingdom and France (N_{total} = 3500). These samples are representative of the adult population of these two countries with regard to age and gender, and ethnicity in the UK. For studies conducted in France, representative quotas were computed based on census data from the National Institute of Statistics

and Economic Studies (INSEE) and for studies conducted in Britain they were based on census data from the Office of National Statistics.

British participants were recruited through the online platform Prolific Academic and compensated with pay for their participation in the study. The experiment was conducted identically on two British samples. Responses from the first sample were recorded from the 8th to the 10th of February 2021 and responses from the second sample from the 5th to the 7th of March 2021. For the first sample, 900 participants were recruited based on a power analysis using effect sizes obtained in a pilot study. A detailed account of the pilot study is reported in Note A in Supplementary information. The final number of respondents after exclusion of inattentive respondents was 852 (440 females; mean age = 46.0). For the second sample, 1300 participants were recruited and the final number of respondents after exclusion of inattentive respondents was 1244 (633 females; mean age = 46.9). The second sample was recruited in order to replicate the results obtained in the first sample on a larger dataset, as the first sample was to some extent underpowered. As the same experiment was conducted on both samples, the datasets have been merged to perform analyses.

French participants were recruited through the online platform CrowdPanel and compensated with pay for their participation in the study. The study used a representative sample of the adult population on the basis of age and gender. However, due to recruitment difficulties, the category of respondents above 60 is under-represented in our sample. Responses were recorded from the 10th of May to the 5th of September 2021. 1300 participants were recruited and the final number of respondents after exclusion of inattentive respondents was 1271 (661 females; mean age = 40.3).

The distributions of sociodemographic characteristics are reported in Table A in Supplementary information. For all studies, it must be noted that participant samples - both in the UK and in France - may not be representative of the general population with regard to the other variables measured in our survey (such as education level, political ideology, and area of residence) because only age, gender, and ethnicity (in the UK) were used as filtering variables to recruit participants. Hence, as sampling is not probabilistic with regard to variables other than age, gender, and ethnicity, the results obtained in the following studies may vary from those obtained with a fully probabilistic sample.

Design and procedure

In our experiments, participants were first asked to order from 1 to 8 public policy domains (environmental protection, health care, education, culture, housing, social protection, defense, public order and safety) in which they think public spending should be increased (1 = top priority, 8 = lowest priority). They were then presented with an attention check (see Note B in Supplementary information). Participants were then randomly assigned to one of six conditions (see Fig 1). Each condition featured a hypothetical tax scheme in which we varied both: (a) the expenditure domain, with tax revenues either earmarked towards the environmental domain, earmarked towards a non-environmental domain, or not earmarked (i.e., pooled into the general government fund), and (b) the revenue source, with revenues originating either from a carbon tax or a generic tax increase. This experimental design was adapted from the methodology used in standard mental accounting paradigms (see, e.g., Abeler & Marklein, 2008). In these paradigms, researchers manipulate two variables: (a) consumption goods on which money can be spent (e.g., food and beverages), and (b)

sources of revenues, with non-labeled and labeled conditions (e.g., cash and a voucher related to one of the goods).

In the carbon tax conditions, variations in expenditure domains created a matched tax scheme (carbon tax revenues earmarked to the environmental domain), and a mismatched tax scheme (carbon tax revenues earmarked to a non-environmental domain). By contrast, in the generic tax conditions, variations in expenditure domains resulted in tax schemes that are neither matched nor mismatched, as the revenue source is not tied to a particular domain. Generic tax conditions allowed controlling for participants' baseline preferences for the different expenditure domains. The non-environmental domain corresponded to each participant's self-declared preferred policy domain (e.g., health, education; see Methods and Table B in Supplementary information). This created a stringent test for the mismatched condition, to determine whether the mental accounting heuristic can counteract strong individual preferences.

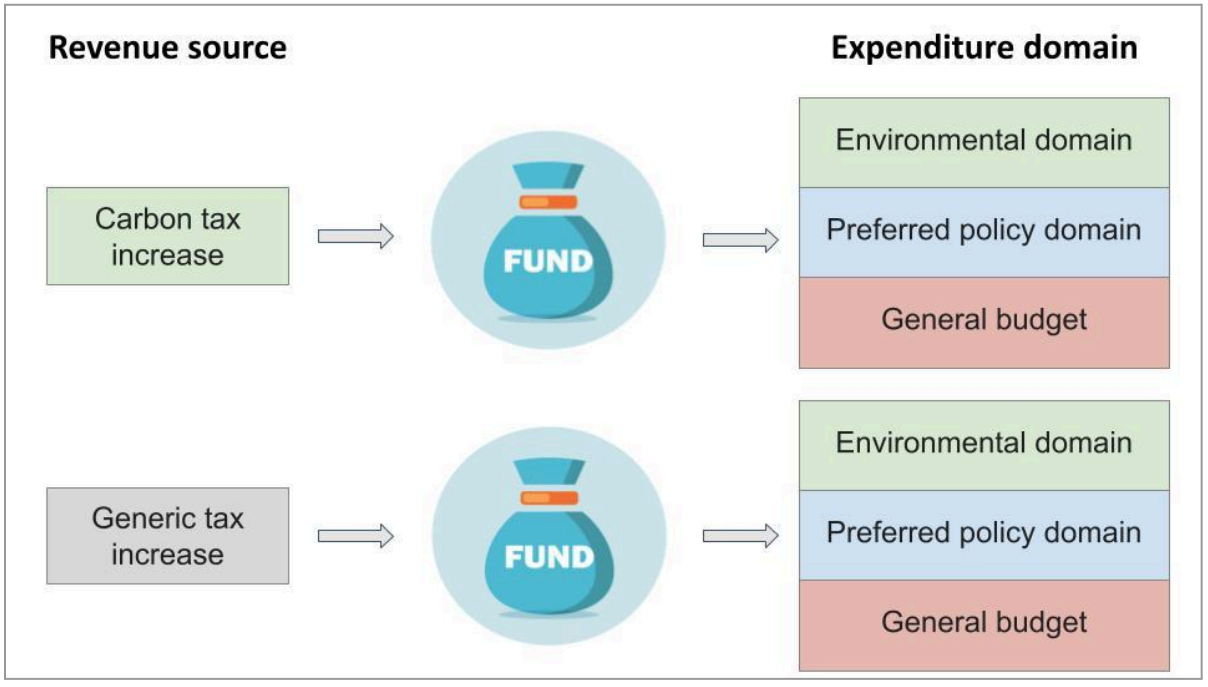


Fig 1. Illustration of the experimental design. This is a 2 (revenue source) x 3 (expenditure domain) between-participants design, with participants randomly allocated to one of six conditions. When carbon tax revenues are earmarked towards the environmental domain, it is a “matched earmarking” scheme. When carbon tax revenues are earmarked towards participants’ preferred policy domain, it is a “mismatched earmarking” scheme.

After reading the tax scheme, participants were asked how much they would agree with the presented policy (i.e., the tax and the way revenues are spent) on a ten-point Likert scale ranging from “fully disagree” to “fully agree”, which constituted our main dependent variable. Participants were then asked about their general level of trust towards other people and the government, as well as their perceived effectiveness of the carbon tax in changing people's behavior, using ten-point Likert scales. Finally, participants answered socio-demographic questions on their age, gender, highest education level, perceived relative income level, political ideology, residence area and were thanked. The full survey (with the precise wording of all questions) is available as part of the replication archive for this article at https://osf.io/5nyve/.

Hypotheses

Mental accounting makes thematic matching between revenues and expenses cognitively intuitive and mismatched policies less attractive. We thus predicted that participants’ preferences would vary across earmarking domains depending on whether the earmarking domain is matched or mismatched with the revenue source. More specifically, our hypotheses were the following:

(1) Citizens prefer a carbon tax earmarked for environmental purposes rather than a carbon tax which is not earmarked. This hypothesis is in line with previous research findings (Amdur et al., 2014; Sælen & Kallbekken, 2011).

(2) Citizens' preferences follow a mental accounting heuristic. This heuristic will give rise to an interaction between the revenue source and the expenditure domain, with the effect of the expenditure domain being stronger in the carbon tax conditions (where earmarking is either matched or mismatched) than in the generic tax conditions (where earmarking is neither matched nor mismatched).

Results

Respondents who failed the attention check were excluded from the analyses. Moreover, when running analyses on earmarked conditions only, the 11.2% of participants who ranked the environment as their first priority were excluded in order to create distinct conditions between the "environmental earmarking" and "preferred policy earmarking" schemes. Finally, as the experiment in the United Kingdom was performed on two samples with the same design and sampling methodology (to obtain a direct internal replication), we merged the two datasets to perform analyses.

The specific preference for matched earmarking

Using two-sided independent-samples Student's t-tests, we first showed that people prefer a carbon tax earmarked for environmental protection rather than not earmarked, both in the UK, $t(696.92) = 3.10$, p-value = 0.002, Cohen's d = 0.23, 95% confidence interval [0.21, 0.94], and in France, $t(427) = 7.38$, $p < 0.001$, d = 0.71, 95% CI [1.47, 2.53]. This effect is stronger in the French sample than in the British sample,

as French participants display lower support on average for a carbon tax that is not earmarked (Fig 2).

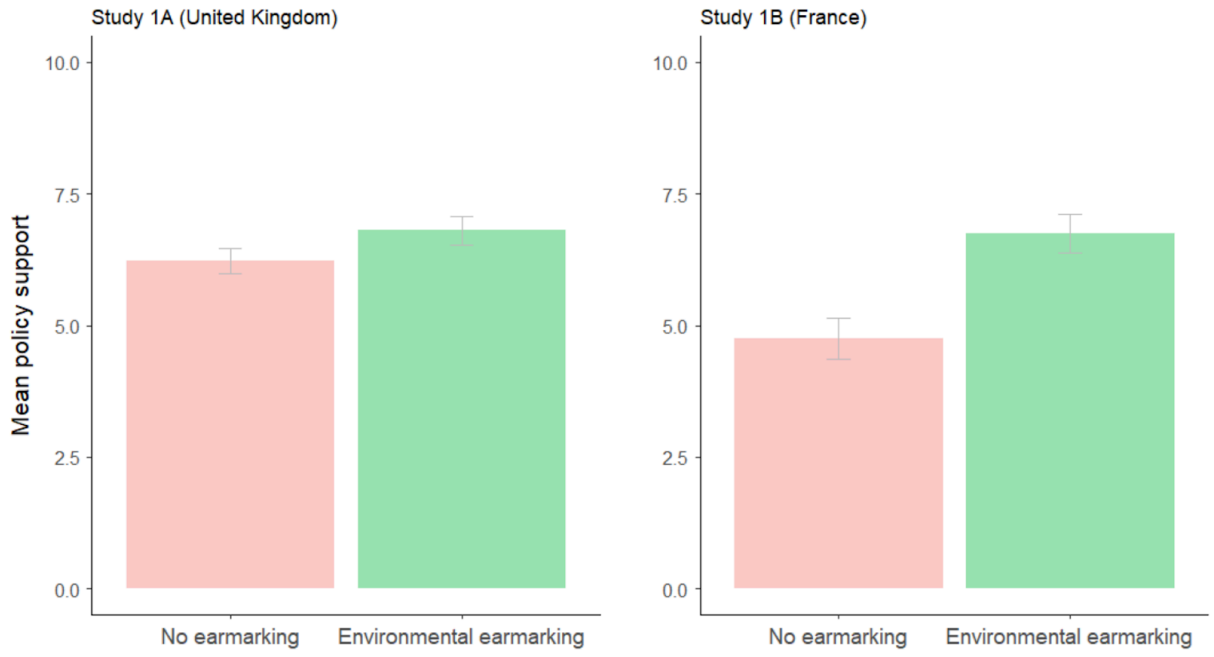


Fig 2. Bar graphs representing policy support for a carbon tax increase when revenues are either earmarked for environmental protection ('matched earmarking') or not earmarked, for each study (N_{1A} = 706, N_{1B} = 429). Policy support was rated on a ten-point Likert scale. Data points from the two British samples are combined. Plotted are 95% confidence intervals.

We then tested for a potential interaction effect between the four earmarked conditions. A two-way ANOVA showed a main effect of both the revenue source, and the earmarking domain on policy support (see Note C in Supplementary information for full results). In line with the mental accounting hypothesis, we found a significant interaction between the revenue source and the expenditure domain on policy support, both in the French study, $F(1,683) = 18.48$, $p < 0.001$, np^2 (partial eta-squared) = 0.03, and in the British study $F(1,1246) = 33.75$, $p < 0.001$, $np^2 = 0.03$

(Fig 3). In terms of effect size, these effects range between small and medium effects (d = 0.35). When tax revenues are allocated to participants' preferred policy domain, the level of support does not significantly vary with the revenue source. On the contrary, when tax revenues are allocated towards environmental projects, the revenue source impacts the level of support: participants prefer when environmental projects are funded by carbon tax revenues rather than by general tax revenues. These results are consistent with the mental accounting hypothesis as the only situation where thematic matching between revenues and expenses takes place is when carbon tax revenues fund environmental projects.

By design, earmarking towards participants' preferred policy domain is favored over environmental earmarking, but this relative advantage shrinks considerably (and nearly disappears in the French sample) when the revenue source is a carbon tax. This suggests that, once we control for participants' baseline preferences for different expenditure domains, participants favor tax schemes in which the revenue source and the expenditure domain are matched, as predicted by mental accounting theory.

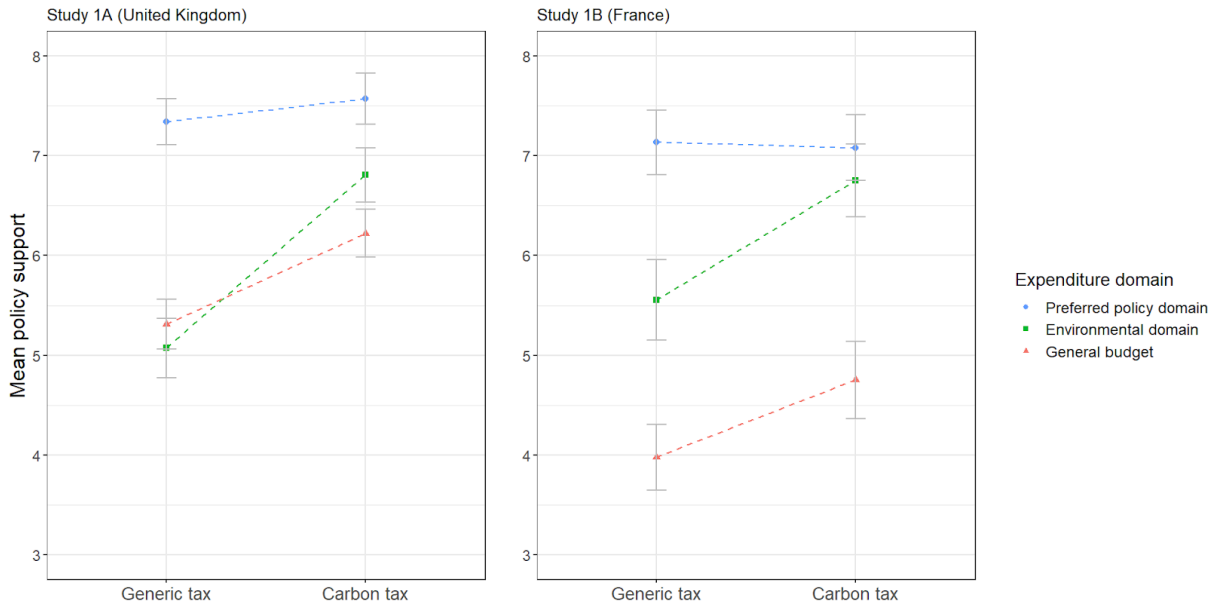


Fig 3. Mean policy support when tax revenues, coming from a generic tax or a carbon tax increase, are either earmarked towards participants' preferred policy domain, towards environmental protection or not earmarked (pooled into the general budget), in each study (N_{1A} = 2096, N_{1B} = 1271). Policy support was rated on a ten-point Likert scale. Data points from the two British samples are combined. Plotted are 95% CIs.

Robustness analyses

Perceptions of carbon tax ineffectiveness cannot explain our results. To the best of our knowledge, the only alternative explanation in the literature that may explain a specific support for environmental earmarking of carbon tax revenue relates to a misperception of the effectiveness of the tax (Deroubaix & Lévêque, 2006; Maestre-Andrés et al., 2021). According to this hypothesis, if citizens underestimate the power of carbon taxation to modify people's behavior by the price signal only, then it is crucial that tax revenues are earmarked towards environmental projects for the

tax to have a beneficial impact on the climate. In line with this account, several studies have shown that people tend to neglect the primary effect of the carbon tax (Baranzini & Carattini, 2017; Deroubaix & Lévêque, 2006; Maestre-Andrés et al., 2021), which is that negative externalities are integrated into the price and that this higher price will lead to less demand for the taxed product (i.e., the principle of Pigouvian taxation). Another version of this hypothesis is that people perceive a carbon tax complemented by the funding of environmental projects as more likely to affect behavior than a carbon tax not accompanied by such projects. This hypothesis of a misperception of the tax effectiveness and the mental accounting hypothesis are not mutually exclusive, but to test the validity of the mental accounting hypothesis, it is important to demonstrate that this alternative hypothesis does not fully account for our results.

In our studies, participants were asked to rate the effectiveness of the carbon tax to change people's behavior (see Table C in Supplementary information for descriptive statistics). If the preference for environmental earmarking were purely driven by the low perceived effectiveness of the carbon tax, it should not be observed among those participants who think that the carbon tax is effective. Indeed, if these participants think that the price signal sent by the tax is sufficient to change behavior, then revenue use should not be an important factor for effectiveness. By contrast, mental accounting predicts that the preference for environmental earmarking should also hold among those participants. We thus tested whether the interaction between the revenue source and the expenditure domain persisted in the subsample of participants who believed the carbon tax to be effective in changing behaviors (i.e., who answered above 5 on a ten-point scale). Among British participants, the interaction effect remains significant and is as strong as in the whole sample $F(1,618) = 17.40$, $p < 0.001$, $np^2 = 0.03$. In the French sample, the effect goes into the same

direction as in the British sample (see Fig A in Supplementary information). However, the effect is weaker in this subsample ($np^2 = 0.01$) than in the whole sample ($np^2 = 0.03$), and it is not significant to the 5% level ($p = 0.21$). This lack of significant effect in contrast to the British sample may be due to the lower proportion of participants believing the carbon tax to be effective (only 38% of French participants compared to 50% of British participants, see Table C in Supplementary information).

Moreover, it is important to note that this alternative explanation does not apply to taxes that do not aim at behavioral change. Perceptions of ineffectiveness cannot explain results showing that people prefer an inheritance tax scheme in which earmarking is matched (Halter, 2014; Stark & Kirchler, 2017). Mental accounting, on the contrary, offers an explanation for this preference (see Study 2A). Together with the results presented above, this suggests that perceived tax ineffectiveness does not fully account for people's preference towards matched earmarking.

The mental accounting heuristic affects every relevant subgroup. If the preference for environmental earmarking of carbon tax revenues were driven by a specific subsample of the population, it might be more difficult to leverage this preference to guide policy design. While some individual characteristics (e.g., gender, education) have been shown to moderate the extent to which people engage in mental accounting (Muehlbacher & Kirchler, 2019), the effect of mental accounting can be observed in most socio-demographic groups (Choi et al., 2009), which highlights its robustness. In line with these findings, the interaction effect (revenue source x expenditure domain) did not vary among French participants as a function of gender ($p = 0.99$), age ($p = 0.57$), education ($p = 0.64$), political ideology ($p = 0.28$), the priority given to the environment ($p = 0.21$), perceived income level ($p = 0.95$), residence area ($p = 0.51$), political trust ($p = 0.80$) or social trust ($p = 0.47$) (see Fig B

in Supplementary information for a visualization). Among British participants, the only exception to this pattern was the effect of political ideology ($p = 0.02$), and of the priority given to environmental protection ($p = 0.004$), such that the interaction between the revenue source and the expenditure domain (i.e., the effect of mental accounting) was stronger for individuals who are more right-wing, and those who prioritize the environment to a lesser extent. Nevertheless, even among participants for whom the effect was weaker, the interaction term remained significant ($p < 0.001$ in both cases, Fig 4; see Note D in Supplementary information for full results). These results underline the robustness of the mental accounting heuristic in explaining variations of acceptability levels across earmarking domains, and point towards a generalized cognitive mechanism shaping policy support.

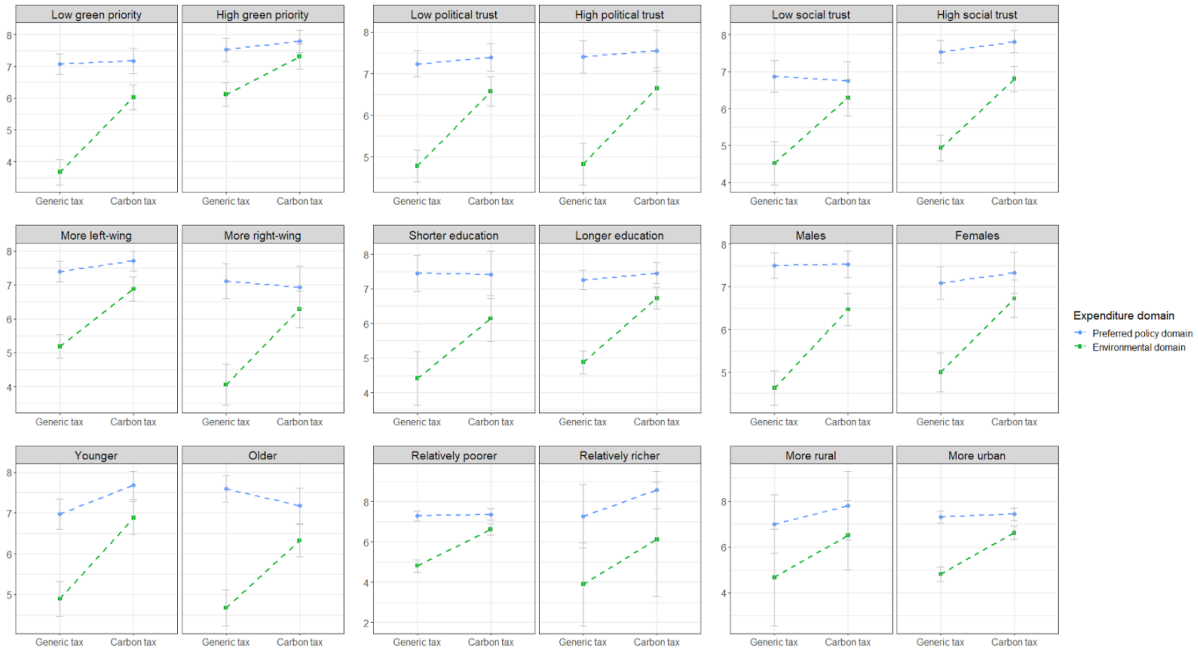


Fig 4. Mean policy support in the British study for the four earmarked tax schemes (revenue source: generic tax or carbon tax; expenditure domain: preferred policy domain or environmental domain), when splitting the sample according to the priority given to environmental protection,

political trust, social trust, political ideology, highest education level, gender, age, perceived relative income level and residence area (see Note D in Supplementary information for the detailed procedure). Policy support was rated on a ten-point Likert scale. Data points from the two British samples are combined (N_{total} = 1250). Plotted are 95% CIs.

3. Study 2

If the preference for matched earmarking is in part due to a general cognitive mechanism such as mental accounting, this preference should hold for taxes besides the carbon tax. Previous research has shown that Austrian participants prefer an inheritance tax earmarked to reduce social inequalities than not earmarked (Halter, 2014; Stark & Kirchler, 2017). Vardavas and colleagues (2012) conducted an empirical study in Greece showing that citizens prefer tobacco taxes earmarked for health care and tobacco control rather than not earmarked. These results suggest the potential operation of the mental accounting heuristic in both of these domains. To test this hypothesis, we conducted two studies to test whether mental accounting can explain the preference for matched earmarking in the case of the inheritance tax (Study 2A) and the tobacco tax (Study 2A').

Materials and methods

Both studies were conducted on participants representative of the adult British population in terms of age, gender, and ethnicity (N_{total} = 1800), and were pre-registered at https://osf.io/hgmak/. The design of the earmarked conditions was identical to the one used in the carbon tax studies, except for the name of the revenue

source (“inheritance tax” and “tobacco tax” respectively) and of the matched category (“poverty reduction” and “health care and tobacco control” respectively). The wording used for the matched category was derived from the studies showing a preference for thematic earmarking in the case of the tobacco tax (Vardavas et al., 2012) and the inheritance tax (Stark & Kirchler, 2017). A more detailed account of the materials and methods used for Study 2A and Study 2A' can be found in Note E in Supplementary information.

Results

In the inheritance tax study, there was a significant interaction between the revenue source and the expenditure domain on the level of support, $F(1,648) = 4.01$, $p = 0.046$, $np^2 = 0.006$. In the tobacco tax study, the interaction was similarly strong, but it did not reach significance at the 5% level, $F(1,493) = 3.64$, $p = 0.057$, $np^2 = 0.007$. Interaction patterns, however, vary across studies due to different baseline preferences for tax domains and earmarking domains (see Fig 5). It is important to note that because of varying baseline preferences, the mental accounting hypothesis makes no prediction about the specific interaction pattern to be observed in each case, as long as the effect of the expenditure domain is stronger in the specific tax conditions (where earmarking is either matched or mismatched) than in the generic tax conditions (where earmarking is always unmatched).

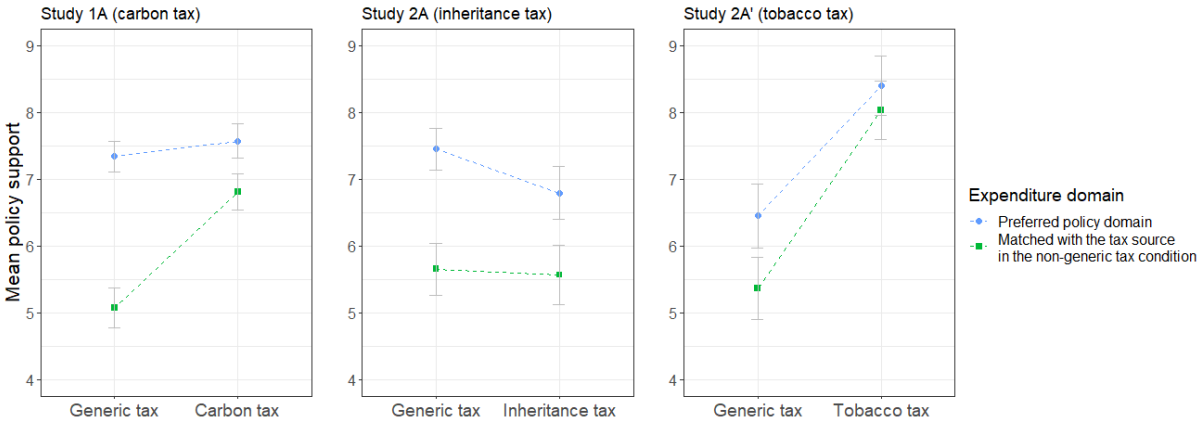


Fig 5. Mean policy support for the four earmarked tax schemes in all of the British studies (carbon tax: Study 1A, inheritance tax: Study 2A, tobacco tax: Study 2A'). Policy support was rated on a ten-point Likert scale. The matched earmarking domain corresponds to: (a) environmental protection in the carbon tax study, (b) poverty reduction programs in the inheritance tax study, (c) health and tobacco control programs in the tobacco tax study. Plotted are 95% CI.

To test the degree to which our findings are robust to variations in the type of taxation, and might thus be generalizable to other taxes, we performed a meta-analysis on all pre-registered studies conducted in the United Kingdom, computing the summary effect of mental accounting on the preference for matched earmarking across the three taxes under scrutiny: the carbon tax (Study 1A), the inheritance tax (Study 2A) and the tobacco tax (Study 2A'). As the experimental design and the measured variables are identical across studies, a meta-analysis yields a more powerful test of the effect of mental accounting across replications than analyzing each study separately (Braver et al., 2014). We used a random-effects meta-analysis model because effect sizes may vary depending on the type of tax

studied. The estimated effect is d = 0.25 (SE = 0.05, 95% CI [0.15, 0.35], z = 5.12, p < 0.001, I^2 = 29.2%, n = 4; see Fig C in Supplementary information).

4. Study 3

In line with past studies (Amdur et al., 2014; Baranzini & Carattini, 2017; Carattini et al., 2017, 2019; Deroubaix & Lévêque, 2006; Maestre-Andrés et al., 2019, 2021; Sælen & Kallbekken, 2011), our results suggest that to maximize support for carbon taxation, an optimal solution is to earmark all tax revenues for environmental protection. However, to meet other policy goals, such as reducing the inequalities introduced by the carbon tax, policy makers may wish to split the generated revenues into multiple expenditures. From a practical standpoint, it is therefore important to investigate if and how acceptability is affected when only a fraction of tax revenues is directed towards the matched category (environmental protection in the case of the carbon tax). Mental accounting theory makes no clear prediction regarding these "partial matching" situations: any use of funds for expenditures that are not matched might cause the mental accounting heuristic not to be triggered at all, or on the contrary the strength of the heuristic could vary proportionally to the share of expenditures dedicated to matched earmarking. We thus conducted two additional experiments in the United Kingdom and in France (N_{total} = 2200) to investigate this question.

Materials and methods

In Studies 3A and 3B, the schemes only featured a carbon tax earmarked for environmental protection. The proportion of earmarked funds was experimentally

manipulated (0%, 25%, 50%, 75%, 100%), with participants randomly allocated to one of these five hypothetical tax schemes. The experiment was otherwise identical to the previous experiment. As we were mainly interested in the variation of acceptability for tax designs with earmarking, we restrained our main analysis to the four earmarked conditions.

For this experiment, we recruited 1100 French participants from CrowdPanel and 1100 British participants from Prolific Academic. The survey period was 14 October to 5 November 2021 for the French sample, and 26 October to 28 October 2021 for the British sample. As for Studies 1A and 1B, these studies used representative samples of the adult population in terms of age and gender, as well as ethnicity in the British study. Only participants who succeeded the attention check were included in the analyses. After exclusion of inattentive respondents, the final sample size was 1038 for the French study (529 women, mean age = 39.6) and 995 for the British study (500 women, mean age = 44.8). We did not pre-register any hypotheses related to this experiment, as mental accounting theory makes no prediction with regard to these “partial matching” situations. Only the methodology and the sampling plan were pre-registered.

Results

Conditional on green earmarking being implemented, the proportion of earmarked funds significantly affected policy support both among British and French participants, $F_B(3,797) = 2.85$, $p_B = 0.04$, $np^2_B = 0.01$; $F_F(3,821) = 6.99$, $p_F < 0.001$, $np^2_F = 0.02$, such that acceptability increases with the proportion of funds earmarked for green projects (see Fig 6). Post-hoc tests revealed that full earmarking is preferred to 25%

earmarking in both countries (p_B = 0.04, p_F < 0.001). Also, full earmarking is preferred to no earmarking in France (p < 0.001), and tends to be preferred to no earmarking in the UK (p = 0.07). In both countries, however, there was no significant difference in support between the full earmarking and 75% earmarking tax schemes (p_B = 0.57 and p_F = 0.99).

Between-country differences in the level of support across conditions can also be noted. In France, the average level of support is statistically different between each of the partially matched earmarking schemes and the non-earmarked carbon tax (p = 0.03, p < 0.001, and p < 0.001 for 25%, 50%, and 75% earmarking respectively), whereas it is not the case in the UK (p = 0.88, p = 0.83, and p = 0.43 respectively). This result is likely due to the difference in support for a non-earmarked carbon tax between the two countries (see Fig. 6), already evidenced in Study 1.

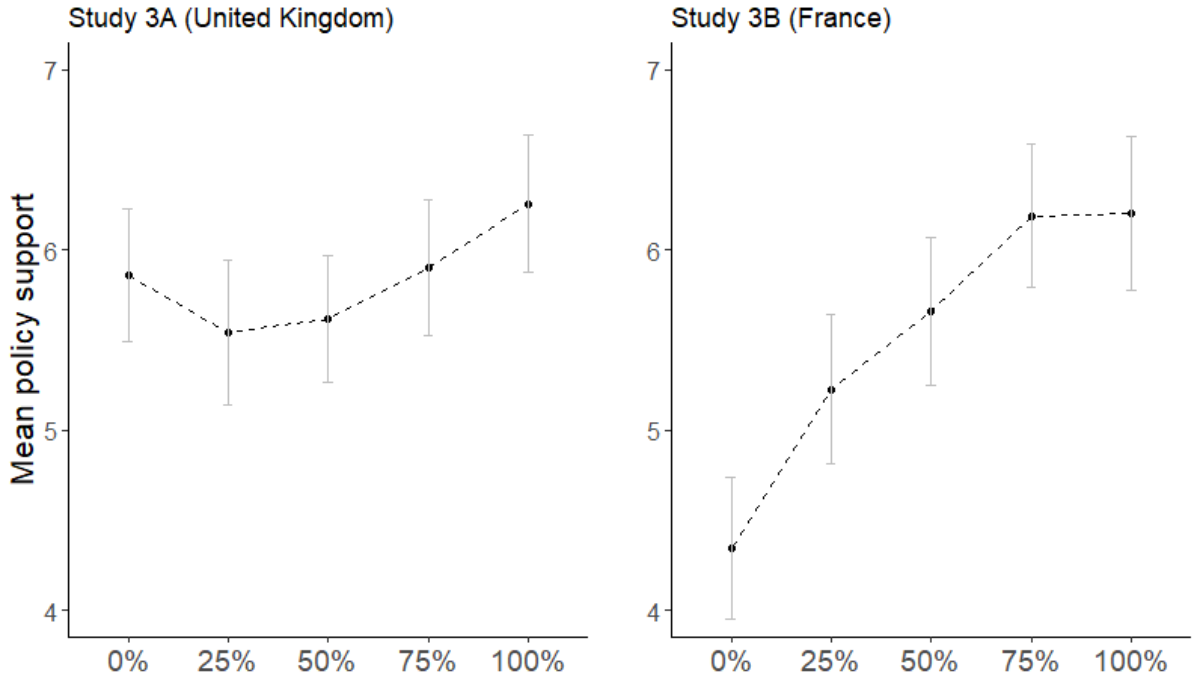


Fig 6. Mean policy support in the British study (N_{3A} = 801) and in the French study (N_{3B} = 758) when either 0%, 25%, 50%, 75% or 100% of carbon tax revenues are earmarked for environmental protection. Policy support was rated on a ten-point Likert scale. Plotted are 95% CIs. Average levels of support when either 0% or 100% of carbon tax revenues are earmarked for environmental protection are consistent with those observed in Study 1.

5. Study 4

Mental accounting helps understand why citizens are more likely to support a carbon tax when its revenues are mostly or completely directed to green projects. However, without mechanisms by which tax revenues are redistributed ("revenue-recycling"), the carbon tax is often regressive and risks increasing fuel poverty, and is thus likely to exacerbate social inequalities (Berry, 2019). Several studies estimated that the regressive effects of the carbon tax can be attenuated if part of the carbon tax revenue is redistributed to the first three income deciles (Berry, 2019; Morris & Mathur, 2014).

Given that citizens in France and in the UK display not significantly lower levels of support for carbon taxation when only 75% of its revenues is earmarked for green projects compared to a full earmarking scheme (Studies 3A and 3B), a straightforward solution to tackle the anti-redistributive effects of the carbon tax could be to incorporate redistribution in the taxation scheme using the 25% of tax revenues that are left un-earmarked. Such a tax design might render the carbon tax both acceptable and fair by combining environmental earmarking (of most of the revenues) and redistribution (of the remaining revenues).

The mental accounting heuristic, however, should also apply to the redistributed part of the revenue. Standard revenue-recycling schemes in which poorer households receive compensation (e.g., a reduction in other taxes, an increase in social transfers, or cash transfers) could be perceived as mismatched earmarking, since an environmental tax is used to achieve a social outcome. In line with this suggestion, several studies report that while citizens appear concerned over the distributional consequences of the carbon tax (Jagers et al., 2021; Maestre-Andrés et al., 2019; Morris & Mathur, 2014; Povitkina et al., 2021), the effect of compensation policies on public support is modest in size and limited to some subgroups of the population (Jagers et al., 2019, 2021; Mildenberger et al., 2022; Muhammad et al., 2021). Moreover, when given the choice, people tend to prefer using carbon tax revenues for environmental purposes instead of compensating inequitable outcomes (Amdur et al., 2014; Kotchen et al., 2017; Maestre-Andrés et al., 2019; Sælen & Kallbekken, 2011).

To avoid this mismatch effect, we tested the acceptability of a matched revenue-recycling scheme in which poorer households receive a cash transfer that can only be used on sustainable goods and services (“matched redistribution”). In this scheme, 75% of revenues is earmarked for environmental protection, and the remaining 25% of revenues is redistributed to the first three income deciles as a conditional cash transfer that can only be spent on sustainable goods and services (e.g., home insulation, heating system change, green transportation). We predict that this policy scheme is more acceptable to citizens than a similar scheme in which redistribution takes the form of an unconditional cash transfer to the same target population (as it would constitute a mismatch from the point of view of mental accounting). It can be noted that other forms of matched revenue-recycling schemes

could be implemented, such as an environmental cash transfer given to each citizen. In this study, we chose a targeted transfer as it is more progressive, and similar to existing schemes (e.g., energy checks in France).

Materials and methods

To test this hypothesis, we conducted two additional experiments in the United Kingdom and in France (N_{total} = 1400). In Studies 4A and 4B, participants were asked to rank three imaginary schemes of an increase in the carbon tax, varying in their allocation of revenues: a) 100% of tax revenues are earmarked for environmental protection ("no cash transfer"), b) 75% of tax revenues are earmarked for environmental protection and 25% are redistributed to the first three income deciles as a cash transfer ("unconditional cash transfer"), c) 75% of tax revenues are earmarked for environmental protection and 25% are redistributed to the first three income deciles as a cash transfer that can only be spent on sustainable goods and services ("environmental cash transfer"). A rank of 1 corresponds to the preferred policy scheme whereas a rank of 3 corresponds to the least preferred scheme. The presentation order of schemes was randomized. The rest of the experiment (attitudes and sociodemographic questions) was identical to previous studies, the only addition being an environmental concern scale (see full survey with precise wording at https://osf.io/5nyve/). To test whether there was a significant difference in ranking scores between conditions, a Friedman test was used (non-parametric). To determine which conditions statistically differ, post-hoc tests using Nemenyi's procedure were used.

For this experiment, we recruited 700 British participants from Prolific Academic based on a power analysis using effect sizes obtained in a pilot study (reported in Note F in Supplementary information), and 700 French participants from CrowdPanel. The survey took place on February 24th 2022 for the British sample and from March 1st to March 8th 2022 for the French sample. As for previous studies, representative samples of the adult population in terms of age and gender, as well as ethnicity in the British study, were used. Only participants who succeeded the attention check were included in the analyses. After exclusion of inattentive respondents, the final sample size was 653 for the French study (335 women, mean age = 41.3) and 662 for the British study (340 women, mean age = 45.4).

Results

Among both British and French participants, ranking scores of the three schemes varied significantly, $\chi_B^2(2) = 36.30$, $p_B < 0.0001$, $w_B = 0.03$; $\chi_F^2(2) = 45.76$, $p_F < 0.0001$, $w_F = 0.04$ (see Fig 7). In line with our hypothesis, post-hoc comparisons revealed that on average participants ranked higher (i.e. closer to 1) the tax scheme in which the redistributive component was matched ("environmental cash transfer", $M_B = 1.81$, $SD_B = 0.68$; $M_F = 1.80$, $SD_F = 0.68$) compared to the tax scheme in which it was mismatched ("unconditional cash transfer", $M_B = 2.13$, $SD_B = 0.84$; $M_F = 2.17$, $SD_F = 0.82$), $p_B < 0.0001$; $p_F < 0.0001$, and compared to the tax scheme without any redistribution ("no cash transfer", $M_B = 2.06$, $SD_B = 0.88$; $M_F = 2.03$, $SD_F = 0.89$), $p_B < 0.0001$; $p_F < 0.0001$ (see Fig D in Supplementary information for unaveraged results). Comparing average ranks between the mismatched-redistribution and the no-redistribution tax schemes, results vary between countries. In the UK sample, there is no significant difference in support between the two schemes ($p = 0.45$), whereas

French participants show a preference for the no-redistribution scheme over the mismatched-redistribution one (p = 0.03). These results suggest that thematic matching should be taken into account when designing revenue-recycling schemes along with a carbon tax.

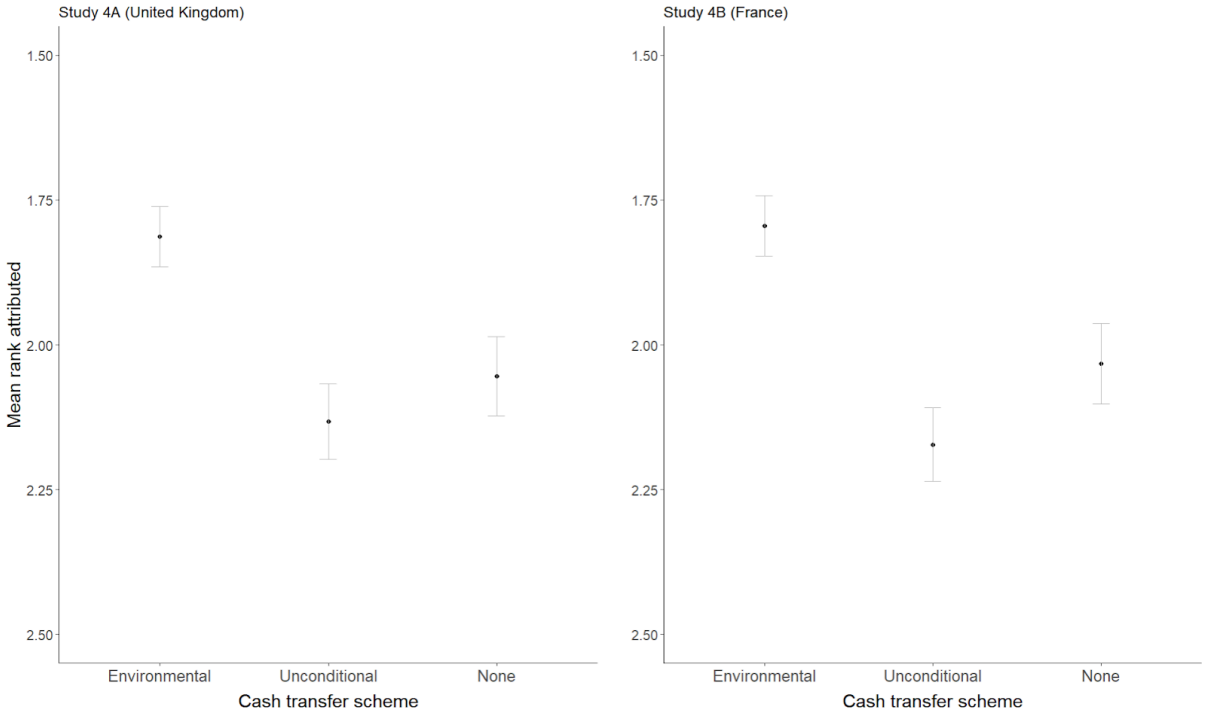


Fig 7. Average ranking scores (ranging between 1 and 3 where 1 is the most preferred scheme and 3 the least preferred scheme) when (a) 75% of carbon tax revenues are earmarked for environmental protection and 25% redistributed as a cash transfer to the three lowest income deciles, that can only be spent on pro-environmental expenses (“environmental cash transfer”), (b) 75% of carbon tax revenues are earmarked for environmental protection and 25% redistributed as an unconditional cash transfer to the three population deciles with lowest income (“unconditional cash transfer”), or (c) 100% of carbon tax revenues are earmarked for environmental protection (“no cash transfer”). Results are plotted for each study (N_{4A} = 649, N_{4B} = 643).

Subgroup analyses revealed that, in the British sample, the environmental cash transfer scheme was ranked higher on average than the alternatives by all

subgroups when splitting the sample according to age, gender, highest education level, political ideology, residence area, perceived income level, environmental concern, social and political trust. In the French sample, the only exception to this pattern was respondents displaying a low level of environmental concern, who ranked the unconditional cash transfer scheme as highly as the environmental cash transfer scheme. Full results and figures are reported in Note G in Supplementary information. Interestingly, participants who believed their income to be lower than average, and who would thus be the likely beneficiaries of the cash transfer, also ranked the environmental cash transfer higher than the unconditional cash transfer scheme. From a purely economic point of view, this preference can be surprising as there is a loss of freedom in the environmental cash transfer scheme, which is conditional, compared to the unconditional cash transfer scheme. From a psychological perspective, however, mental accounting theory can account for this result.

6. Conclusion and discussion

The success of public policies depends on their acceptability. In this article, we probed the mechanisms underlying the support (or lack thereof) for one of the most important climate related policies: the carbon tax. Past studies have shown that the acceptability of the carbon tax varies as a function of whether its revenues are earmarked, and of the domain to which they are earmarked, with a clear preference for environmental earmarking. We suggest that this preference is due to the application of a mental accounting heuristic, a cognitive mechanism that relies on the thematic matching between the origin of revenue and its spending. Mental accounting has been shown to be a robust cognitive mechanism across domains, time, and culture (Priolo et al.,

2023). The results obtained with well-powered pre-registered experiments conducted in the United Kingdom and France are consistent with the mental accounting hypothesis. Relative to tax designs where earmarking is not thematically matched, participants displayed a strong and specific preference for matched earmarking schemes (here a carbon tax earmarked for environmental protection, Studies 1A and 1B).

Subgroup analyses revealed that the preference for matched earmarking is not conditional on participants' age, gender, education level, residence area, political ideology, perceived income level, trust towards others and the government, the priority given to environmental protection, and the perception of the tax effectiveness. Even in subgroups that are initially more opposed to carbon taxation (e.g., citizens who prioritize environmental protection to a lesser extent, or who display low levels of trust; Harring & Jagers, 2013), using matched earmarking greatly increases support for a carbon tax. Our results thus point to a generalized cognitive mechanism shaping policy support, in line with the mental accounting heuristic. Importantly, this finding is compatible with variations in earmarking preferences, for instance between different socio-demographic groups (Tatham & Peters, 2023). The mental accounting heuristic does not imply that citizens always prefer green earmarking of carbon tax revenue to any other earmarking scheme. In our own results, British participants preferred to earmark carbon tax revenues toward their preferred policy domain rather than toward green spending (Study 1A). What the mental accounting heuristic predicts is the existence of an interaction between the revenue source and the expenditure domain. In the case of the carbon tax, this means that the high acceptability of carbon taxes with green earmarking cannot be explained only by adding up the acceptability of the carbon tax in general and the acceptability of green spending in general. There is an

acceptability boost induced by the fact that the tax and the earmarking domain are thematically matched.

As mental accounting is a general cognitive mechanism, the specific preference for matched earmarking should hold for other taxes than the carbon tax. Replication studies conducted with the inheritance tax and the tobacco tax suggested that the mental accounting heuristic also applies to these taxes. Relative to tax designs in which earmarking is not thematically matched, participants tended to display a specific preference for an inheritance tax earmarked towards poverty reduction programs (Study 2A) and a tobacco tax earmarked towards health and tobacco control expenses (Study 2A'). Across all British studies, the effect of mental accounting was estimated to d = 0.25 with a random-effects meta-analysis.

Focusing on the carbon tax, a tax scheme in which all of the generated revenues are earmarked for environmental protection might thus seem ideal in terms of acceptability. However, to dampen the regressive effects of the carbon tax alone (Berry, 2019), policy makers may wish to use some of the revenues for redistribution. In Studies 3A and 3B, we therefore investigated public support when only a fraction of carbon tax revenues is earmarked towards environmental protection. Results showed that acceptability varied with the proportion of funds earmarked towards environmental protection, but that support for a scheme in which only 75% of the revenues for the carbon tax are earmarked to this end is not significantly lower than for a fully earmarked scheme.

Consequently, in Studies 4A and 4B, we tested the acceptability of carbon tax policies in which a small fraction (25%) of revenues was used for redistributive purposes (as a cash transfer for low-income households), while the majority of

revenues (75%) was kept for environmental protection. We hypothesized that if the redistribution scheme is matched with the revenue source (i.e., a cash transfer that can only be spent on pro-environmental expenses in the case of the carbon tax), it should garner more support than a mismatched scheme. Results indicate that a carbon tax with a matched redistribution scheme is not only rated more favorably than a mismatched scheme, but also than a carbon tax entirely earmarked for environmental protection, with no redistribution scheme. It therefore appears as an ideal carbon tax scheme, addressing both acceptability and fairness concerns.

Given the context of the Yellow Vest movement in France (starting in 2018) and the sustained freezing of the carbon tax rate in the UK since 2015, our results have practical relevance. They suggest that more public support may have been garnered in these two countries if carbon taxes had been designed by taking into account citizens' preferences, with a significant proportion of environmental earmarking and a thematic redistributive component. However, field experiments should be conducted to assess whether citizens would show the same preferences as those exhibited in our experiments (which involved hypothetical scenarios), if governments were to implement different carbon tax designs. Also, theoretical accounts besides mental accounting could help explain citizens' specific preference for environmental earmarking of carbon taxes. In particular, citizens may perceive the carbon tax and the funding of green projects as having synergistic effects, for instance in places where developing public transports and electric vehicles is necessary to reduce thermal car use. Nevertheless, we note that this hypothesis could not account for other documented cases of preferences for specific earmarking outside consumption taxes (e.g. the preference for social spending earmarking of the inheritance tax evidenced in Study 2A). In conclusion, the present studies offer policy makers powerful tools to

create more acceptable tax schemes, including more redistributive ones, across multiple domains.

Pre-registrations. Experiments were pre-registered at https://osf.io/5nyve/ (Study 1, 3, 4) and at https://osf.io/hgmak/ (Study 2).

Ethical approval. All studies received approval by the CER-Paris Descartes (N° 2019-03- MERCIER).

Data and code availability. Data and analysis code to reproduce the presented analyses are available at https://osf.io/5nyve/ (Study 1, 3, 4) and https://osf.io/hgmak/ (Study 2).

Financial disclosure. This work was supported by the French National Research Agency (ANR-17-EURE-0017 to Frontiers in Cognition, ANR-10-IDEX-0001-02 to Paris Sciences & Lettres, and the ANR-21-CE28-0016-01 to HM). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests. The authors have declared that no competing interests exist.

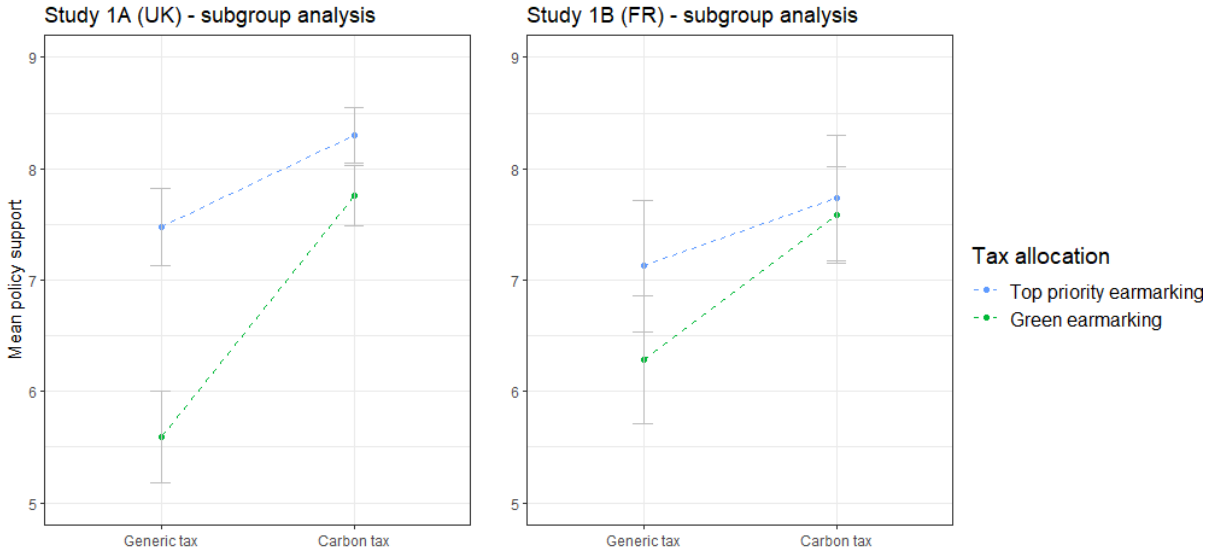
7. Supplementary information

Contents:

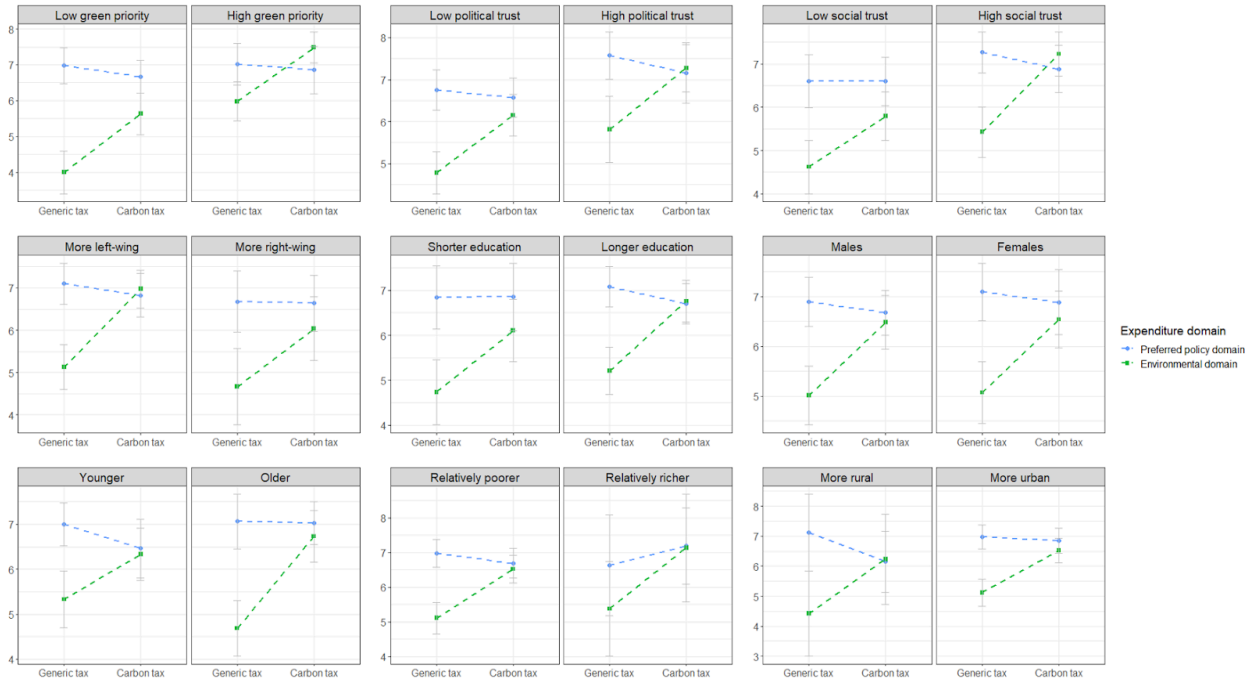
Supplementary Figures A to D

Supplementary Tables A to C

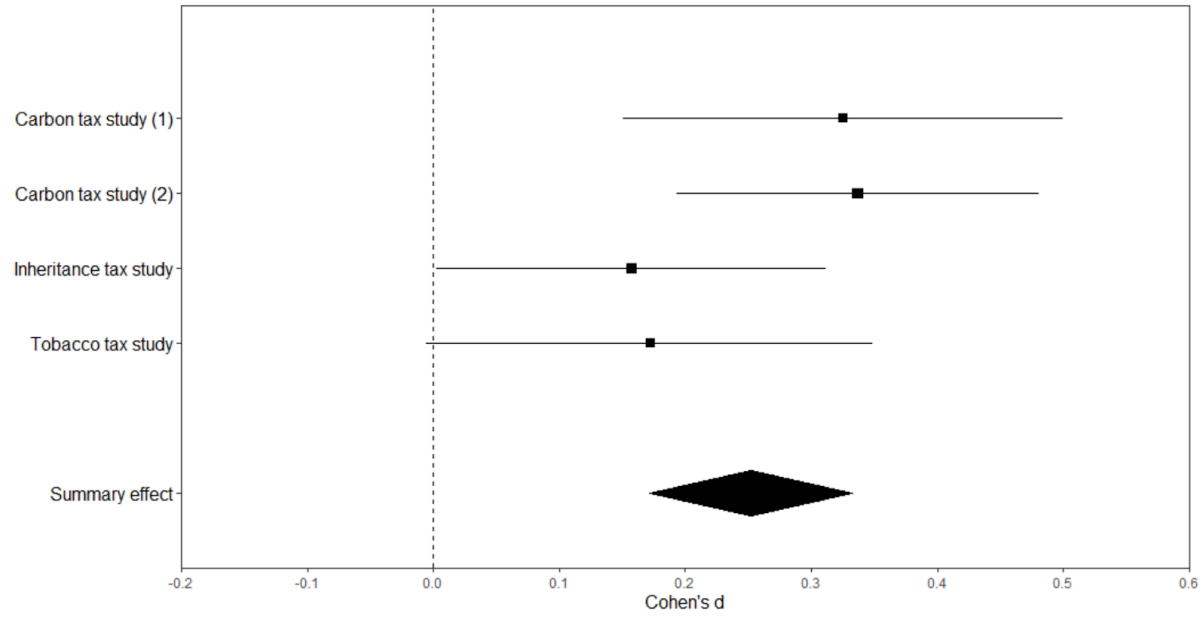
Supplementary Notes A to G



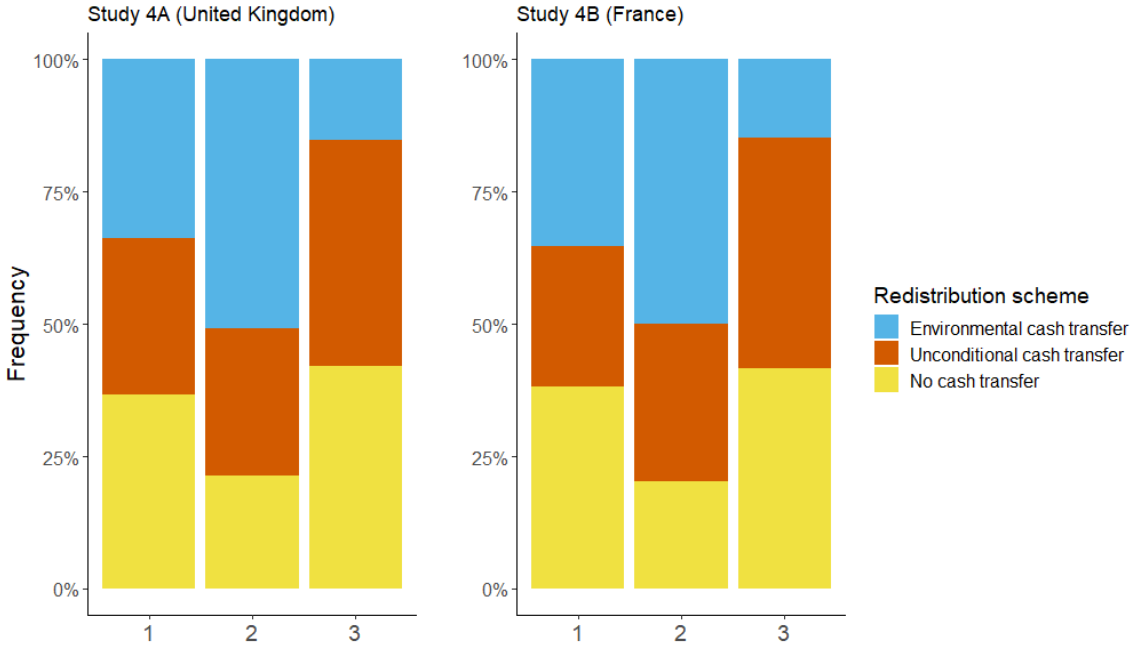
Supplementary Figure A. Mean policy support for the four earmarked tax schemes (revenue source: generic tax or carbon tax; expenditure domain: preferred policy domain or environmental domain) in the subsample of participants who answered above 5/10 to the question "How effective do you think the carbon tax is to change behavior?" (1-10 Likert scale), both in the UK (N = 622) and in France (N = 261). Plotted are 95% CIs.



Supplementary Figure B. Mean policy support in Study 1B (France, N = 687) when tax revenues are either earmarked towards environmental protection or towards participants' preferred policy domain, when splitting the sample according to the priority given to environmental protection, political trust, social trust, political ideology, highest education level, gender, age, perceived relative income level and residence area (see Supplementary Note 2 for the detailed procedure). Plotted are 95% CIs.



Supplementary Figure C. Forest plot showing results from the random-effects meta-analysis model conducted on all of the British studies (carbon tax: Studies 1A, inheritance tax: Study 2A, tobacco tax: Study 2A'). Effect sizes from each individual study are reported and expressed in Cohen's d, along the summary effect. Plotted are 95% CI.



Supplementary Figure D. Frequency in ranking scores (1 = most preferred scheme, 3 = least

preferred scheme) when (a) 75% of carbon tax revenues are earmarked for environmental protection and 25% redistributed as a cash transfer to the three lowest income deciles, that can only be spent on pro-environmental expenses ("environmental cash transfer"), (b) 75% of carbon tax revenues are earmarked for environmental protection and 25% redistributed as an unconditional cash transfer to the three population deciles with lowest income ("unconditional cash transfer"), or (c) 100% of carbon tax revenues are earmarked for environmental protection ("no cash transfer"). Results are plotted for each study (N4A = 649, N4B = 643).

	Sample (UK)	Population (UK)	Sample (FR)	Population (FR)
Gender: Female	51.1%	51.0%	52%	52.2%
Gender: Male	48.6%	49.0%	47.6%	47.8%
Gender: Other	0.2%		0.4%	
Age: 18-34	27.5%	27.6%	35.6%	24.8%
Age: 35-49	27.1%	24.4%	34.3%	24.2%
Age: 50-59	17%	17.3%	16.8%	16.6%
Age: 60+	28.4%	30.8%	8.7%	34.4%
Age: No response	0%		4.6%	
Education: some high school or less	1.9%		3%	
Education: completed high school	15.7%		6.9%	
Education: some college	12.3%		24.5%	
Education: completed college	38.5%		37.7%	
Education: post-graduate	28.8%		16.5%	
Education: trade/technical school	2.8%		11.3%	
Education: No response	0%		0%	
Ideology: Left (1-5)	68.1%		59.6%	
Ideology: Right (6-10)	26.9%		31.3%	
Ideology: No response	5%		9.1%	
Perceived income level: Low (1-5)	53%		56.2%	
Perceived income level: High (6-10)	44.7%		38.2%	
Perceived income level: No response	2.4%		5.6%	
Living area: Open countryside	4.8%		11.1%	
Living area: Village/small town	33%		33.7%	
Living area: Medium to large town	30.5%		24.3%	
Living area: City or city suburb	31.7%		30.8%	
Living area: No response	0%		0.1%	

Supplementary Table A. Distribution of sociodemographic characteristics in Studies 1A (UK, N = 2096) and 1B (France, N = 1271), as well as population means where available. Political ideology and perceived income level were measured on ten-point Likert scales. Data points from the two British samples are combined. For studies conducted in France, representative quotas along age and gender were computed based on census data from the National Institute of Statistics and Economic Studies (INSEE, 2021). Due to recruitment difficulties, however, French participants above 60 years old are under-represented in our sample. For studies conducted in Britain, representative quotas along age, gender and ethnicity were computed based on census data from the Office of National Statistics (2021).

Top priority domain (frequency in %)	United Kingdom	France
Environmental protection	11.2%	17.8%
Education	12.4%	20.2%
Defense	2.2%	2.5%
Health	57.0%	31.6%
Social protection	3.3%	5.4%
Housing	7.1%	4.7%
Public order and safety	6.5%	16.7%
Culture	0.4%	1.0%

Supplementary Table B. Frequency table of preferred policy domains (i.e. ranked as top priority) in which participants believe public spending should be increased, in Studies 1A (UK, N = 2096) and 1B (France, N = 1271). Participants were presented with eight different public policy domains and were asked: "*According to you, in which domains should public spending be increased? Please rank from 1 (top priority) to 8 (lowest priority) by dragging up or down the various domains.".* Data points from the two British samples are combined.

	United Kingdom	France
Political trust		
mean (sd)	3.82 ± 2.46	3.82 ± 2.35
median	4	4
variance	6.05	5.52
Interpersonal trust		
mean (sd)	5.66 ± 2.04	5.13 ± 2.00
median	6	6
variance	4.14	3.99
Perceived efficiency of carbon taxation		
mean (sd)	5.10 ± 2.37	4.47 ± 2.62
median	6	4
variance	5.63	6.84

Supplementary Table C. Descriptive statistics of participants' level of political trust, interpersonal trust, and perceived effectiveness of carbon taxation in Studies 1A (UK, N = 2096) and 1B (France, N = 1271). Attitudes were measured on a ten-point Likert scale. Data points from the two British samples are combined.

Supplementary Note A - Pilot study of Study 1A

Participants

We conducted an unregistered pilot study in which we recruited 500 British participants on the online platform Prolific Academic. Participants who failed the attention check were excluded from the analyses (final N = 474; 350 females; mean age = 33.9). Responses from the pilot study were recorded from 20 to 27 November 2020.

Design

Participants were randomly assigned to the carbon tax increase or the generic tax increase condition. In both conditions, participants saw the three scenarios varying in the expenditure domain (environmental earmarking, preferred policy earmarking, no earmarking). The order of presented scenarios was randomized between participants.

Results

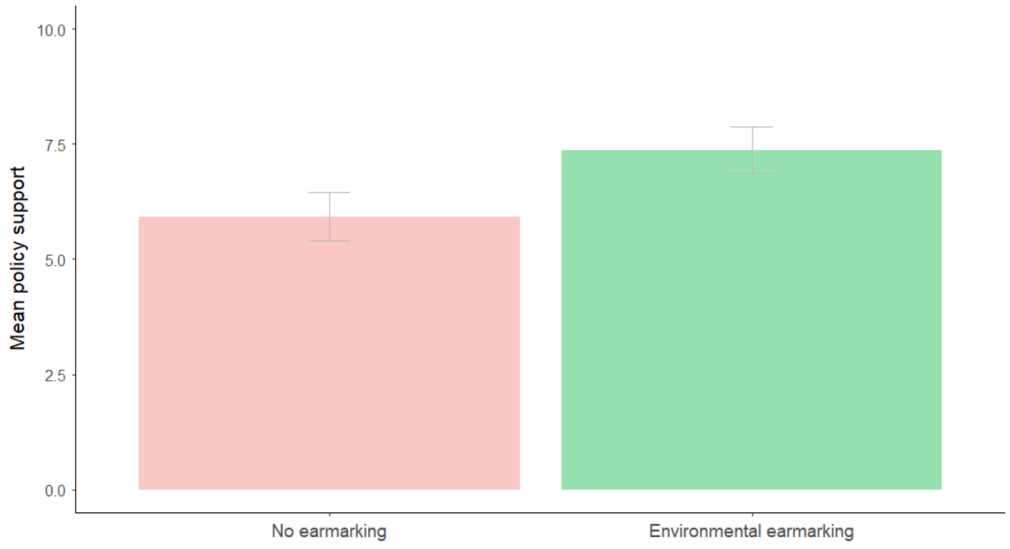
As order effects significantly influenced policy support in three of the scenarios (the "carbon tax - environmental earmarking" scenario ($F(2,235) = 8.76$, $p < 0.001$), the "generic tax - environmental earmarking" scenario ($F(2,233) = 4.42$, $p = 0.01$) and the "generic tax - no earmarking" scenario ($F(2,233) = 3.46$, $p = 0.03$)), we only performed analyses on participants' answer to the first scenario they were presented with. We found that:

(a) Average policy support is higher when carbon tax revenues are earmarked for environmental protection ($M = 7.36$, $SD = 2.26$) than when carbon tax

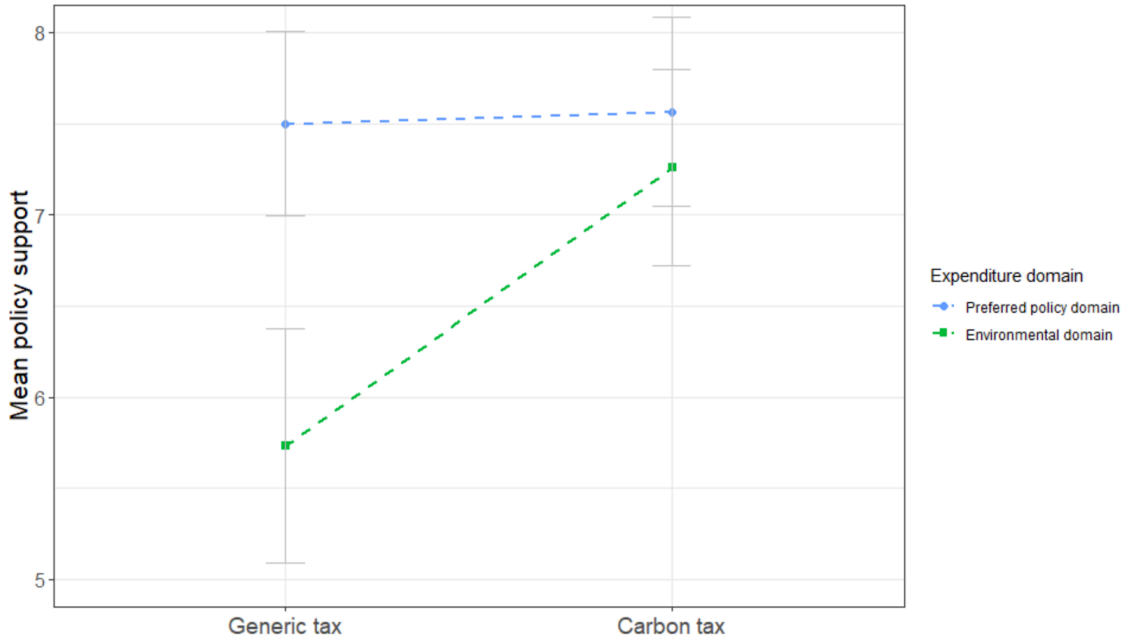
revenues are not earmarked (M = 5.92, SD = 2.48), t(167) = 3.93, p < 0.001, d = 0.61, 95% CI [0.72, 2.17], see Supplementary Figure E.

(b) There is an interaction effect between the source domain and the allocation domain of the tax (F(1,262) = 6.71, p = 0.01, np^2 = 0.02), such that differential support for policies allocating revenues to environmental protection compared to participants' preferred policy domain is smaller in the carbon tax condition (MD = 0.31, SD = 0.04) than in the generic tax condition (MD = 1.77, SD = 0.05), see Supplementary Figure F.

(c) This effect remains significant on the subsample of participants believing the carbon tax to be efficient in changing behaviors (F(1,114) = 6.19, p = 0.01, np^2 = 0.05).



Supplementary Figure E. Mean policy support in the carbon tax condition when revenues are either earmarked for environmental protection or are not earmarked (N = 169). Only participants' answer to the first tax scheme presented was used in the analysis, to rule out order effects.



Supplementary Figure F. Mean policy support when tax revenues are either earmarked for environmental protection or for the preferred policy domain participants indicated (N = 266). Only participants' answer to the first tax scheme presented was used in the analysis, to rule out order effects.

Supplementary Note B - Attention check used in all studies

In all studies reported in the paper, participants who failed our attention check were excluded from the analyses. We used the "color test" as an attention check in all studies. In this test, participants have to read the following text and answer a question:

"The color test is simple, when asked your favorite color you must enter the word bole (iris in French) in the textbox below. Having read the instructions, what is your favorite color? [textbox]"

British participants who do not enter “bole” (or a close variant or typo) and French participants who do not enter “iris” are excluded from the analyses.

Supplementary Note C - Main effects of revenue source and expenditure domain on policy support (Studies 1A and 1B)

In Studies 1A and 1B, a two-way ANOVA model with interaction was used to analyze the effects of the revenue source, and expenditure domain on policy support, only focusing on earmarked tax schemes. Here we report main effects from the revenue source and the expenditure domain separately on policy support. To this end, independent-samples t-test were used as there are only two groups for each variable (as the analysis focuses on earmarked tax schemes). Regarding the revenue source, results show that participants prefer policy scenarios that feature an increase in the carbon tax rather than a general increase in taxes of equivalent amount, both in the UK (meta-analysis on two samples, SMD = 0.37, SE = 0.06, 95% CI [0.36; 0.49], $z = 6.65$, $p < 0.0001$, $I^2 = 85{,}2\%$) and in France, $t(675.53) = 3.01$, $p = 0.002$, $d = 0.23$, 95% CI [0.22, 1.03]. Regarding the earmarking domain, participants prefer tax schemes where revenues are earmarked towards their preferred policy domain rather than for environmental protection, both in the UK (meta-analysis on two samples, SMD = 0.65, SE = 0.06, 95% CI [0.54; 0.76], $z = 11.53$, $p < 0.001$, $I^2 = 0\%$) and in France, $t(682.11) = 7.27$, $p < 0.001$, $d = 0.40$, 95% CI [0.67,1.47].

Supplementary Note D - Subgroup analyses (Studies 1A and 1B)

a) Study 1A (UK)

Political ideology

A significant three-way interaction effect was found between the revenue source, the expenditure, and political ideology ($p = 0.02$) such that the interaction effect between the revenue source and the expenditure domain was weaker for individuals who are more left-wing. However, when restraining the sample to individuals who answered between 1 and 5 to the question “In political matters, people talk of "the left" and "the right." How would you place your views on this scale, generally speaking?” measured on a 0-10 Likert scale (where 1 = Left and 10 = Right), the interaction effect between the revenue source and the earmarking domain remains significant (SMD = 0.28, SE = 0.02, 95% CI [0.24, 0.31], $z = 14.78$, $p < 0.0001$, $I^2 = 0\%$, $n = 2$).

Environmental priority

A significant three-way interaction effect was found between the revenue source, the expenditure domain, and the priority given to environmental protection ($p = 0.004$) such that the interaction effect between the revenue source and the expenditure domain was weaker for individuals who prioritize the environment to a greater extent. However, when restraining the sample to individuals who answered that the environment was either their second, third or fourth priority domain (out of 8 possibilities) in which they wish public spending was increased, the interaction effect between the revenue source and the earmarking domain remains significant (SMD = 0.24, SE = 0.06, 95% CI [0.13, 0.36], $z = 4.22$, $p < 0.0001$, $I^2 = 0\%$, $n = 2$). Participants who had ranked the environment as their first priority could not be

included in the analysis due to design constraints: in order to create distinct conditions between environmental earmarking scenarios and preferred policy earmarking scenarios, participants who ranked the environment as their first priority were excluded.

Other variables

No three-way interactions were found between the revenue source, the expenditure domain, and each of the following variables: age ($p = 0.08$), gender ($p = 0.61$), highest education level ($p = 0.38$), residence area ($p = 0.60$), political trust ($p = 0.64$), social trust ($p = 0.98$) and perceived income level ($p = 0.59$).

b) Study 1B (FR)

No three-way interactions were found between the revenue source, the expenditure domain, and each of the following variables: gender ($p = 0.99$), age ($p = 0.57$), education ($p = 0.64$), political ideology ($p = 0.28$), the priority given to the environment ($p = 0.21$), perceived income level ($p = 0.95$), residence area ($p = 0.51$), political trust ($p = 0.80$) or social trust ($p = 0.47$).

Graphical representation method (for Fig. 4 and Supplementary Fig 2)

To graphically represent that the mental accounting heuristic affects every relevant subgroup (including individuals who are left-wing, and those who prioritize environmental protection to a greater extent in the UK, as detailed above), we split the samples in two according to each variable studied: priority given to environmental protection, political trust, social trust, political ideology, highest education level,

gender, age, perceived relative income level and residence area. For each variable measured with a ten-point Likert scale (political trust, social trust, political ideology, perceived relative income level), we create a binary variable equal to 0 for participants who answered between 1 and 5 to the corresponding question, and 1 for those who answered between 6 and 10. For gender, we split the samples between men and women. For the highest education level, we create a binary variable equal to 0 if the highest education level is the high school diploma, 1 if above. For the residence area, we create a binary variable equal to 0 if people live either in the “open countryside” or a “village/small town”, and 1 if they live in a “medium to large town” or “city or a city suburb”. For age, the samples are split relative to the median age of the sample.

Supplementary Note E - Detailed procedure for Studies 2A and 2A’

a) Study 2A (inheritance tax - UK)

Design

Similarly to the carbon tax studies, six experimental conditions feature an earmarked tax, varying in the tax source and the tax allocation. The presented tax is either a generic tax (similarly to previous studies) or an inheritance tax (instead of a carbon tax used in previous studies). Generated revenues are either allocated to participants’ preferred policy domain (similarly to previous studies), earmarked for poverty reduction (which thematically matches the source of the inheritance tax, just as green earmarking thematically matched the source of the carbon tax) or not earmarked. The present design is thus a between-participants 2 (type of tax) x 3 (type of allocation) design.

Procedure

Participants are first asked to order from 1 to 8 public policy domains in which they think public spending should be increased (1=top priority, 8=lowest priority). The category “social protection” used in the carbon tax studies was replaced by “poverty reduction” in order to thematically match the content of the inheritance tax. Participants are then randomly assigned to one of the six conditions described above. Participants then answer questions on their perceived effectiveness of the inheritance tax in reducing social inequalities, on their perceived likelihood to be affected by the inheritance tax, on their general level of trust towards other people and towards the government. Finally, participants answer socio-demographic questions.

NB : Participants who are randomly allocated to scenarios with an increase in the inheritance tax are presented with the definition of the inheritance tax before being introduced to the policy scenario, to exclude the lack of knowledge as a factor shaping responses (“An inheritance tax is a tax on the estate (the property, money and possessions) of someone who’s died. This tax is only charged on the part of the estate that is above a certain threshold (£325,000 in the UK).” available from: https://www.gov.uk/inheritance-tax). Participants who are randomly allocated to scenarios with a general increase in taxes are presented with the definition of the inheritance tax when asked if they believe this tax to be efficient in reducing social inequalities and their perceived likelihood to be affected by the tax.

Stimuli

Each tax policy scenario follows the same structure and varies only in the tax source (inheritance or generic tax increase) and the tax allocation domain (poverty reduction, top priority spending, no earmarking):

"Imagine that the government plans to increase [the inheritance tax / taxes]. This tax increase will generate £1.5 billions in additional revenue. The government has decided that all this extra revenue will be [allocated to poverty reduction / allocated to ${the top priority spending indicated in question 1} / distributed across all public spending domains in the same proportion as all other governmental revenues].

How much would you agree with this policy? (0-10 scale)"

Participants

1300 British participants were recruited through the online platform Prolific Academic. This sample was representative of the UK population in terms of gender, age, ethnicity.

b) Study 2A' (tobacco tax - UK)

Design

In this study, we focused only on the four earmarked conditions to study whether mental accounting shapes the preference for "matched earmarking". Four experimental conditions feature an earmarked tax, varying in the tax source and the tax allocation. The presented tax is either a generic tax (similarly to previous studies) or a tobacco tax (instead of a carbon tax used in previous studies). Generated revenues are either allocated to participants' preferred policy domain (similarly to previous studies) or earmarked for health care and tobacco control (which thematically matches the source of the tobacco tax, just as green earmarking thematically matched the source of the carbon tax). The matched earmarking category "health care and tobacco control" was chosen because it was used in the study by Vardavas et al.

(2012). The present design is thus a between-participants 2 (type of tax) x 2 (type of allocation) design.

Procedure

Participants are first asked to order from 1 to 7 public policy domains in which they think public spending should be increased (1=top priority, 7=lowest priority). The category “health care” used in the carbon tax studies was removed from the list because nearly half of the sample in our former studies ranked health care as their top priority, and excluding so many participants would introduce a bias in our data. Instead, a question on whether more or less government spending should be spent on health care was added. Participants are then randomly assigned to one of the six conditions described above. Participants then answer questions on their perceived effectiveness of the tobacco tax in reducing tobacco, on their smoking behavior and on their general level of trust towards other people and towards the government. Finally, participants answer socio-demographic questions.

NB : Participants who are randomly allocated to scenarios with an increase in the tobacco are presented with the definition of the tobacco tax before being introduced to the policy scenario, to exclude the lack of knowledge as a factor shaping responses (“A tobacco tax is a tax imposed on all tobacco products (cigarettes, pipe tobacco, cigars, hookah/shisha tobacco, snuff, etc.).” available from: https://www.gov.uk/tobacco-tax). Participants who are randomly allocated to scenarios with a general increase in taxes are presented with the definition of the tobacco tax when asked if they believe this tax to be efficient in reducing tobacco use and their perceived likelihood to be affected by the tax.

Stimuli

Each tax policy scenario follows the same structure and varies only in the tax source (tobacco or generic tax increase) and the tax allocation domain (health care and tobacco control, top priority spending)):

"Imagine that the government plans to increase [the tobacco tax / taxes]. This tax increase will generate £1.5 billions in additional revenue. The government has decided that all this extra revenue will be [allocated to health care and tobacco control / allocated to ${the top priority spending indicated in question 1}].

How much would you agree with this policy? (0-10 scale)"

Participants

Based on a power analysis, 500 British participants were recruited through the online platform Prolific Academic. This sample was representative of the UK population in terms of gender, age, ethnicity.

Supplementary Note F - Pilot study of Study 4A

Participants

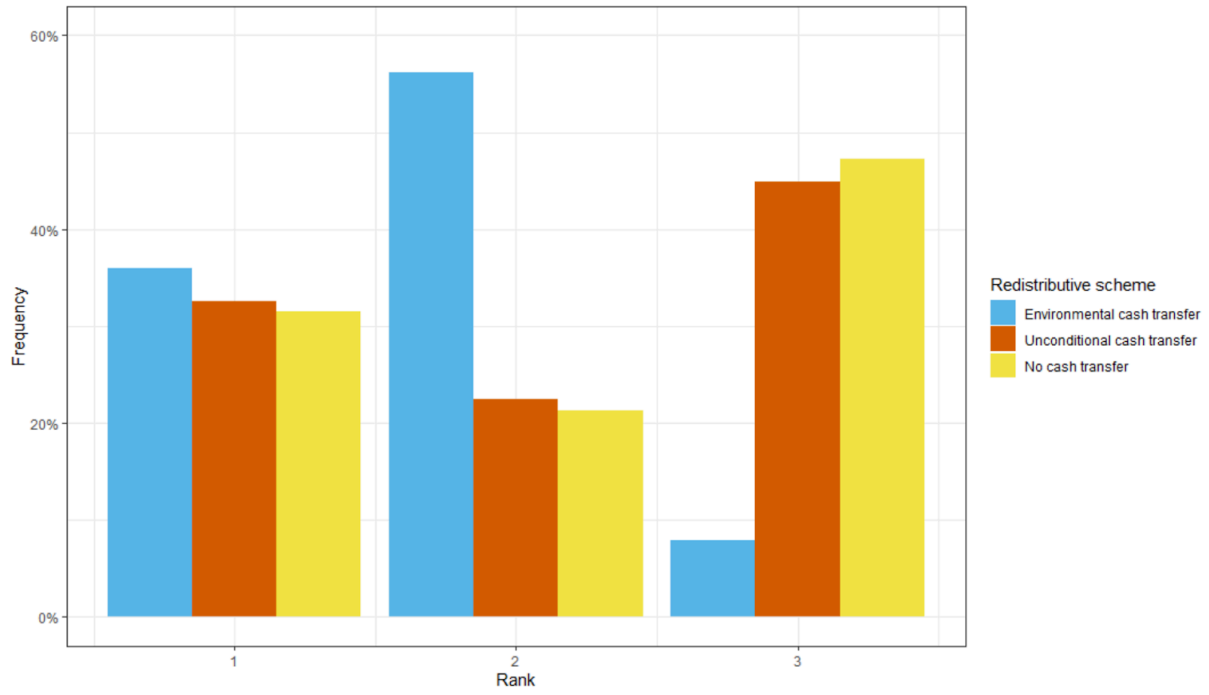
We conducted an unregistered pilot study in which we recruited 100 British participants on the online platform Prolific Academic. Participants who failed the attention check were excluded from the analyses (final N = 89; 46 females; mean age = 36.7). Responses from the pilot study were recorded on February 16th 2022.

Design

Participants were asked to rank three imaginary scenarios of an increase in the carbon tax, varying in their allocation of revenues: a) 100% of tax revenues are earmarked for environmental protection (“no cash transfer”), b) 75% of tax revenues are earmarked for environmental protection and 25% are redistributed to the first three income deciles as a cash transfer (“unconditional cash transfer”), c) 75% of tax revenues are earmarked for environmental protection and 25% are redistributed to the first three income deciles as a cash transfer that can only be spent on sustainable goods and services (“environmental cash transfer”). The presentation order of scenarios was randomized.

Results

Ranking scores significantly varied across the scenarios, $\chi^2(2) = 10.58$, $p = 0.005$, $w = 0.06$. In line with our hypothesis, post-hoc comparisons revealed that participants showed more favorable rankings for a the tax scheme in which the redistributive component is matched (“environmental cash transfer”, $M = 1.72$, $SD = 0.60$) compared to the tax scheme in which it is mismatched (“unconditional cash transfer”, $M = 2.12$, $SD = 0.88$), $p = 0.02$. Moreover, participants also ranked more favorably the tax scheme in which the redistributive component is matched compared to the tax scheme without any redistribution scheme (“no cash transfer”, $M = 2.16$, $SD = 0.88$), $p = 0.01$.



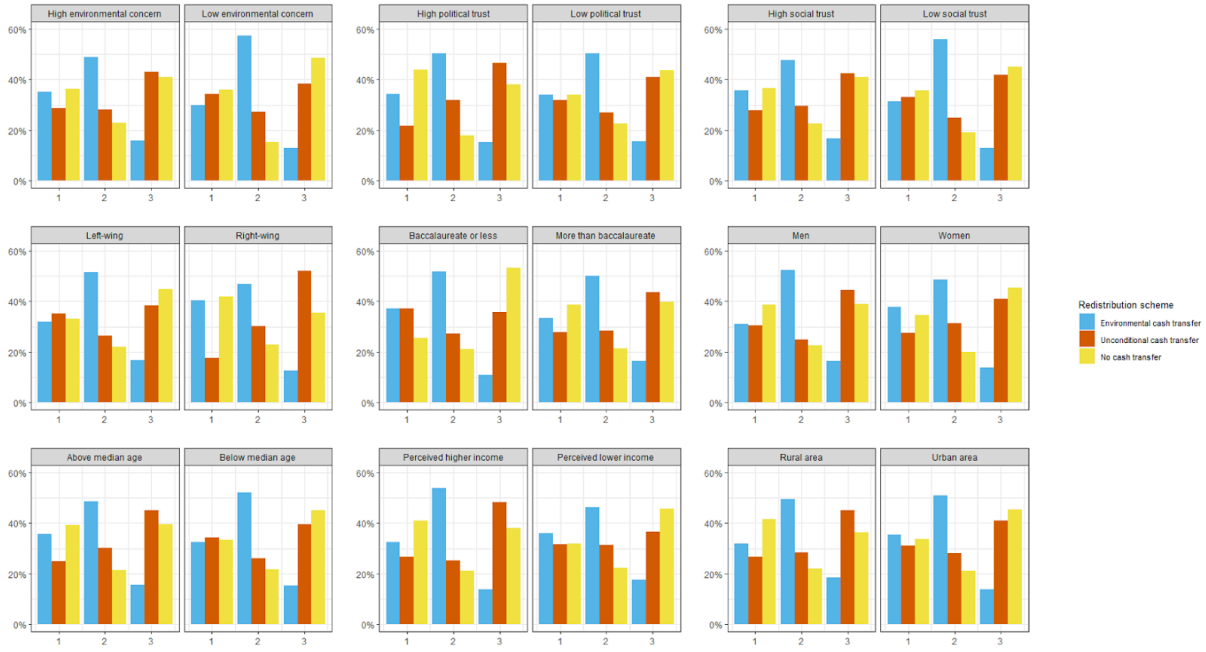
Supplementary Figure G. Frequency in ranking scores across conditions (1 = most preferred scheme, 3 = least preferred scheme) in the pilot study of Study 4A (UK sample, N = 89).

Supplementary Note G - Subgroup analyses (Studies 4A and 4B) and graphical representation

a) Study 4A (UK)

Subgroup analyses revealed that, in the British sample, the "environmental cash transfer" (E) scenario is always preferred (i.e. displays the lowest mean ranking score compared to the "unconditional cash transfer scenario" (U) and the "no cash transfer" (N) scenario) when splitting the sample according to age, gender, education level, political ideology, residence area, perceived income level, social trust, political trust and environmental concern. These variables are measured in the same way as in previous studies, and splits are conducted following the methodology described in

Supplementary Note D. Only the “environmental concern” variable is measured differently than in previous studies (as there is no priority ranking of policy domains in Studies 3A and 3B), with the following question: “In your opinion, should government spending on environmental protection be increased or decreased?” (1-10 scale where 1 = decreased a great deal and 10 = increased a great deal).

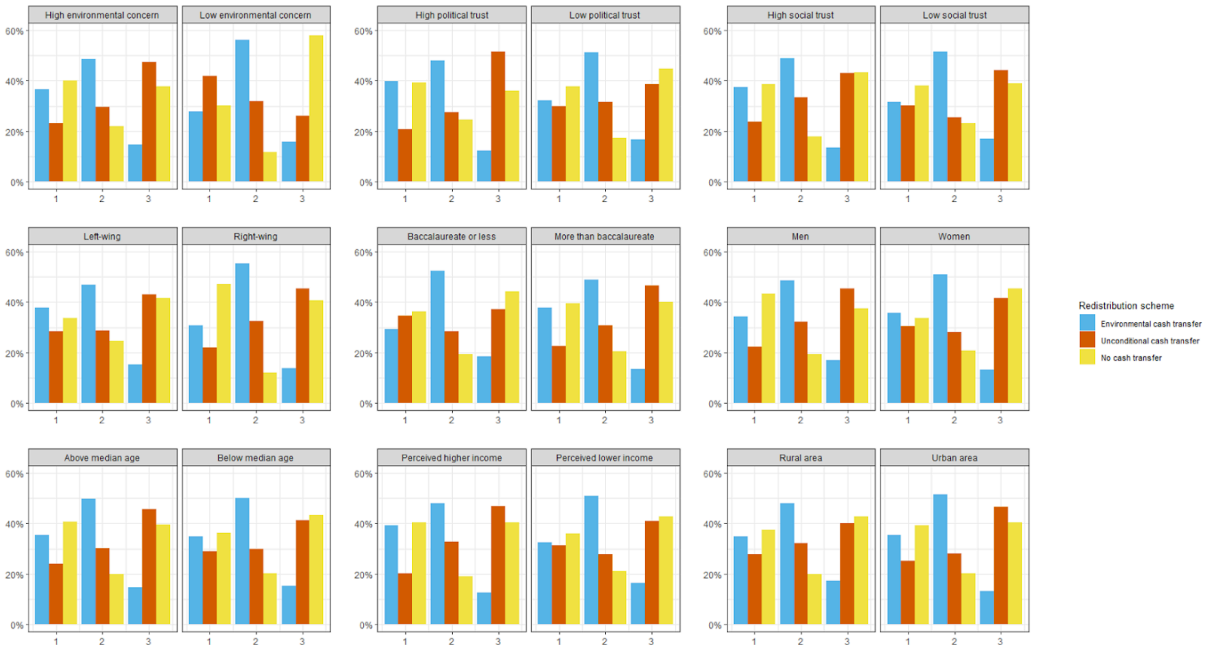


Supplementary Figure H. Frequency in ranking scores (1 = most preferred scheme, 3 = least preferred scheme) in Study 4A (N = 662) across conditions, when splitting the sample according to environmental concern, political trust, social trust, political ideology, highest education level, gender, age, perceived income level, and residence area.

b) Study 4B (FR)

Subgroup analyses revealed that, in the French sample, the “environmental cash transfer” (E) scenario is always preferred (i.e. displays the lowest mean ranking score

compared to the “unconditional cash transfer scenario” (U) and the “no cash transfer” (N) scenario) when splitting the sample according to all the measured variables, except for environmental concern (low level: M_E = 1.88, M_U = 1.84, M_N = 2.28; high level: M_E = 1.78, M_U = 2.24, M_N = 1.98)



Supplementary Figure I. Frequency in ranking scores (1 = most preferred scheme, 3 = least preferred scheme) in Study 4B (N = 653) across conditions, when splitting the sample according to environmental concern, political trust, social trust, political ideology, highest education level, gender, age, perceived income level, and residence area.

Chapter 2 - Energy subsidies versus cash transfers: the causal effect of misperceptions on public support for countermeasures during the energy crisis

Corresponding article: *Mus, M., De Rouilhan, S., Chevallier, C., & Mercier, H. (in revision). Energy subsidies versus cash transfers: the causal effect of misperceptions on public support for countermeasures during the energy crisis.* Preprint available at https://doi.org/10.31234/osf.io/qwa24

Abstract

We test the acceptability of government countermeasures during the energy crisis in two countries, the United Kingdom and France (N_{total} = 4600). We first assess people's support for four energy policy scenarios based on real-world countermeasures, varying in policy instrument (energy subsidy or cash transfer) and policy target (universal or targeted towards vulnerable households). We find that citizens prefer energy subsidies to cash transfers, and especially universal energy subsidies, despite their negative social and environmental impacts. We show that this preference for universal energy subsidies is partly due to widespread misperceptions about the cost, social impact, and environmental impact of this policy. Correcting these misperceptions lowers support for universal energy subsidies in the UK and increases relative support for the three other policies in France. Finally, we show that citizens misperceive the effectiveness of targeted cash transfers, a policy that is socially fairer and more environmentally-friendly than universal subsidies. Correcting this misperception increases support for targeted cash transfers in the UK but not in France.

Keywords: acceptability, energy crisis, misperceptions, public support, energy subsidies, cash transfers

1. Introduction

Since 2021, a global energy crisis has unfolded, characterized by shortages and sharp increases in oil, gas, and electricity prices. The crisis was partly caused by the rapid post-pandemic economic rebound that outpaced the energy supply, and the Russian invasion of Ukraine (International Energy Agency, 2022). In reaction to these events, several governments implemented subsidies to lower energy prices for consumers (Sgaravatti et al., 2021). In France, for example, the government introduced a universal fuel discount in April 2022 to offset the rise in fuel prices. However, there is strong agreement among experts that fossil fuel subsidies have negative impacts on environmental sustainability, social inequality, and economic efficiency (Coady et al., 2017; Ouyang & Lin, 2014; Rentschler & Bazilian, 2017). From an environmental point of view, fossil fuel subsidies interfere with the price-signal and lead to an overconsumption of carbon-intensive energy (e.g., through carbon taxes or cap-and-trade systems) (McFarland & Whitley, 2014; Whitley & Van Der Burg, 2015). From a social point of view, fossil fuel subsidies are regressive because middle- and high- income households consume more carbon-intensive goods, and thus receive most of the benefits from fossil fuel subsidies (Fattouh & El-Katiri, 2013; Feng et al., 2018). Lastly, from an economic perspective, fossil fuel subsidies increase the fiscal burden on governmental budgets, and reduce the competitiveness of low-carbon industries (McFarland & Whitley, 2014; Monasterolo & Raberto, 2019).

To counter energy price shocks, using targeted monetary transfers towards low-income households (e.g., cash transfers or tax rebates) is both fairer and more aligned with pro-environmental objectives. Such transfers only help the most vulnerable households, and do not distort energy prices, hence not interfering with the price-signal associated with carbon emission. Although targeted monetary transfers are more effective from a redistributive and environmental point of view than non-targeted fossil fuel subsidies (i.e. universal subsidies), they might not be favored by the population. As public support is key for policy implementation, examining public preferences with regard to government countermeasures in response to the energy crisis bears important practical relevance. Moreover, trust in government in times of crisis is shaped by the perception of government reactions and implementation of countermeasures (Herati et al., 2023; Rieger & Wang, 2022). Hence, public perceptions of government countermeasures during the energy crisis can have important political consequences.

To the best of our knowledge, no study has examined citizens' preferences towards different policy responses to energy price shocks. In this paper, we hypothesized that citizens hold misperceptions about various countermeasures that can be implemented in response to rising energy prices (i.e. energy subsidies and monetary transfers), and that these misperceptions causally affect policy support. Previous work conducted in the US has identified widespread misperceptions about several policy areas such as social security, national debt and social assistance, and showed that a single correction significantly decreased misperception prevalence (Thorson, 2015). Moreover, correcting misperceptions about existing refugee policy increased support for refugees among the American public (Thorson & Abdelaaty, 2023). In the environmental field, correcting misperceptions about the prevalence of

climate-friendly behaviors and norms increased individual willingness to act against climate change as well as individual support for climate policies (Moxnes & Saysel, 2008).

Here, we suggest that public support for countermeasures in response to the energy crisis varies with citizens' (mis)perception of policy features such as cost and impact, and that correcting potential misperceptions can affect policy support. Previous research has shown that environmental policy support depends on several mental representations of policy characteristics such as perceived policy cost (Bechtel et al., 2020; Brannlund & Persson, 2012), perceived policy fairness (Dreyer & Walker, 2013; Maestre-Andrés et al., 2019) and perceived policy effectiveness (Hensher & Li, 2013; Sælen & Kallbekken, 2011). Moreover, empirical evidence shows that citizens can misperceive these policy features. Regarding policy cost, several studies suggest that citizens can be subject to a fiscal illusion (Dollery & Worthington, 1996), a "systematic misperception of fiscal parameters and an associated pattern of over- and under-estimation of expenditure and taxation liabilities" (Dell'Anno & Dollery, 2014). In Singapore, less than 30% of citizens believe that pronatalist tax deductions are provided at a cost to taxpayers (Poh, 2006). Moreover, questionnaire evidence on fiscal knowledge in the UK suggests a general ignorance of how fiscal structures work, both in terms of expenditure and taxation (Cullis & Jones, 1987). As a result, when a public policy is complex and budgets are non-transparent, citizens may favor subsidy programs because they underestimate their cost (Alesina & Perotti, 1995; Parlevliet et al., 2023).

Regarding policy fairness, Slemrod (2006) found that Americans hold significant misconceptions regarding the incidence - progressive or regressive - of several tax policies (flat tax, retail sales tax, estate tax, income tax). Focusing on the

value-added tax, a study conducted in multiple countries of Latin America showed that a large fraction of respondents underestimate the regressivity of the VAT (Ardanaz et al., 2022). Moreover, respondents who are informed that an increase in the VAT is regressive are significantly more likely to prefer policy reforms that make the tax more progressive (Ardanaz et al., 2022), which shows that perceived policy fairness influences policy support.

Finally, several misperceptions of policy effectiveness have been documented in the literature, two of which are of particular relevance here. Citizens largely underestimate the price-signal effect of a carbon tax, i.e. the fact that a higher price will lead to less demand for the taxed product, and this misperception lowers support for a carbon tax (Baranzini & Carattini, 2017; Sælen & Kallbekken, 2011). Moreover, cash transfer programs directed towards low-income households suffer from the misperception that beneficiaries will misuse the cash (for example by spending it on non-essential products such as alcohol and tobacco), favoring the belief that this policy is ineffective (Devereux, 2002; Evans & Popova, 2017; Ikiara, 2009).

This article is organized as follows. We start by assessing citizens' preferences towards four policy scenarios in response to the energy crisis (based on real-world countermeasures) in two countries, France and the United Kingdom. Results indicate that participants prefer subsidies on energy prices over monetary transfers to households, with universal subsidies being rated as the preferred policy (Study 1). We then seek to understand why citizens show a high level of support for universal subsidies, despite their negative effects on the environment and on social inequality. We hypothesized that many citizens hold misperceptions about the cost, as well as the social and environmental impact of universal subsidies in the energy domain, misperceptions which likely increase public support. We find evidence in favor of this

hypothesis and show that correcting these misperceptions decreases support for universal subsidies (Study 2). Finally, we find that many citizens also hold a misperception about targeted cash transfers regarding low-income households' money use, namely, that low-income households might not use the money as intended and spend it on non-essential goods instead. Correcting this misperception increases support for cash transfer policies in the UK, but not in France (Study 3). All experiments were pre-registered at https://osf.io/9jk5u/?view_only=01d39ca5a30444769c20e1130421bb87. Written consent was obtained for all studies prior to entering the experiment.

2. Study 1

The goal of Study 1 was to establish citizens' baseline preferences regarding various government countermeasures that can be implemented in response to increased energy prices, in the United Kingdom and France. A secondary question was whether, independently of the chosen policy, citizens were generally in favor of governmental action in response to an energy price rise and whether this preference varied depending on the characteristics of the price rise (e.g., large versus small rise, slow versus sudden rise).

Materials and methods

Participants

We conducted pre-registered survey experiments on representative samples of the adult population in two countries, the United Kingdom and France (N_{total} = 1000).

British participants were recruited through the online platform Prolific Academic and compensated with pay for their participation in the study. The experiment was conducted on representative samples of the adult population stratified according to age, gender, and ethnicity. Responses were recorded from the 18th to the 20th of June 2022. 500 participants were recruited based on a power analysis using effect sizes obtained in a pilot study. A detailed account of the pilot study is reported in Supplementary Note 1. The final number of respondents after exclusion of inattentive respondents was 462 (237 women; mean age = 45.5). French participants were recruited through the online platform CrowdPanel and compensated with pay for their participation in the study. The study used a representative sample of the adult population stratified according to age and gender[1]. Responses were recorded from the 23th of June to the 5th of July 2022. 500 participants were recruited and the final number of respondents after exclusion of inattentive respondents was 468 (239 women; mean age = 41.7).

Design and procedure

Participants first completed an attention check (see Supplementary Note 2). They were then told to imagine that the government has decided to use £10 billion to respond to a sharp increase in energy prices. The government has a choice between four countermeasures that will be implemented for three months (see Table 1). Policy responses were chosen based on real-world countermeasures implemented in France and in the UK (Sgaravatti et al., 2021). Each participant saw all four policies and the presentation order was randomized. This was a 2x2 within-participant design in which policies varied according to the instrument (a subsidy vs. a monetary transfer), and

[1] Due to recruitment difficulties, participants over 60 years old were under-represented in our sample.

the target (everyone vs. the most vulnerable). Participants were asked to indicate their level of support for each policy on a 10-point Likert scale. Participants then answered questions about their level of environmental concern, their attitude towards redistribution, their perceived energy use compared to other households, their level of trust towards other people, and towards the government, as well as socio-demographic questions about their age, gender, highest level of education, perceived income level in the population, political ideology, and residence area.

	Subsidy	**Transfer**
Targeted towards the most vulnerable	*"Reducing energy prices for the most vulnerable, for three months"*	*"Sending money to the most vulnerable each month (by cheque or bank transfer), for three months"*
Universal	*"Reducing energy prices for everyone, for three months"*	*"Sending money to everyone each month (by cheque or bank transfer), for three months"*

Table 1. Illustration of the experimental design and stimuli of Study 1. Policy schemes differ according to the policy instrument (subsidy or transfer) and to the policy target (targeted towards vulnerable households or universal). Participants see all four policy schemes (in a randomized order) and have to indicate their support for each scheme on a ten-point Likert scale.

Finally, to study whether the characteristics of the price rise influence the general demand for governmental intervention, participants were asked to indicate whether they thought the government should act in response to a “small”, “large”, “sudden”, or “slow” increase in energy prices. Participants saw only one adjective, randomly selected. The full survey (with the precise wording of all questions) is available as part of the replication archive for this article at https://osf.io/9jk5u/. This question was asked at the very end of the survey in order not to influence participants’ support for the policy options, which was the main focus of the experiment.

Hypotheses

We predicted a main effect of the level (large vs. small), and of the rhythm (sudden vs. slow) of the price rise on the demand for compensation. More specifically, we hypothesized that participants would be more likely to require governmental action when the energy price rise is large and when it is sudden, as the adaptation cost for citizens is higher in these situations.

Turning to people’s preferences between the different compensation policies, we predicted a main effect of the policy instrument on the level of support. More specifically, we hypothesized that participants would be more supportive of subsidies than money transfers. As mentioned in the introduction, citizens are likely to hold misperceptions about subsidies that may increase their support for this policy, and to hold misperceptions about cash transfer policies that may decrease their support for this policy (these misperceptions will be explored in detail in Study 2 and Study 3). We had no prediction, however, on the effect of the policy target (universal vs. vulnerable households only) on the level of support.

Results

Only respondents who succeeded the attention check were included in the analyses (N_{UK} = 462, N_{FR} = 468). In both the British and the French sample, the presentation order of policy schemes had no significant impact on the level of policy support (p = 0.72 and p = 0.42 respectively).

First, a vast majority of respondents in both countries required governmental intervention when facing an energy price rise, whether this price increase was described as large, small, sudden, or slow (see Figure 1). However, participants displayed a higher demand for governmental intervention when the price rise was described as "large" rather than "small", both in the UK (X^2 = 33.17, 95% CI [0.20, 0.39], p < 0.001), and in France, (X^2 = 53.62, p < 0.001). Regarding the speed of the price rise, British participants showed a higher demand for governmental intervention when the price rise was described as "sudden" rather than "slow" (X^2 = 5.12, 95% CI [0.01, 0.13], p = 0.02), but not French participants (p = 0.99).

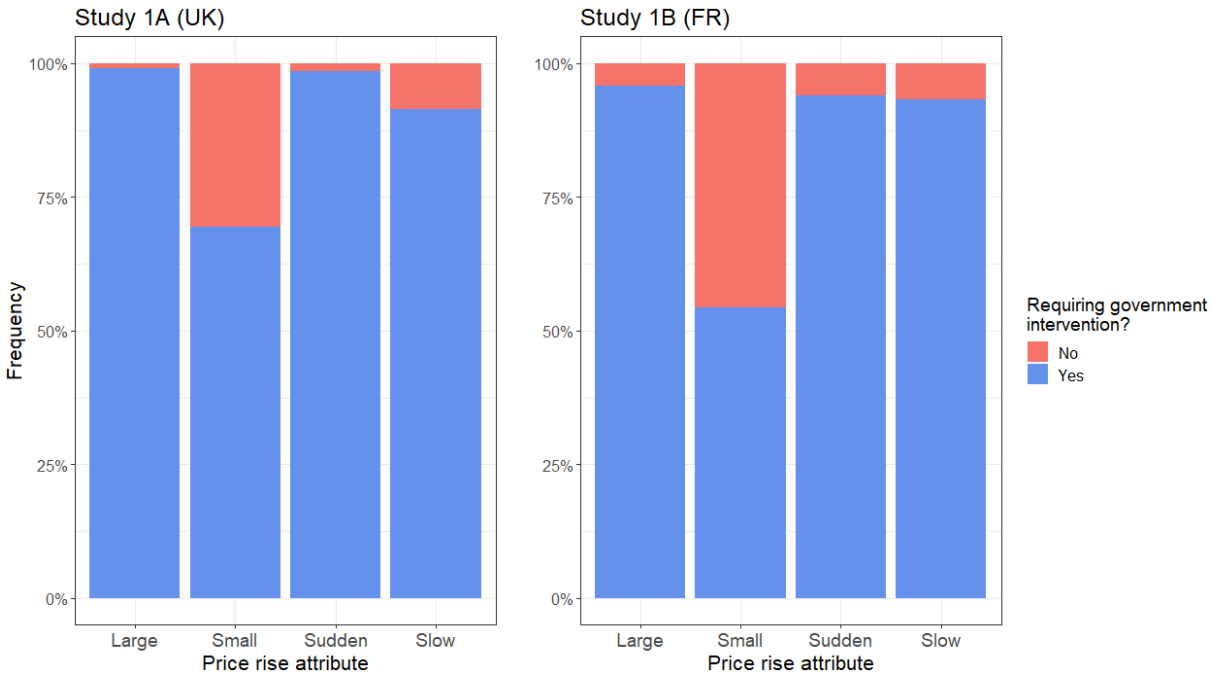


Figure 1. Bar graphs representing the percentage of respondents requiring (in blue, from the bottom) or not requiring (in red, from the top) governmental intervention when the energy price rise is described as either “large”, “small”, “sudden”, or “slow”, in the UK (N = 462) and in France (N = 468), in Study 1.

Turning to differences in support between the various policies, we found that, in line with our hypothesis, the choice of policy instrument had a significant impact on policy support, such that participants preferred subsidies to cash transfer policies both in the UK ($F(1, 461) = 194.99$, $\eta^2 = 0.07$, $p < 0.001$), and in France ($F(1,467) = 212.81$, $\eta^2 = 0.06$, $p < 0.001$). This effect remained significant when controlling for age, gender, education, political ideology, living area, perceived income level, environmental concern, inequality aversion, political, and social trust (see Supplementary Figures 1 and 2 for a graphical representation of preferences across socio-demographic groups and statistical analyses). Policy target (universal vs. vulnerable households only) on the other hand, was not significantly associated with policy preferences in both countries ($p_{UK} = 0.16$, $p_{fr} = 0.71$). However, there was an interaction effect between the policy instrument and policy target both in the UK, $F(1,461) = 33.49$, $\eta^2 = 0.005$, $p < 0.001$, and in France, $F(1,467) = 63.50$, $\eta^2 = 0.01$, $p < 0.001$ (see Figure 2). For cash transfers, participants in both countries preferred targeted transfers to universal transfers ($p_{UK} = 0.002$, $p_{FR} = 0.008$). For subsidies, French participants preferred universal subsidies to targeted subsidies ($p < 0.001$), and British participants showed a non-significant preference ($p = 0.31$).

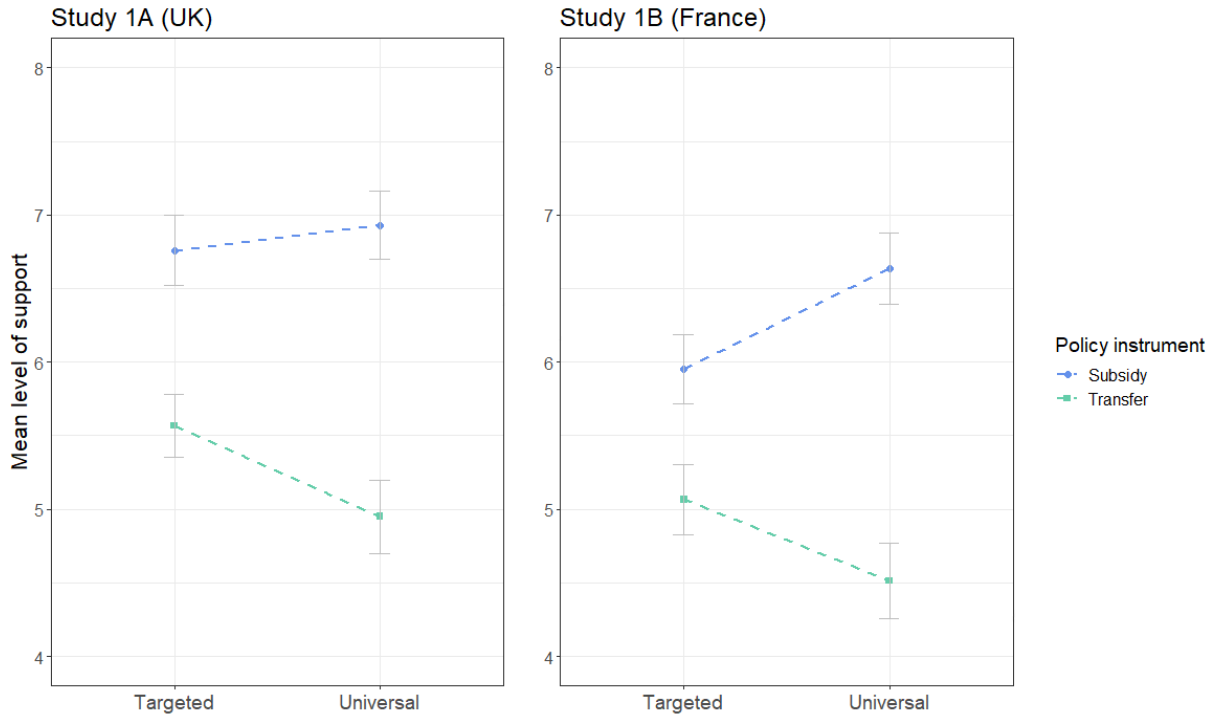


Figure 2. Mean level of support for four policy schemes varying in policy instrument (subsidy vs. cash transfer), and policy target (universal vs. vulnerable households only), from Study 1. Participants (N_{UK} = 462, N_{FR} = 468) rated each policy on a ten-point Likert-scale. Plotted are 95% CIs.

3. Study 2

Study 1 revealed an overwhelming preference for governmental reaction in response to a rise in energy prices for both British and French citizens, and, within common policy responses, a preference for subsidies over cash transfers. In particular, universal subsidies were rated as the preferred policy in spite of their negative effects on the environment and on social inequalities. Study 2 tests the hypothesis that this preference for universal energy subsidies is partly the result of misperceptions about their cost, their social and environmental impact, and that correcting these

misperceptions reduces support for subsidies. More specifically, based on existing studies reviewed in the introduction, we identified three misperceptions that people may hold about universal energy subsidies:

Misperception 1: Universal subsidies on energy prices are costless to taxpayers

Misperception 2: Universal subsidies on energy prices are not regressive (i.e. rich people do not save more money than poor people with this policy)

Misperception 3: Universal subsidies on energy prices have no negative environmental impact

Our first hypothesis was that the more misperceptions participants hold about universal subsidies, the more likely they are to support this policy. Our second hypothesis was that when participants are presented with correct information about universal subsidies, they are less likely to support this policy than when they are not presented with this information.

Materials and methods

Participants

We recruited 800 French participants from CrowdPanel and 800 British participants from Prolific Academic. Participants were compensated with pay for completing the experiment. The survey period was January 31st to February 3rd 2023 for the British sample, and May 30th to June 20th 2023 for the French sample. These studies used representative samples of the adult population in terms of age and gender, as well as ethnicity in the British study. Only participants who passed the attention check (see Supplementary Note 2) were allowed to enter the main phase of the experiment.

Design and procedure

After completing an attention check, participants were told to "[imagine] that the government responds to a sharp increase in energy prices by providing a discount (i.e. reduced prices) on energy products (fuel, gas, electricity, etc.)." They then had to state whether they thought that this discount policy (a) had a cost or no cost for taxpayers, (b) made rich people save more, less, or an equal amount of money than poor people, (c) had a negative, positive, or no environmental impact (correct answers here appear in italics). Each participant saw all three questions. The presentation order of the three questions was randomized, as well as the order of possible responses for each question. Participants were forced to choose one answer per question. In addition to answering these questions, participants in the treatment group received the correct answer and its justification (i.e. a correction treatment) after each response, whereas participants in the control group only received the correction for all questions at the end of the survey. Participants were randomly allocated to either the control or treatment group when entering the experiment.

Each correction followed the same structure: 1) the correct answer, 2) a theoretical explanation, 3) an empirical example coming from a competent source. All corrections can be found in Supplementary Table 2. As an illustration, the following correction was used to inform respondents about the social impact of universal energy subsidies: "*With this discount policy, rich people save more money than poor people. This is because richer households consume more energy than poorer households. Thus, richer households benefit from greater savings than poorer households when energy prices are reduced. In France, for example, the subsidy on fuel implemented in the spring 2022 benefited twice as much to the richest 10% households than to the*

poorest 10% households (French Council of Economic Analysis, July 2022)." Corrections were pre-tested for clarity and convincingness.

In a second phase, participants were told to imagine another situation in which the government has decided to use 10 billion pounds (or euros in the French study) to respond to a sharp increase in energy prices and has a choice between four policies. They were then asked the same questions, regarding the same policies, as in Study 1. Finally, as in Study 1, participants answered various questions about their attitudes and socio-demographics.

Results

Statistical analyses about the prevalence of misperceptions were conducted in the control group only in order to avoid treatment effects (N_{UK} = 400, N_{FR} = 399), as receiving the correct answer to one question could modify participants' answers to the next. A strong majority of citizens in both countries held misperceptions about universal energy subsidies: 82.2% of British participants and 75.9% of French participants held at least one of the three tested misperceptions. In the UK, 38%, 32.2%, and 12.0% of participants held one, two or the three misperceptions respectively. In France these frequencies were respectively 38.1%, 28.1%, and 9.7%. Moreover, the more misperceptions participants held about universal subsidies, the more likely they were to support this policy, both in the UK (R^2 = 0.02, $F(1,398)$ = 8.93, p = 0.003), and in France (R^2 = 0.08, $F(1,398)$ = 37.28, $p < 0.001$, see Supplementary Figure 3).

Focusing on each misperception, 20.8% of participants in the UK and 20.1% of participants in France (wrongly) believe that universal subsidies on energy prices have no cost for taxpayers. Turning to the social impact of universal subsidies, 57.0% of participants in the UK and 53.1% of participants in France (wrongly) believe that rich people do not save more money than poor people with this policy. Finally, 60.7% of participants in the UK and 50.4% of participants in France (wrongly) believe that universal subsidies on energy prices do not have a negative impact on the environment (see Figure 3).

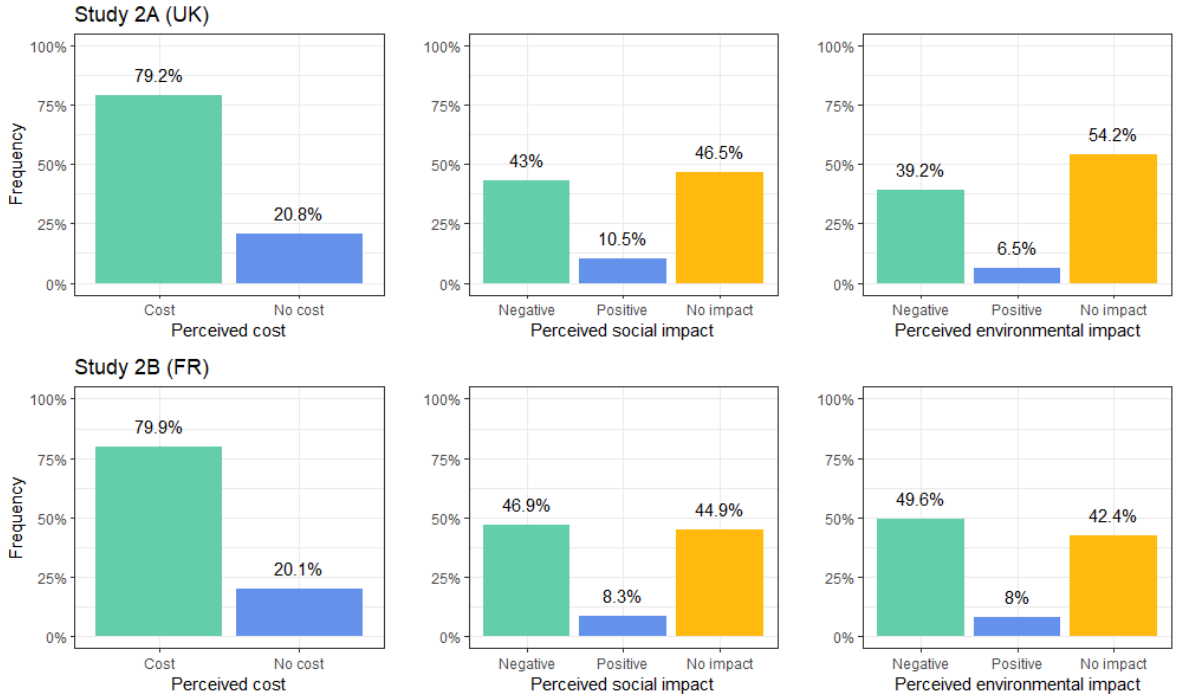


Figure 3. Frequency of answers to the three questions about universal energy subsidies (perceived cost, perceived social impact, perceived environmental impact) in the control group of Study 2 (N_{UK} = 400, N_{FR} = 399). Correct answers appear in green and are positioned on the left of each graph.

Correcting these misperceptions lowered support for universal subsidies in the UK sample, $t(796.97) = 3.08$, 95% CI [0.21, 0.96], $d = 0.22$, $p = 0.002$. Secondary analyses revealed that the effect of the correction treatment varied with perceived energy use ($p = 0.03$) and perceived income level ($p < 0.001$), such that it was stronger for participants who declare using less energy and receiving less income than the average household. In the French sample, correcting misperceptions about universal subsidies did not significantly decrease support for this policy ($p = 0.21$) but an exploratory analysis revealed that it significantly increased support for the three other policies relative to universal subsidies, $F(1,797) = 6.45$, $\eta^2 = 0.003$, $p = 0.01$ (see Figure 4). Also, the effect of the correction treatment on universal subsidy support was moderated by gender ($p = 0.02$) and inequality aversion ($p = 0.03$), such that the correction treatment significantly lowered universal subsidy support for women ($p = 0.009$) and for participants who think that social inequalities should be reduced ($p = 0.04$).

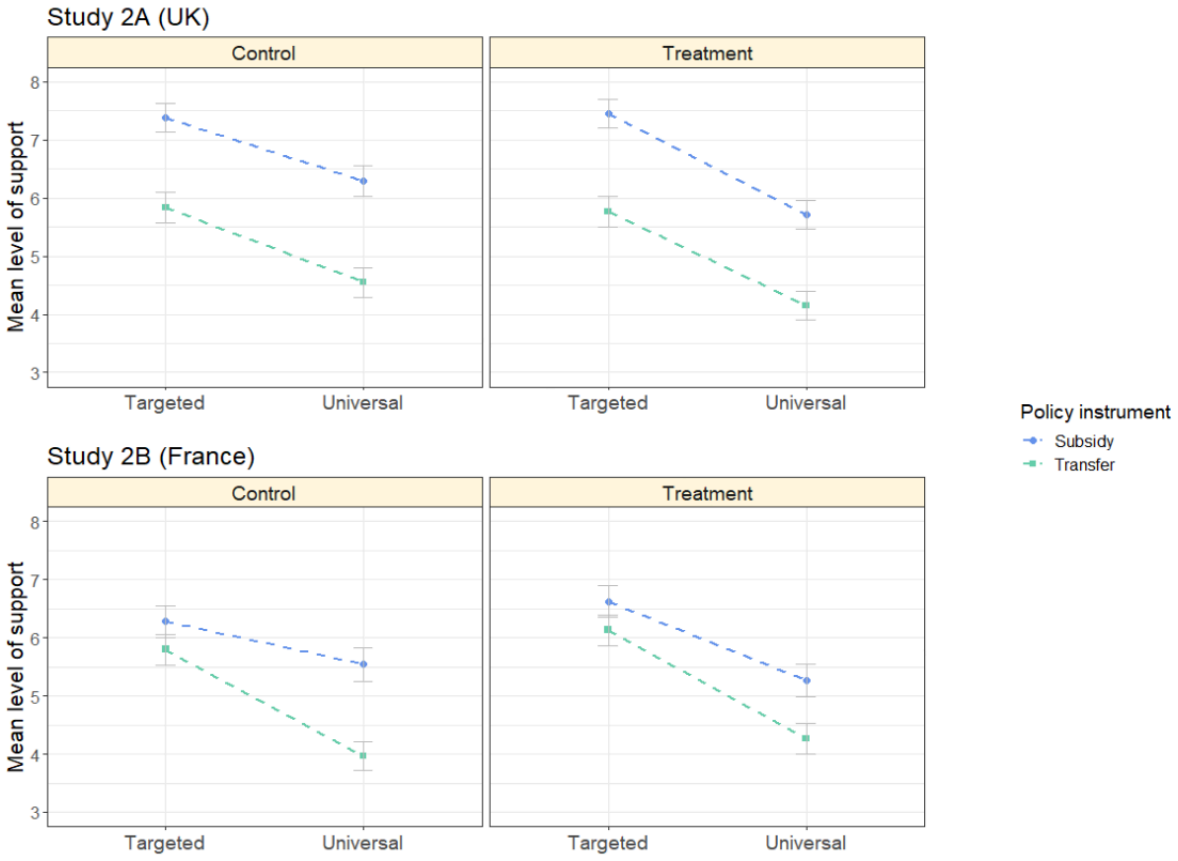


Figure 4. Mean level of support in each experimental group of Study 2 (control: no correction, treatment: correction) for four policy schemes varying in policy instrument (subsidy vs. cash transfer), and policy target (universal vs. vulnerable households only). Participants (N_{UK} = 799, N_{FR} = 799) rated each policy on a ten-point Likert-scale. Plotted are 95% CIs.

4. Study 3

Study 2 showed that most citizens in the UK and France hold misperceptions about universal subsidies as a response to a rise in energy prices, which helps explain the high level of support for a policy that is socially and environmentally problematic. Conversely, Study 1 revealed a relatively low level of support for targeted cash transfers, a more socially and environmentally sound policy. This relative distaste for

targeted cash transfers might itself stem from a misperception, namely that low-income households will use the money received from cash transfer programs on non-essential goods such as alcohol and tobacco. Interviews conducted in Kenya, for instance, have highlighted a "*widespread belief that cash transfers would either be abused or misdirected in alcohol consumption and other non-essential forms of consumption*" (Ikiara, 2009). An international study shows that there is a "*prejudice against giving people choices. There is a widely held belief that cash given to poor people (especially to men) will be squandered on alcohol and other non-essentials, whereas food (especially if targeted at women and children) will translate into direct nutritional gains*" (Devereux, 2002). However, this widespread belief is a misperception: a meta-analysis conducted on 19 different studies showed that cash transfer beneficiaries do not spend more on alcohol and tobacco when receiving monetary help, compared to similar households who did not benefit from the policy (Evans & Popova, 2017). We thus hypothesized that the following misperception affects support for money transfer programs:

Misperception 4: When receiving money transfers, low income households spend more on non-essential goods such as alcohol and tobacco than similar households who did not benefit from the policy.

To the best of our knowledge, the causal impact of this misperception on the support for cash transfer programs has never been tested. We first hypothesize that participants holding the misperception about non-essential spending of cash transfer money by low-income households are less supportive of targeted money transfer programs (in the context of an attenuation of the effect of energy price hikes) than participants who do not hold this misperception. Our second hypothesis is that when

participants are presented with correct information about low income households' use of money transfers, they become more supportive of the policy.

Materials and methods

Participants

For this experiment, we recruited 1000 French participants from CrowdPanel, and 1000 British participants from Prolific Academic. Participants were compensated with pay for completing the experiment. The survey period was September 20 to October 24 2023 for the French sample, and August 18 to August 19 2023 for the British sample. As for Studies 1 and 2, these studies used representative samples of the adult population in terms of age and gender, as well as ethnicity in the British study. Only participants who passed the attention check were allowed to enter the main phase of the experiment.

Design and procedure

The design of this study differs from the design of Study 2 only in its focus on targeted cash transfers instead of universal subsidies. The structure of the experiment is otherwise identical. After completing an attention check, participants were told that "in several countries around the world, money transfer programs have been put in place. Usually this policy consists in sending money to low-income households to help them meet their needs". They then had to answer whether they thought that compared to similar households who do not benefit from money transfer programs, low-income households who benefit from this policy spend more or do not spend more on non essential goods such as alcohol and tobacco. In addition to answering these

questions, participants in the treatment group received the right answer and its justification (i.e. a correction treatment) after each response, whereas participants in the control group only received the correction at the end of the survey. The correction was the following: “Compared to similar households who do not benefit from this policy, low-income households who benefit from the policy do not spend more on non-essential goods such as alcohol and tobacco. Scientific data [hyperlink towards Evans & Popova, 2017 inserted here] from 19 different studies conducted around the world found that low-income households do not buy more alcohol and tobacco when they receive monetary help (compared to similar low-income households).” This correction was pre-tested for clarity and convincingness. Participants were randomly allocated to either the control or treatment group when entering the experiment.

In a second phase, participants were told to imagine another situation in which the government had decided to use £10 billion to respond to a sharp increase in energy prices and had a choice between four policies. They were then asked the same questions, regarding the same policies, as in Studies 1 and 2. Finally, as in Studies 1 and 2, participants answered various questions about their attitudes and socio-demographics.

Results

43.6% of participants in the UK and 37.0% of participants in France (wrongly) believed that compared to similar households who do not benefit from money transfer programs, low-income households who benefit from this policy spend more on non essential goods such as alcohol and tobacco. Participants holding this misperception were less likely to support targeted cash transfers in the energy domain, both in the

UK, t(343.08) = 8.49, 95% CI = [-2.72, -1.70], d = 0.81, p < 0.001, and in France, t(391.87) = 5.54, 95% CI = [-2.04, -0.97], d = 0.56, p < 0.001. This analysis was only conducted in the control group of each sample (N_{UK} = 502, N_{FR} = 505) to obtain the relationship between misperception prevalence and policy support independently of the correction treatment. In both countries, misperception prevalence explained a large share of the variance in targeted cash transfer support, as evidenced by the large effect sizes (d > 0.5).

Finally, correcting this misperception by giving participants in the treatment group the right answer and a justification significantly increased support for targeted cash transfers in the UK sample, t(993.73) = 4.05, 95% CI = [0.39, 1.12], p < 0.001, but not in the French sample (p = 0.67, see Figure 5). In both countries, no heterogeneous effects of the correction treatment on the support for targeted cash transfer were found across the sociodemographic variables and attitudes recorded in the survey. In the UK, however, the effect of the correction treatment on policy support was moderated by the presence of the misperception (p < 0.001, see Supplementary Figure 4), such that the correction treatment only impacted targeted cash transfer support for participants who held the misperception. Regarding the impact of the correction on other policies than targeted cash transfers, a significant increase in support for universal cash transfers was found in the UK, t(997.69) = 4.08, 95% CI = [0.41, 1.18], p < 0.001 (see Figure 5).

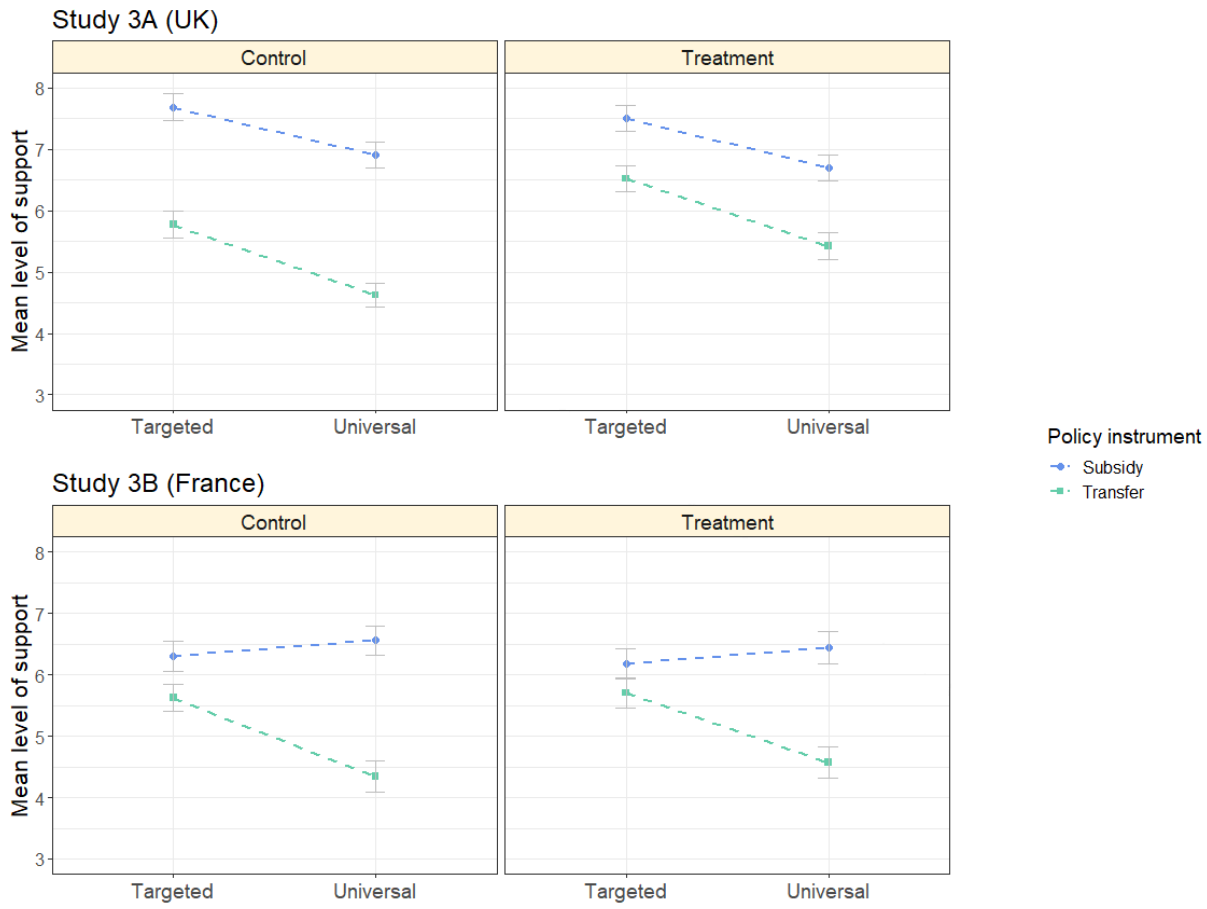


Figure 5. Mean level of support in each experimental group (control: no correction, treatment: correction) for four policy schemes varying in policy instrument (subsidy vs. cash transfer), and policy target (universal vs. vulnerable households only). Participants (N_{UK} = 1000, N_{FR} = 999) rated each policy on a ten-point Likert-scale. Plotted are 95% CIs.

5. Conclusion and discussion

In this article, we tested the acceptability of policy responses in the current context of rising energy prices across the world. In Study 1, we measured participants' support for four possible countermeasures based on real-world policies: a universal subsidy on energy prices, a targeted subsidy on energy prices for vulnerable households, a universal cash transfer and a targeted cash transfer for vulnerable households. We

found that participants preferred subsidies to cash transfer policies, both in the UK and in France, and that participants' preferred policy was universal energy subsidies. In Study 2, we investigated why people favor universal energy subsidies despite their negative social and environmental consequences. We found evidence that this can be explained by misperceptions about universal energy subsidies, misperceptions relative to their cost, their social impact, and their environmental impact. We also demonstrated that correcting these misperceptions lowers support for universal energy subsidies in the UK, and increases support for the three other policies relative to universal subsidies in France. In Study 3, we investigated the relatively low level of support for targeted cash transfers, a policy option that is fairer socially and more environment-friendly than universal subsidies. We found that the misperception that low-income households spend more on non-essential goods such as alcohol and tobacco when receiving monetary help (compared to similar households who do not receive such help) explains an important share of the support for targeted monetary transfers in the context of rising energy prices. We also showed that correcting this misperception increased support for targeted cash transfers in the UK, but not in France.

Several policy implications can be derived from the results obtained in these studies. First, the widespread nature of misperceptions about countermeasures both in the UK and in France suggest that political attitudes will be formed on the basis of inaccurate policy representations. Second, the fact that British participants increased their level of support for more redistributive and effective policies (i.e. targeted monetary transfers), and decreased their support for less redistributive and effective policies (i.e. universal subsidies) after a one-shot informational treatment suggests that communication campaigns about the cost and impact of countermeasures to

energy price hikes can be an effective yet low-cost intervention to reduce the effectiveness-acceptability gap in the UK. One hypothesis for the lack of treatment effect on French participants in Study 3 relates to the level of trust in experts, as various international surveys have shown that France has lower levels of scientific trust than the UK (CEVIPOF, 2023). However, participants' mean ratings of the correction's convincingness were similar in the two countries (M_{UK} = 6.44, M_{FR} = 6.54), which does not support this hypothesis. Alternatively, the fact that fewer participants in France than in the UK held the studied misperception about targeted cash transfers may have made it more difficult to observe an effect of treatment.

Future work could investigate whether misperceptions about policy cost and policy outcomes can also impact support for more long-term energy policies (e.g. increasing the share of renewable energy production). A recent cross-national study showed stable levels of public support for renewable energy policies during the energy crisis (Frings et al., 2023), but heterogeneity according to policy perception was not measured. Moreover, determining whether policy misperceptions arise from an informational deficit and/or from specific cognitive biases could be an interesting area of study. Finally, other mechanisms than policy misperceptions may also play a role in shaping policy support for countermeasures in response to energy price hikes. For example, the "belief in a just world" can lower support for any policy targeted at low-income households if it is believed that these people are "deserving" of their place in society, and thus that compensatory policies are not deemed necessary (Appelbaum et al., 2006; Wilkins & Wenger, 2014).

To conclude, these studies underline the importance of policy misperceptions in shaping public support for government countermeasures in response to energy

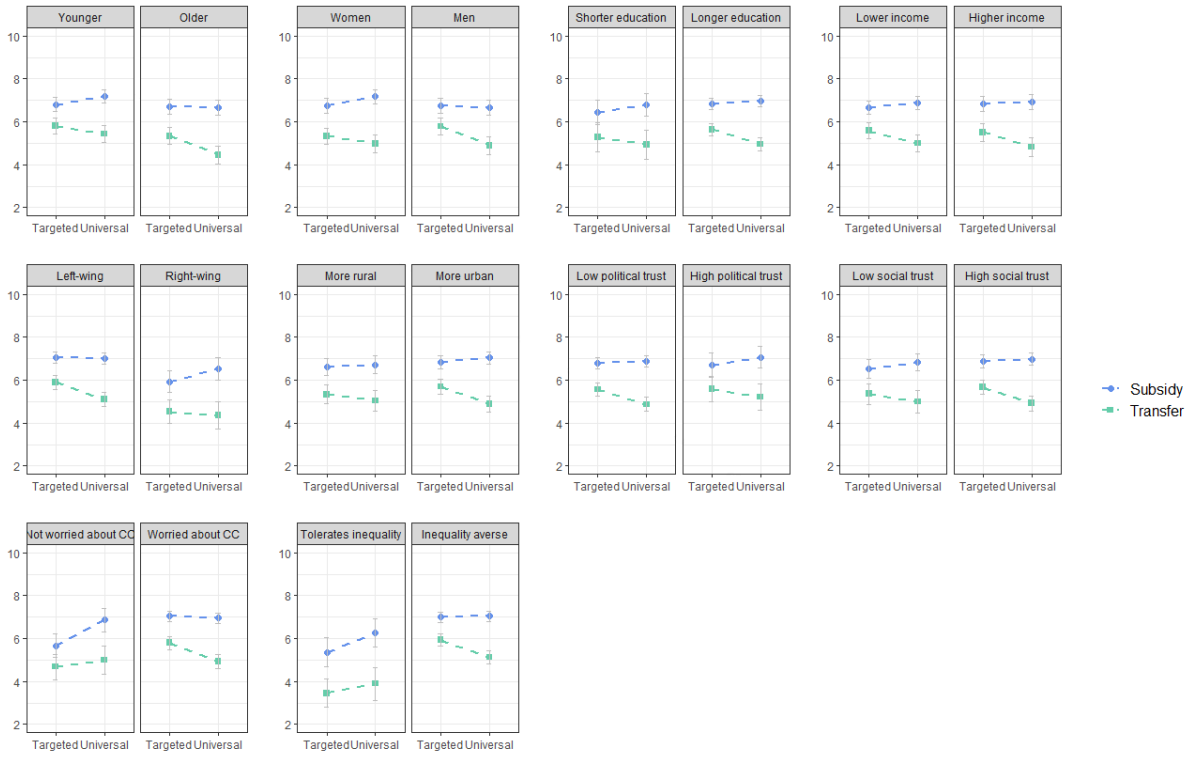
price hikes, and suggest that correcting these misperceptions with communication campaigns can be an effective intervention in the UK at least.

Pre-registrations. All experiments were pre-registered at https://osf.io/9jk5u/.

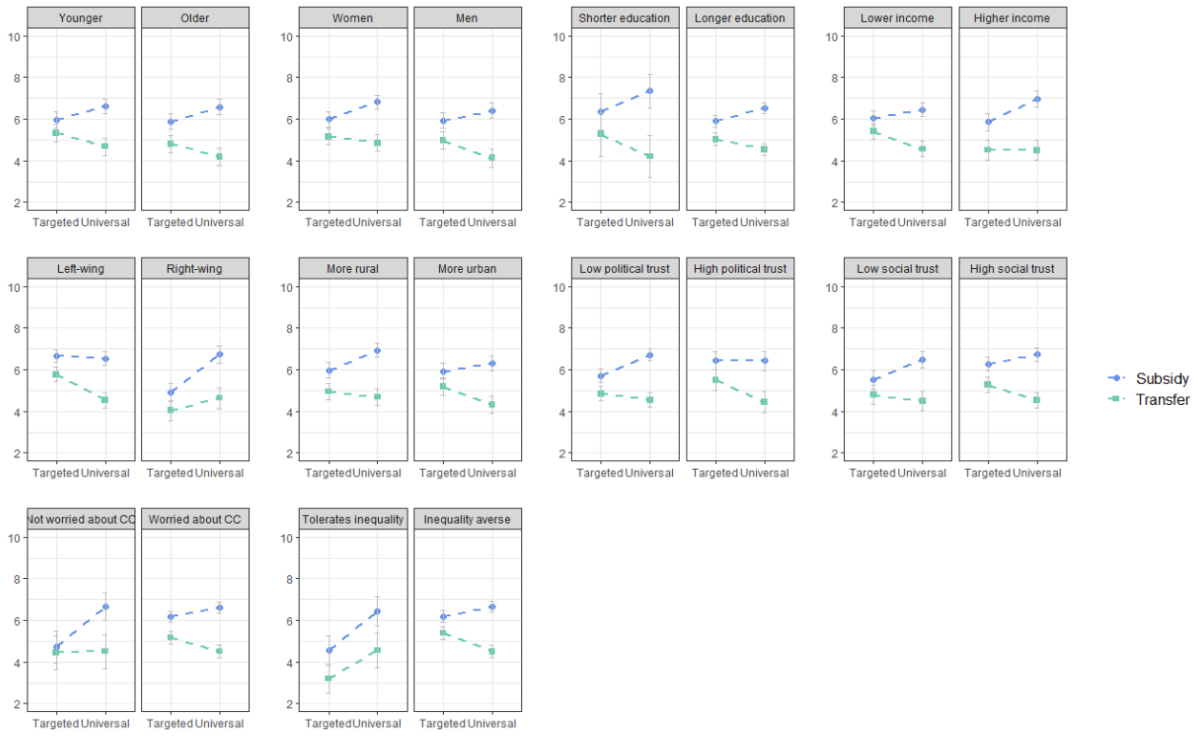
Data and code availability. Data and analysis code to reproduce the presented analyses are available at https://osf.io/9jk5u/.

6. Supplementary information

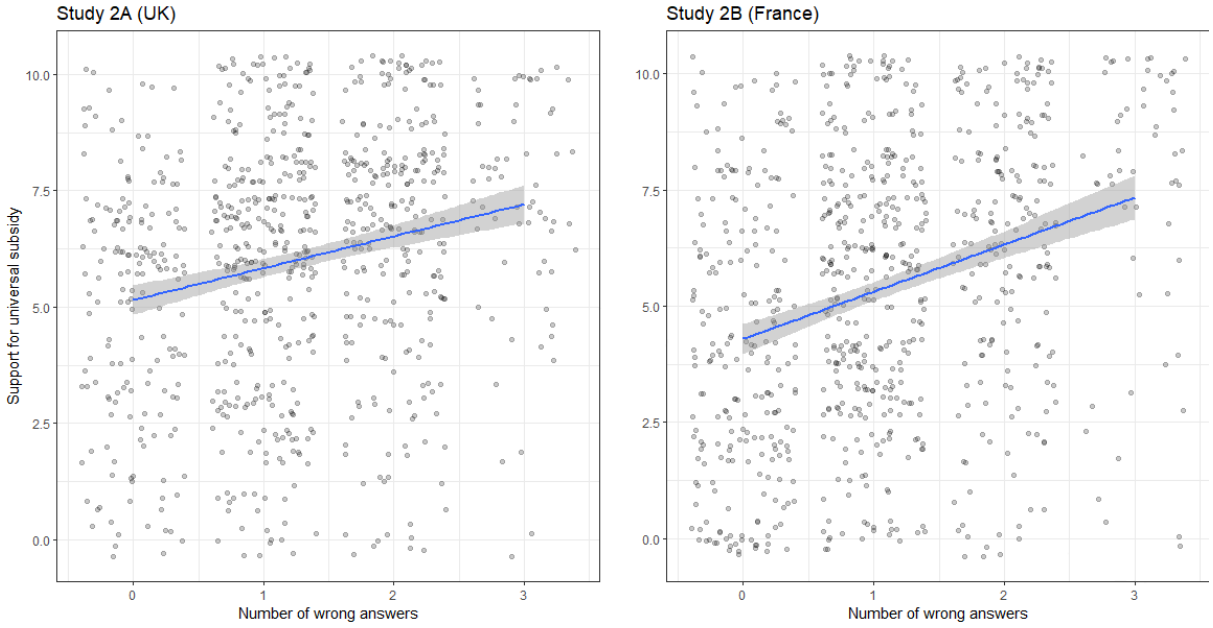
Contents:



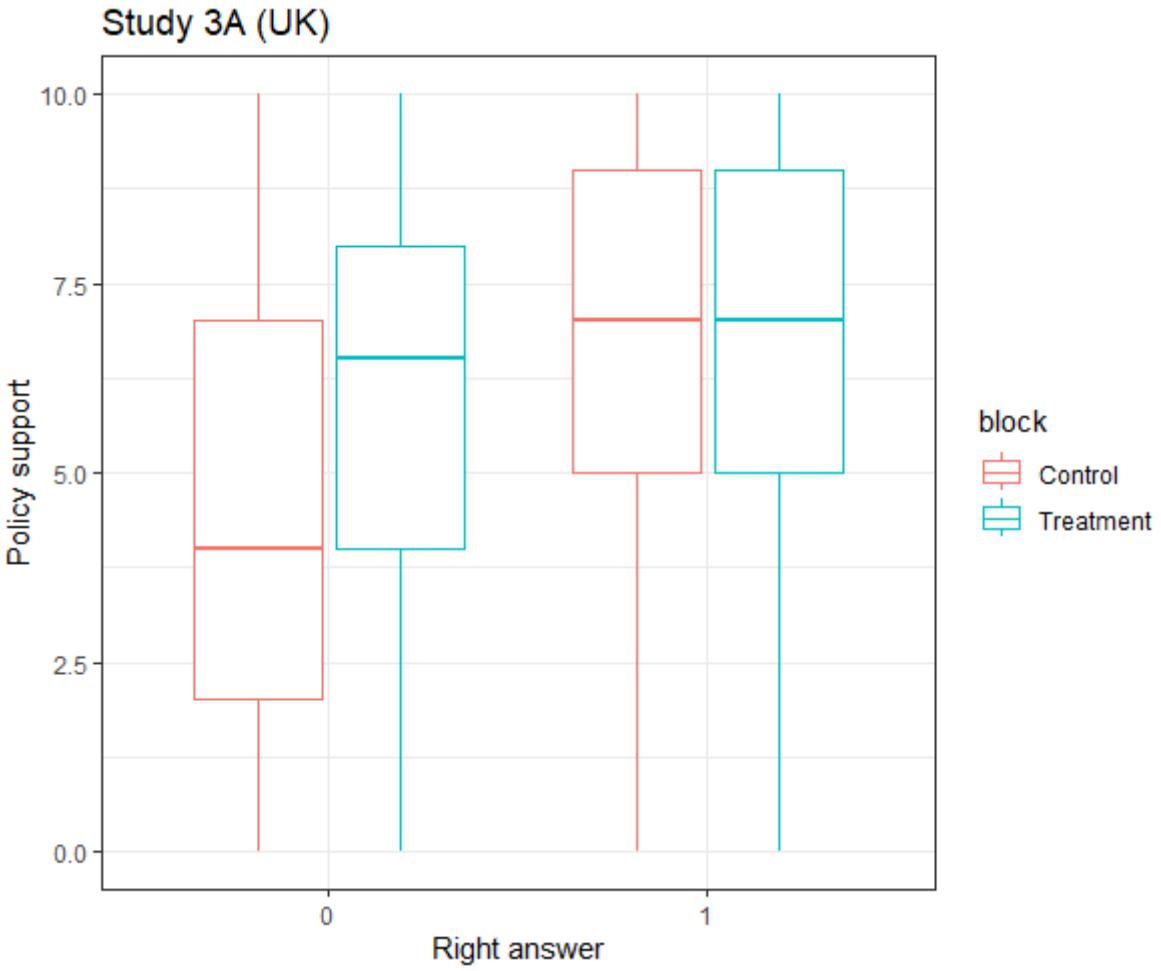
Supplementary Figure 1. Mean level of support of British participants (N = 462) for four policy schemes varying in policy instrument (subsidy vs. cash transfer), and policy target (universal vs. vulnerable households only), when splitting participants according to age, gender, education level, perceived income level, political ideology, residence area, political trust, social trust, environmental worry and inequality aversion in Study 1. Participants rated each policy on a ten-point Likert-scale. Plotted are 95% CIs.



Supplementary Figure 2. Mean level of support of French participants (N = 468) for four policy schemes varying in policy instrument (subsidy vs. cash transfer), and policy target (universal vs. vulnerable households only), when splitting participants according to age, gender, education level, perceived income level, political ideology, residence area, political trust, social trust, environmental worry and inequality aversion. Participants rated each policy on a ten-point Likert-scale in Study 1. Plotted are 95% CIs.



Supplementary Figure 3. Scatter plot showing the correlation between the number of wrong answers to each question about universal subsidies (ranging between 0 and 3 as participants answered three questions) and the level of support for this policy in the control group, in the British study (N_{2A} = 399) and in the French study (N_{2B} = 399). Policy support was rated on a ten-point Likert scale. Plotted is the regression line with the specified slope and intercept of the model.



Supplementary Figure 4. Boxplot showing the level of policy support for targeted cash transfers in the UK in Study 3 (N = 1000), by experimental group (control: no correction, treatment: correction) and answer to the question about low-income households' use of cash transfers (right answer = 1, wrong answer = 0).

Cost correction	Social impact correction	Environmental impact correction
This subsidy policy has a cost for taxpayers. *This is because the State compensates energy suppliers in order to reduce prices for individuals. As the State budget relies on taxpayers' contributions, this policy has a cost for taxpayers.* *In Luxemburg, for example, the subsidy on fuel implemented in the spring and summer 2022 cost the State 56 million euros (Luxemburg's Ministry of Environment, November 2022).*	*With this subsidy policy, rich people save more money than poor people.* *This is because richer households consume more energy than poorer households. Thus, richer households benefit from greater savings than poorer households when energy prices are reduced.* *In France, for example, the subsidy on fuel implemented in the spring 2022 benefited twice as much to the richest 10% households than to the poorest 10% households (French Council of Economic Analysis, July 2022).*	*This subsidy policy has a negative impact on the environment.* *If energy prices are high, people consume less polluting energy from fossil fuel products (such as oil, gas and coal). This decreased consumption decreases CO2 emissions. By reducing energy prices, subsidy policies do not make people consume less energy, and thus fail to decrease CO2 emissions.* *In G20 countries, it has been shown that eliminating subsidies on fossil fuel products would reduce CO2 emissions by 3.5% by 2030 (GSI Report, July 2021).*

Supplementary Table 1. Corrections used in Study 2 about the cost, the social impact and the environmental impact of universal energy subsidies. Each correction followed the same structure: 1) the correct answer, 2) a theoretical explanation, 3) an empirical example coming from a competent source. All corrections were pre-tested for clarity and convincingness.

Supplementary Note 1. Pilot study of Study 1A

a) Participants

200 British participants were recruited on Prolific (balanced sample on gender) on May 31st 2022. 10 participants failed the attention check, leaving 190 participants included in the analyses.

b) Methods

Participants are told to imagine that the government has decided to use £10 billion to respond to a sharp increase in energy prices. The government has a choice between four policies that will be implemented for three months:

a) Sending a check to everyone each month, for three months.

b) Sending a check to the most vulnerable each month, for three months.

c) Reducing energy prices for everyone, for three months.

d) Reducing energy prices for the most vulnerable, for three months.

Each participant sees all policies and the presentation order is randomized. This is a 2x2 within-subjects design where scenarios vary according to the policy instrument (subsidy or transfer) and policy target (everyone or the most vulnerable). Participants are asked to indicate their level of support for each scenario on a 10-point Likert scale. Then, they are asked to justify both their choice for their preferred and least preferred policy (open questions). Participants then answer questions about their level of environmental concern, their attitude towards redistribution, their level of trust towards other people and towards the government. Then, participants answer

socio-demographic questions: age, gender, highest level of education, perceived income level in the population, political ideology and residence area. Finally, participants are asked to indicate whether they think the government should do something in response to a [small/big] increase in energy prices (Yes/No).

c) Results

The proportion of participants thinking that the government should do something in response to a rise in energy prices is higher when the rise is described as “big” rather than “small” ($p < 0.001$, see Figure A).

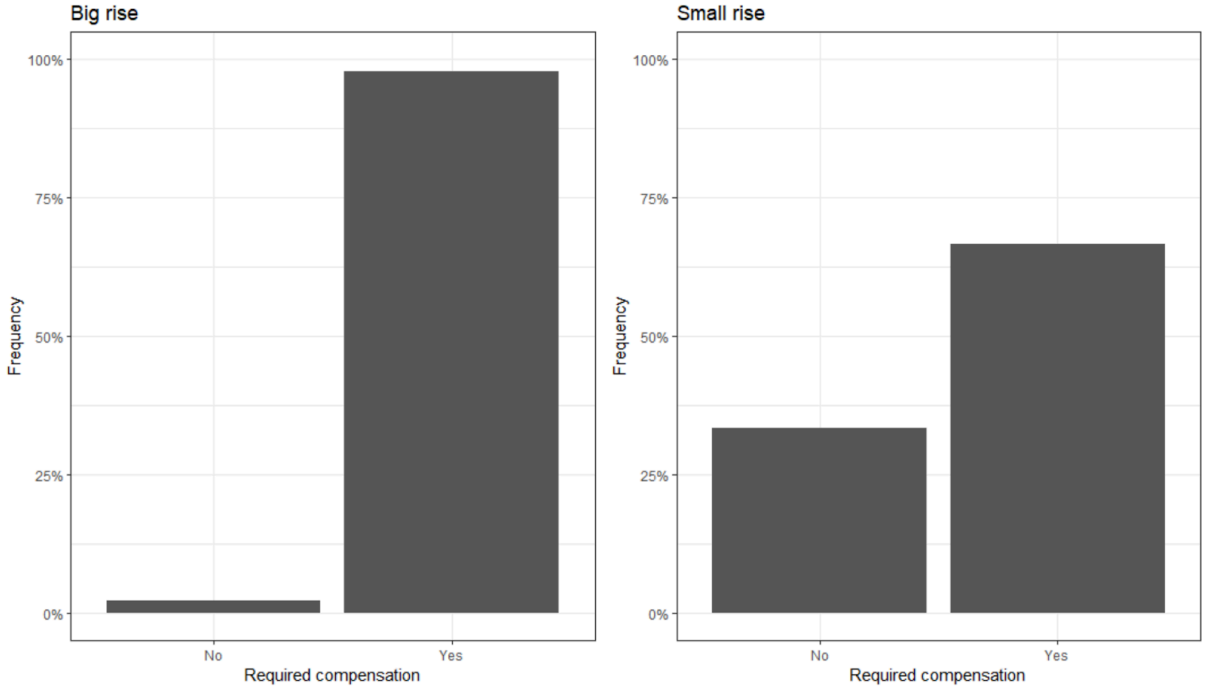


Figure A. Frequency of respondents answering “Yes” or “No” to the question “Do you think the government should do something in response to a [big/small] rise in energy prices?” across conditions (N = 190).

Significant differences in support can be observed across social policy scenarios ($p < 0.001$). Policy instrument has a significant impact on support ($p < 0.001$). More specifically, participants prefer subsidy policies ($M = 7.02$, $SD = 2.36$) to transfer policies ($M = 4.98$, $SD = 3.02$; see Figure B). Policy target (universal vs. targeted), on the other hand, does not have a significant effect on policy support ($p = 0.12$). There is a significant interaction effect between policy instrument and policy target ($p = 0.045$).

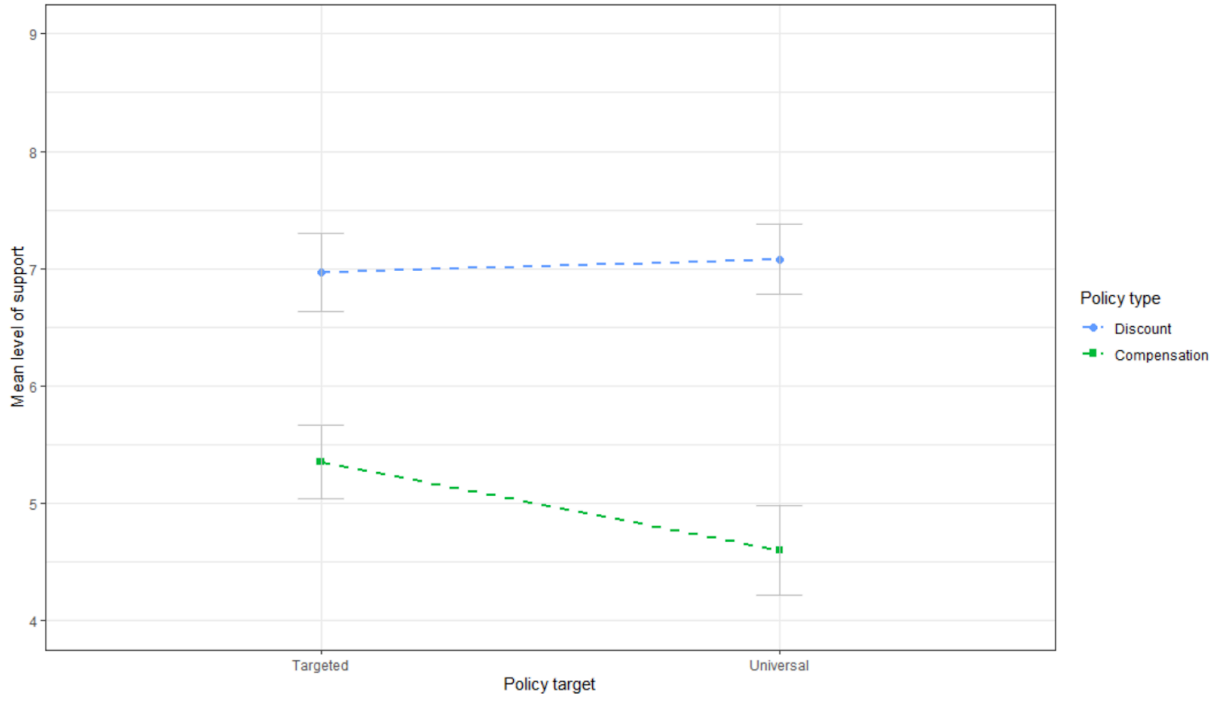


Figure B. Mean level of support on a ten-point Likert scale across policies, distinguishing by policy instrument (subsidy vs. transfer) and policy target (targeted towards the most vulnerable vs. universal). Plotted are 95% CIs (N = 190).

Supplementary Note 2. Attention check used in all studies

In all studies reported in the paper, participants who failed our attention check were excluded from the analyses. We used the “color test” as an attention check in all studies. In this test, participants have to read the following text and answer a question:

“*The color test is simple, when asked your favorite color you must enter the word bole (iris in French) in the textbox below. Having read the instructions, what is your favorite color? [textbox]*”

British participants who do not enter “bole” (or a close variant or typo) and French participants who do not enter “iris” are excluded from the analyses.

Chapter 3 - What are the psychological drivers of conservation policy support? A systematic scoping review of quantitative evidence

Corresponding article: *Mus, M., Hadjes, A., Mercier, H., & Chevallier, C. (to be submitted). What are the psychological drivers of conservation policy support? A systematic scoping review of quantitative evidence.* Preprint available at osf.io/preprints/psyarxiv/xu7pm

Abstract

In light of the current biodiversity crisis, broader and stricter conservation policies are increasingly required. As is the case of other environmental policies, public support for conservation measures often is a necessary condition for their success. Identifying which factors are associated with citizens' support for conservation policies is thus crucial for policy-making. To do so, we conducted the first scoping review of studies empirically investigating the effect of psychological factors on conservation policy support, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for scoping reviews (PRISMA-ScR). After completing data screening, 66 studies were included in the review and the results were synthesized using both a narrative approach and descriptive statistical analyses. Among the reviewed sources, we found that representational factors (i.e. beliefs, perceptions) have received the most attention from scholars, and normative factors (i.e. moral and social norms) the least. Moreover, wildlife value orientations, knowledge about conservation and environmental issues, and general policy attitudes are the psychological factors most robustly associated with conservation policy support.

Keywords: systematic review, scoping review, conservation policy, biodiversity, psychology, public support, PRISMA framework

1. Introduction

Implementing conservation policies is crucial for safeguarding our planet's biodiversity and maintaining ecosystem balance. Conservation policies can effectively protect threatened species and habitats (Bowgen et al., 2022), preventing further loss of biodiversity. By preserving natural resources and promoting sustainable practices, conservation policies also contribute to mitigating climate change and ensuring a more resilient environment for future generations, hence positively impacting human livelihoods (Larsen et al., 2012). As conservation takes place in social-ecological systems containing both human and non-human actors and stakeholders (Berkes et al., 2008), not only ecological but also human dimensions of biodiversity conservation must be taken into account by policy-makers. In this perspective, the Convention on Biological Diversity lists "mainstreaming biodiversity across government and society" as a strategic goal (CBD, 2011), and various scholars have argued that successful conservation is dependent on the integration of social concerns and public support (Chan et al., 2007; Lischka, 2018). For instance, a study investigating 90 protected areas in 42 countries identified public engagement as the most important determinant of success (Van Cuong et al., 2017). This raises an important question for both researchers and policy-makers regarding what type of factors influence people's support for biodiversity conservation policies. From a policy point of view, an increased understanding of the determinants of conservation policy support would help to better integrate citizen preferences into the design and the implementation of

successful conservation policies, where environmental effectiveness and social acceptability dimensions are aligned.

Existing research investigating the determinants of public support for various environmental policies stresses that demographic factors such as age, gender, education and income generally have small effects on acceptability (Ejelöv & Nilsson, 2020). On the other hand, psychological factors have been shown to play an important role in shaping acceptability judgments towards environmental policies across domains (Drews & van den Bergh, 2016; Ejelöv & Nilsson, 2020; Huijts et al., 2012). Examples of psychological determinants of environmental policy support include representational factors such as perceived effectiveness and fairness (Bergquist et al., 2022; Wang et al., 2018), worldviews and value orientations (Harring et al., 2017), emotional factors such as guilt, worry, interest, and hope (Hignell et al., 2022; Smith & Leiserowitz, 2014), and experiential factors such as exposure to extreme weather events (Owen et al., 2012).

In this systematic scoping review, we aimed to identify the psychological factors that are associated with public support for conservation policy. Existing reviews focus on specific conservation fields and specific psychological factors (Ihemezie et al., 2021; Lesch & Wachenheim, 2014), or do not measure policy support as their outcome of interest (St John et al., 2010). Conducting a scoping review across psychological factors and across conservation policy domains to investigate variations in policy support thus fills an evidence gap and helps identify psychological mechanisms robustly associated with public support in a variety of policy settings. The aim of this review is therefore twofold: a) identifying and mapping the psychological factors that have been studied in relation to conservation policy support, b)

determining which psychological factors are significantly associated with conservation policy support.

2. Methodology

We conducted a scoping review to identify and synthesize the various types of psychological factors associated with conservation policy support. A scoping review is a systematic literature review approach that aims to identify, map, and analyze a broad range of studies within a given research field, and to identify relevant research gaps (Arksey & O'Malley, 2005). To guide the structure of this systematic review, we followed the framework of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR, Tricco et al., 2018). The methodological protocol used for this review was pre-registered on the Open Science Framework website (https://osf.io/tqw3d).

Search strategy

Five electronic databases relevant to psychological and conservation studies were searched: Scopus, Web of Science, PsychInfo and Pubmed for published academic literature, as well asProQuest for grey literature. We also used the PsyArXiv repository to search for preprints related to conservation psychology. All sources available online before our search date (December 12th 2023) were included in the search results. To explore our primary research questions, we targeted sources that: i) studied one or several psychological factors as independent variables, and ii) measured conservation policy support as the dependent variable. Query strings were developed based on existing conceptual frameworks (e.g. cognitive-affective-behavioral model,

value-belief-norm model), and existing reviews on similar topics (e.g. the drivers of public support for climate policies, Drews & van der Bergh, 2015). Keyword testing and pilot exploration were then used to enhance search comprehensiveness. To limit selection bias, we did not include terms related to psychological factors for searches in PsychINFO and PsyArXiv, as a filter on psychological content is already present via the thematic scope of these registries. The full search queries used for this review can be found in Supplementary Note 1. Additionally, we used Research Rabbit (www.researchrabbit.ai) to perform backward and forward citation-tracking on all sources included in the final screening phase, to find relevant sources that may have been missed by our search algorithm (see Supplementary Note 2). Experts in the field of conservation psychology were also contacted as a complementary search strategy.

Inclusion and exclusion criteria

Study methodology

As the aim of this review is ultimately to inform policy making, we focused on empirical studies, excluding theoretical articles. More specifically, only primary sources that performed quantitative analyses of the relationship between the variables of interest were included in this review, as we used significance tests to determine whether the studied psychological factors were associated with changes in policy support levels. As a result, quantitative sources for which significance tests were not reported (or made available upon request) were also excluded from this review.

Study content

We first excluded studies in which none of the independent variables was a psychological factor. We used a broad definition of psychological factors that includes all individual-level processes which involve cognitive, affective and/or behavioral components (Fabrigar & Petty, 1999), in line with other systematic reviews (Campbell et al., 2017; Sood et al., 2022). As a result, we excluded studies that only investigated the effect of socio-structural factors such as age, gender, ethnicity, education level, income or occupation-related variables. In terms of study outcomes, we only included sources measuring public attitudes towards wildlife and habitat conservation policies, and excluded studies focusing on household-related conservation measures (energy conservation, water conservation). In addition, we excluded sources that only measured general conservation attitudes (e.g. willingness to protect natural resources in general) and not support for specific conservation policies. Although a majority of citizens are in favor of broad biodiversity conservation goals, public support declines when specific programs or measures are presented (McCune et al., 2017; Responsive Management, 2011), thus making support for specific policies a more realistic outcome to capture public preferences. Moreover, we only included sources that studied public support for conservation policies prior to implementation (i.e. acceptability studies versus acceptance studies) for two reasons: a) baseline levels of support for public policies vary before and after implementation (Jagers et al., 2017; van Wee et al., 2023), and b) the psychological variables investigated in post-implementation studies mostly relate to observable policy outcomes or management (e.g. actual policy impacts, actual forms of governance), which limits comparability with pre-implementation studies and would be better addressed with a separate review.

Other criteria: study population, language and availability

We excluded sources that targeted children, as several measures of policy support include voting behavior or payment tasks. Moreover, we only included studies that targeted the general public and not specific subgroups of the population (e.g. fishers, scientists, farmers) due to the high heterogeneity across the subgroups studied, and low comparability with general public samples because of different degrees of expertise and stakes. Finally, we only included studies written in English and for which a full-text version was accessible or made available upon request.

Screening

After removing duplicates with an automation tool (Borissov et al., 2022), we conducted three rounds of data screening (titles, abstracts, full-text), each performed independently by two screeners. Each screener was provided the list of inclusion and exclusion criteria presented above. Importantly, for sources that reported several studies conducted on independent samples, each study was screened separately. Inter-rater reliability for each screening phase was calculated using Cohen's kappa (Cohen, 1960; McHugh, 2012), to measure internal consistency between the two screeners. Traditionally, kappa levels between 0.7 and 0.8 indicate an acceptable agreement, between 0.8 and 0.9 a strong agreement, and above 0.9 a near-perfect agreement. Disagreements at the end of each screening stage were discussed orally between the two screeners until an agreement was reached for each source.

Extraction

From each included study, we extracted the following data: a) metadata: author(s) name(s), journal name, year of publication; b) study context: study aim, study location, policy/policies of interest; c) study methodology: study design, sample size, data collection procedure and period, sample characteristics, description of the dependent and independent variables of interest, description of controls, mediators and moderators, analysis method; d) study results: description of significant ($p < 0.05$) and non-significant direct effects of the independent variables on the dependent variables, as well as the direction of the effect and reported p-values; e) risk of bias indicators: pre-registration document, data availability, declared conflict(s) of interest. For sources that reported several studies conducted on independent samples, each study was extracted separately. Extraction was performed independently by two data extractors. One extractor retrieved all the data variables described above while the other extractor only retrieved the variables of interest to answer the main research question (policy.ies of interest, study design, independent variables of interest, dependent variables of interest, analysis method, study results). Disagreements were resolved by discussion between the two extractors.

Quality assessment

To critically appraise the quality of the included sources, we used the Mixed Methods Appraisal Tool (Hong et al., 2018), which assesses study quality with a list of five evaluation criteria specific to study type. We specifically used the evaluation criteria for quantitative randomized studies and observational studies, since all the included

studies fell into these two categories. For quantitative randomized studies, examples of the evaluation criteria include the randomization procedure, blinding, and manipulation checks. For observational studies, examples of assessed items include the sampling strategy, representativeness and the risk of non-response bias (see Supplementary Note 3 for a detailed description of all items). As recommended by the authors of the framework, evaluation criteria are adapted to be relevant within the research field reviewed (Hong et al., 2018). Assessors should report “yes”, “no” or “cannot know” for each assessed item per study. Calculating an overall score from the ratings of each criterion (i.e. aggregating the number of “yes” and “no” to compute a global numerical score) is discouraged in this framework, in line with many scholars who have argued that numerical quality scoring of sources can introduce important methodological biases (Fenton et al., 2015). Thus, we decided to attribute one of three quality categories (high quality, medium quality, low quality) to each source based on a qualitative appreciation of the rated criteria and taking into account each study’s specificity. As excluding studies with low methodological quality is usually discouraged in systematic reviews (Page et al., 2021), we do not use quality assessment as a screening criterion but rather as an informative tool to review results and perform sensitivity analyses when necessary.

Data analysis and synthesis

Due to the heterogeneity of the included data and the unsystematic reporting of effect sizes, we did not conduct a systematic quantitative comparison of findings across the reviewed sources. Instead, we used a narrative approach to synthesize study results, complemented by descriptive statistical analyses to summarize study characteristics

across sources (e.g. study context, study design, variable types). Some analyses were directly performed on raw data variables from the extraction phase (e.g. sample size), while others required data transformation such as categorization (e.g. variable types). To identify and map the psychological factors studied in relation to conservation policy support, we relied on existing theoretical frameworks such as the value-belief-norm model in environmental psychology (Stern, 2000), on the categorization of psychological factors used in related reviews (Drews & van den Bergh, 2016; Ejelöv & Nilsson, 2020), as well as thematic mapping from a pilot coding stage to add and refine category templates. This resulted in the creation of ten categories: values, representations, norms, knowledge, emotions, preferences and attitudes, sense of identity, engagement, exposure and recreational behavior. These categories were filled with all the psychological variables extracted from the reviewed sources, as well as their respective coded results on policy support (significance and effect direction). Importantly, our classification process was based on the terms used by the authors to describe the psychological variables they investigated (i.e. a variable described as a “value” was placed in the “values” category). To enhance comparability with regards to the direction of effects, we reverse coded results from studies where anti-conservation (rather than pro-conservation) policy support was the measured outcome. To synthesize results, we used a counting methodology to identify the number of studies reporting significant and/or non-significant effects per psychological construct investigated, similarly to other systematic reviews in the field of environmental psychology (Ihemezie et al., 2021).

3. Findings

5,909 search results were obtained by database and repository searching and 10 sources were identified by alternative search strategies. After duplicate removal using an automation tool (Borissov et al., 2022), 3466 search results were screened using titles. This first screening stage resulted in 790 sources being screened using abstracts. Among them, 232 were kept to assess full-text eligibility. 47 sources met the eligibility criteria and were used to perform backward and forward citation-tracking. This resulted in 17 additional sources that met the eligibility criteria. 64 records were thus included in the review, resulting in 66 independent studies when accounting for multiple studies per source (see Figure 1). Inter-rater reliability was high for each screening stage ($\kappa_{Titles} = 0.81$, $\kappa_{Abstracts} = 0.90$, $\kappa_{Full\text{-}texts} = 0.90$, p-value < 0.05), indicating strong between-screeners agreement.

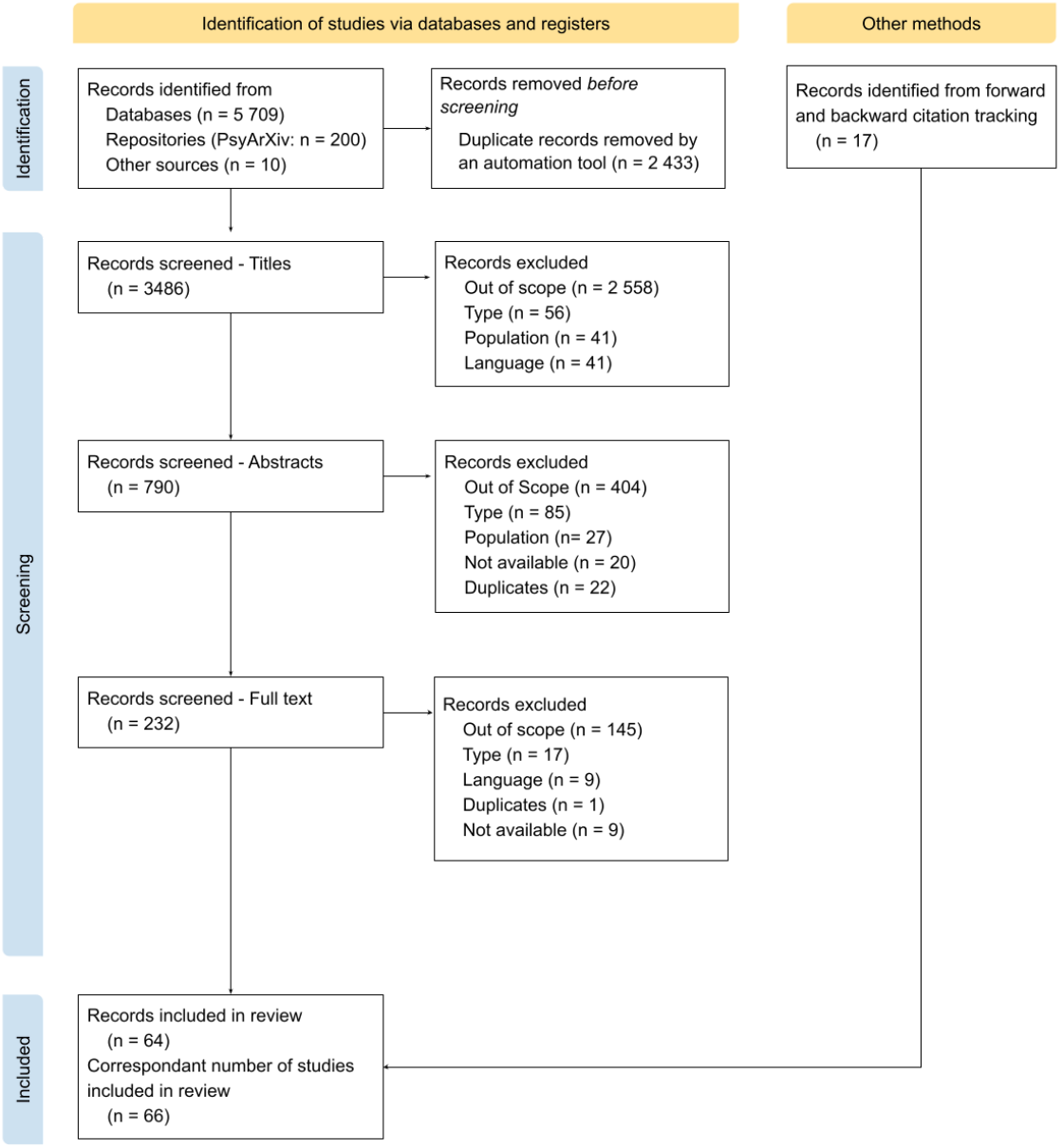


Figure 1. PRISMA flow chart reporting the systematic search and selection process for this review.

Study characteristics

In this section we provide descriptive quantitative analyses on the prevalence of various study characteristics among the reviewed sources. It should be noted that several studies investigate more than one type of conservation policies, or combine

different methodologies such that the reported percentages do not necessarily sum up to 100.

All reviewed studies were published between 1985 and 2024, with 79% of studies published after 2010 (Figure 2A). Most studies were conducted in North America and Europe (44% and 29% respectively), followed by Asia (17%). 17% of studies were conducted in regions defined as biodiversity hotspots, i.e. regions containing a high level of species diversity, many endemic species, and a significant number of threatened or endangered species (Myers et al., 2000) (Figure 2C). The most prevalent type of conservation policy studied was species management measures (47%) such as population control, followed by habitat protection policies (32%) such as protected areas, habitat restoration and revitalization measures (21%) and finally species (re)introduction (17%) (Figure 2F). Only 12% of studies presented participants with real policy scenarios under consideration by public authorities, while the rest used hypothetical policy scenarios (although often based on real-world policies or projects).

Regarding study methodology, all studies used a questionnaire survey to collect responses. Only 11% of studies used an experimental design, while 89% used observational designs (Figure 2D). All studies but one were cross-sectional. Sample sizes for our analyses of interest (i.e. the effect of psychological variables on conservation policy support) varied between 102 and 4183, with a median of 659 (Figure 2B). Policy support was measured using Likert scales of stated agreement in 61% of studies, willingness-to-pay tasks in 26% of studies, and policy choice tasks (e.g. conjoint experiments) in 20% of studies (Figure 2E). The most prevalent analysis method was regression models (75%), followed by group differences tests such as ANOVAs, t-tests, and chi-squared tests (15%) and finally correlation tests (12%).

Regarding quality assessment and risk of bias indicators, 42% of studies were rated as high quality using the MMAT criteria, 56% were rated as medium quality, and only one study was rated as low quality (see Supplementary Note 3). All published articles included in the review followed a peer-review process. None of the reviewed studies declared a conflict of interest. Turning to open practices, none of the reviewed studies were pre-registered, and only 20% provided available data. Additional analyses and data visualizations are provided in Supplementary Note 4.

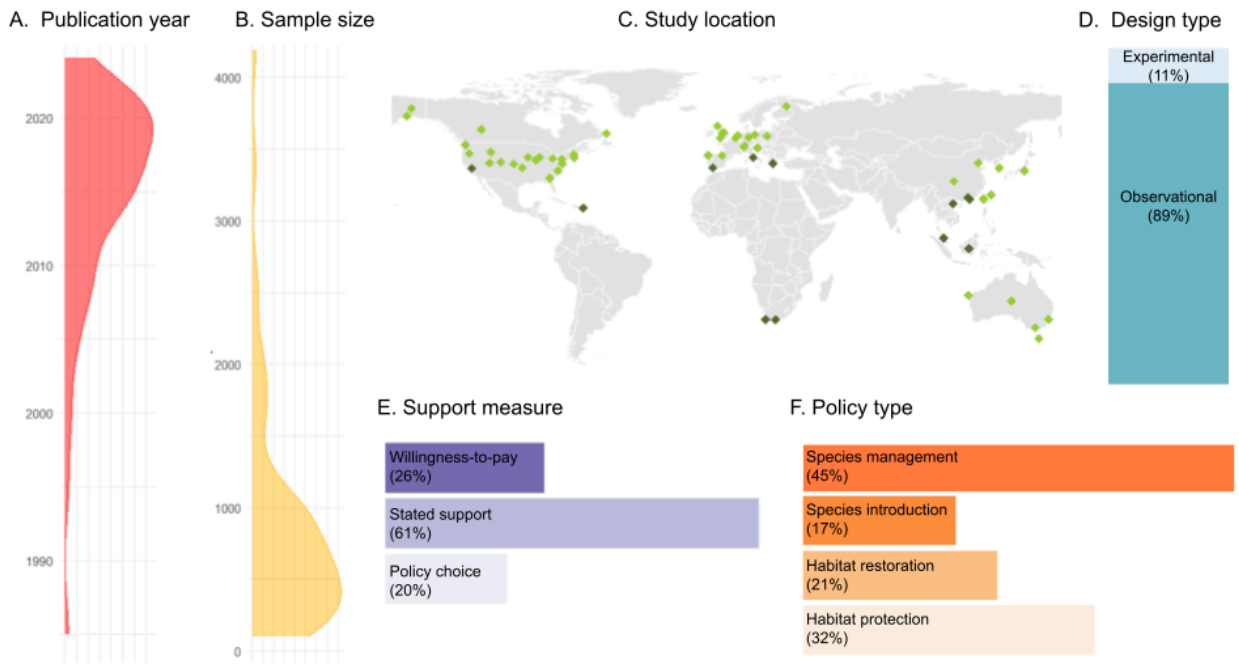


Figure 2. Representations of six study characteristics across the reviewed sources. **A.** Density plot showing the publication year distribution. **B.** Density plot showing the sample size distribution. **C.** World map depicting study location, with dark green diamonds corresponding to studies conducted in biodiversity hotspots (Myers et al., 2000). **D.** Barplot showing the prevalence of design types (observational or experimental). **E.** Barplot showing the prevalence of tasks used to measure policy support (stated support, willingness-to-pay, choice experiments). **F.** Barplot showing the prevalence

of policy types investigated (species management, species (re)introduction, habitat protection, habitat restoration). Note: several studies investigate more than one type of conservation policies, or use several support measures such that the reported percentages do not necessarily sum up to 100.

Psychological factors associated with conservation policy support

All psychological factors investigated as independent variables of conservation policy support in the reviewed studies were classified in the ten categories mentioned in the data analysis section. It is important to note that many sources study various categories of factors, as well as several variables within a category. Mental representations (i.e. beliefs, perceptions) was the psychological category that received the most attention from scholars (49% of the reviewed studies), followed by values (32%), knowledge (31%), preferences and attitudes (31%), recreational behavior (25%), sense of identity (22%), engagement (20%), emotions (20%), exposure (15%) and finally norms (9%).

In the sections below, we examine the quantitative findings regarding the relationship between psychological factors and conservation policy support for each of the ten psychological categories identified. Studies were numbered between 1 and 66 to facilitate referencing when synthesizing results (see Extended Table A for the full correspondence list). A summary table of all findings is provided in Table 1.

Values

Three main value types have been studied in the reviewed sources: wildlife value orientations (7,12,14,19,23,47,55,56,57,62,64,66), environmental value orientations (8,11,23,27,28,29,34,38,42,54), and general human values (34,35). Wildlife value orientations (WVOs) can be defined as value types reflecting concerns, beliefs and attitudes held about wildlife (Manfredo, 2009). WVOs are often clustered into two categories: mutualism/preservationism (considering that wildlife species are relatively equal to humans and possess an existence value) and domination/utilitarianism (considering that humans are superior to other animals and can use them for their benefit). Significant associations between WVOs and conservation policy support were found in ten studies out of twelve (7,12,14,23,47,55,56,57,64,66). Most often, participants scoring higher in mutualism or preservationism, and lower in domination or utilitarianism, display more support for restoration and recovery policies, and less support for policies which harm wildlife. However, in a study conducted in Switzerland, participants scoring higher in nature appreciation and lower in utilitarianism preferred more intensive interventions to remove invasive alien species (14). It is important to note that non-significant effects of WVOs on conservation support were also evidenced in several policy contexts (12,19,23,56,62,64,66).

Environmental value orientations are clusters of values reflecting concern, beliefs, and attitudes towards environmental issues (De Groot & Steg, 2007; Stern & Dietz, 1994). Most of the reviewed studies used a version of the biospheric-altruistic-egoistic model of environmental values in which biospherism (or ecocentrism) reflects a value of the environment for its own sake, altruism or anthropocentrism a value of the environment centered on the protection of humans,

and egoism a value of the environment based on self-interest (Schultz et al., 2005). In the reviewed studies, participants displaying a strong biospheric orientation usually showed more support for pro-conservation policies (8,23,29,34,42,54). Regarding the effect of altruistic values, most studies found non-significant results on conservation policy support (11,23,27,29,34). The pattern is mixed for egoistic values: depending on the studied policies, the effect is either positive (28,23), negative (27,29), or non-significant (11,23,34).

Finally, two studies investigated general human values such as traditionalism, openness to change, and self-transcendence, and reported mostly non-significant effects on pro-conservation support (34,35).

Representations

Six main categories of mental representations have been studied in the reviewed sources: perceived policy costs and impacts (3,11,16,19,45,46,51,53,58,62,63), beliefs about species or habitats (17,19,24,35,57,62), perception of conservation or environmental issues (4,16,35,54,57,61,65), risk perception (9,10,11,19,21,24,34,38,56), perceived behavioral control (18,22,30) and perceived trustworthiness of managers (53,58,62). Perceptions of policy cost and impacts was the most studied type of representational factors among the reviewed sources. Three studies out of four found significant negative effects of perceived policy cost on conservation policy support (3,46,66). Results are mixed regarding perceived policy impact: while six studies find only significant (positive) associations with policy support (11,46,58,62,63,66), six other studies report both significant and non-significant effects depending on the outcomes studied and the policies investigated (3,16,19,45,51,53). For example, the support of Burgeo residents for the designation of a National Marine

Conservation Area is significantly influenced by their belief that this policy will improve marine conservation and benefit economic development, but not by the perceived impact on industry and fishing activities (45).

Regarding beliefs about species or habitats, perceiving the target species as a personal problem or nuisance was found to be negatively correlated to pro-conservation policy support in all relevant studies (19,24,57). Perception of species (or area) beauty was a non-significant predictor of policy support in two studies (19,62), while another study found that it lowered support for invasive plant species removal in Switzerland (17). Finally, anthropomorphism (i.e. attributing human characteristics to non-human species) decreased support for lethal control as a management policy for native and non-native species in Germany (35).

Turning to the perception of conservation issues, studies investigating the perceived importance of biodiversity and its benefits for humans (i.e. ecosystems services) found both significant and non-significant results on conservation support depending on the benefits studied (4,16). For example, in a study conducted in Finland, participants who perceived the importance of boreal forest streams to mitigate floods showed more support for a forest stream restoration program, but the importance attributed to species' protection was not a significant predictor of policy support (16). On the other hand, participants who more strongly perceived negative consequences of a given species on ecosystems displayed higher support for population control of these species (35, 57, 61, 66), with only one study reporting a non-significant effect (65). Finally, believing that climate change is a serious problem and that governmental spending on land management is too low was found to increase support for ecosystem conservation policies in the US (54).

Regarding risk perception, most studies measured either whether non-human species (or ecosystems) are deemed at risk (19,21,34), or whether humans perceive threat from wildlife (9,10,11,19,24,38,56). The majority of studies investigating the belief that species and ecosystems are endangered or vulnerable found significant evidence that risk perception is positively correlated to conservation policy support (19,21,34). On the other hand, mixed results were evidenced regarding the belief that wildlife threatens humans and their livelihood: threat perception significantly lowers pro-conservation support in some policy contexts (11,24,38,56), while it is not a significant predictor in others (9,10,11,19,56). Interestingly, perceiving threat on one's livelihood from grizzly bear reintroduction in California was negatively associated with support for this policy, while perceiving threat on one's safety was not a significant predictor (11).

Three studies investigated the effect of perceived behavioral control or agency (i.e. the evaluation of the difficulty or ease of performing a certain action) on conservation policy support. Perceived behavioral control or agency in this context refers to one's perceived ability to take an active part in conservation, for example through payment, participation in public hearing or involvement in the policy process. Two studies found positive associations between perceived behavioral control and pro-conservation policy support (22,30), but a study conducted in Spain found a null effect on support for an annual household tax financing park conservation (18).

Finally, all studies measuring the effect of perceived trustworthiness of conservation managers found significant positive associations with pro-conservation policy support (53,58,62).

Norms

Two main types of norms have been studied in the reviewed sources: moral norms (18,19,27,40,62) and social norms (18,30). Moral norms refer to a sense of personal obligation and responsibility about environmental protection, while social norms (also named subjective or personal norms) reflect the perception of other people's attitudes towards environmental protection. Among the studies investigating moral norms, all found a positive significant association with pro-conservation policy support (18,19,27,40,62). Among the studies measuring social norms, the evidence is mixed: one study did not find any significant association with support for the conservation of an urban park (18), while another study found a significant positive association with public support for protected area expansion (30).

Knowledge

Two main types of knowledge variables have been investigated in relation to conservation policy support: knowledge about species (1,2,9,10,11,14,17,35,52), and knowledge about conservation or environmental issues (4,21,26,27,31,32,33,34,39,44). Among the sources studying species knowledge (e.g. taxonomic knowledge, knowledge about nativity), the evidence is mixed: four studies report non-significant results (1,9,10,52) while five studies report positive associations with pro-conservation policy support (2,11,14,17,35). Among the sources investigating conservation and environmental knowledge (e.g. knowledge of protected areas, awareness of habitat loss, knowledge of ecosystem services), positive associations with pro-conservation policy support were evidenced in seven studies out of ten (26,27,31,32,34,39,44).

Emotions

Three main types of emotions have been studied in the reviewed sources: emotions toward target species or habitats (15,24,25,35,38,43,55,59,63), emotions towards conservation issues (20,44), and individual emotional states (3,22). For the first category, three studies found that general positive (or negative) emotions towards species were negatively (or positively) associated with support for policies that harm wildlife (24,35,59). Six other studies focused on specific emotions, the majority of which evidenced significant associations between the emotion targeted/studied and policy support. Three studies found significant negative associations between fear of species and support for species conservation (25,38,55) although results vary across species and policies. One study found a significant effect of anger towards wolves on public support for different wolf management options (43), whereas only non-significant effects of anger on policy support were observed in two other studies (25,38). Finally, specific positive feelings towards species and ecosystems such as sympathy, joy, and attachment were significantly associated with conservation policy support (15,25,43). Turning to conservation-related emotions, passion and concern for nature conservation were found to positively predict pro-conservation support (20,44). Finally, the evidence is mixed for the effect of individual emotional states: while feelings of safety and lack of worry positively correlated with support for protection policies (22), happiness and general financial concern were not significant predictors (3,22).

Preferences and attitudes

Two main types of preferences and evaluative attitudes were investigated: attitudes or preferences towards species (1,9,10,20,50,59,61), and general policy attitudes

(5,6,15,18,21,27,30,33,40,46,48,52,58,63). All seven studies exploring the effect of attitudes towards species found a significant association with conservation policy support (1,9,10,20,50,59,61), such that positive attitudes towards the target species predicted higher support for this species' protection/restoration and lower support for policies harming this species (e.g. lethal control). Regarding general policy attitudes (e.g. satisfaction with current policies, general opinion about conservation strategies), eleven studies out of fourteen found significant effects on support for specific conservation policies (5,6,15,19,21,27,33,40,46,48,63). However, non-significant effects of attitudes towards existing conservation measures (e.g. satisfaction with protected area management, opinion on current crop protection policies) on the support for new policy scenarios were also reported (30,52,58).

Sense of identity

Two types of identity-related factors have been studied in the reviewed sources: place identity (1,5,6,8,15,36), and group identity (6,11,19,21,33,34,41,61). We here define place identity as a feeling of connection and identification to a location/territory/environment and group identity as an identification to various social and political groups (e.g. farmers, environmentalists, liberals, conservatives). Positive associations between local place identity (e.g. identification with local rivers, peatlands or townships) and pro-conservation policy support were found in all relevant studies (8,15,36). National identification, on the other hand, was not a strong predictor of support for forest logging in Poland (5,6). Finally, the effect of identifying with the natural environment in general (i.e. nature-relatedness) on conservation policy support was mixed: while one study conducted in the USA evidenced a positive association

between identification with nature and support for open space conservation (36), two studies reported non-significant effects of nature-relatedness on policy support (1,51).

Turning to group identity, significant associations between socio-environmental identity (e.g. agricultural, environmental, conservationist) and policy support were evidenced in the two relevant studies (41,61), such that participants identifying as farmers were more supportive of wildlife control actions than environmentalists or conservationists. Besides, among the six studies on political identity, four found it to be a significant determinant of conservation policy support (6,19,21,33), such that participants identifying as left-wing (e.g. liberals, democrats) display more support for pro-conservation policies than participants identifying as right-wing (e.g. conservatives, republicans).

Engagement

The vast majority of sources studying engagement-related factors focus on environmental engagement (1,2,9,10,13,17,32,38,39,51,58,66), such as belonging to an environmentalist or conservationist organization, as well as supporting or participating in environmental initiatives. Among these sources, the evidence is mixed: significant positive associations with pro-conservation policy support have been found (2,13,32,38,39,51,58), but also many non-significant effects (1,9,10,17,38,39,51,66). One study investigated political engagement in the form of voting participation and reported a non-significant effect on participants' support for establishing wildlife areas and refuges (34). Finally, one study investigating support for orangutan protection policies in both Malaysia and Indonesia found no significant effect of a composite score assessing participation in a range of organizations (e.g. religious, political, cultural, environmental) (22).

Exposure

Two types of exposure-related factors have been studied in the reviewed sources: familiarity with wild animals and natural habitats (2,13,19,20,32,52,54,56), and exposure to domesticated species (9,10,66). The effect of familiarity with wildlife and wilderness (e.g. having seen or heard wild species in one's proximate environment, living near natural habitats) on conservation policy support is mixed. While some significant associations between familiarity with species and policy support have been evidenced (20,32,54), many non-significant effects have also been reported (2,13,19,52,54,56). Finally, no significant associations between exposure to domestic animals (i.e. owning pets and/or livestock) and conservation policy support were found in all relevant studies (9,10,66).

Recreational behavior

Two main types of recreational behavior have been studied in the reviewed sources: visits to natural areas and conservation parks (20,27,32,34,40,49,51) and taking part in nature-related activities such as hunting, fishing, birdwatching, hiking or gardening (1,9,10,13,14,37,40,54,56,60,66). Focusing first on area visiting, five sources out of seven found significant associations with conservation policy support (20,27,32,40,49). While most associations are positive, one study found that Australians were less likely to support wildlife management policies within the Ningaloo marine park if they had visited it or other marine parks before (32). Regarding nature-related activities, a vast majority of non-significant effects on conservation policy support were reported in the reviewed sources (1,9,10,13,37,40,54,56,60,66). Exceptions include some significant associations between hunting and conservation support varying in direction depending on the

studied policies (1,56,60,66), and a positive association between gardening and support for invasive species management in Switzerland (14).

	Minority of significant results	Mixed results	Majority of significant results
High evidence	Nature-related activities	Environmental value orientations	Wildlife value orientations
		Perceived policy costs and impacts	Knowledge about conservation and environmental issues
		Environmental engagement	General policy judgments
Medium evidence	Familiarity with wild species and habitats	Risk perception	Moral norms
		Beliefs about conservation and environmental issues	Attitudes and preferences towards species
		Knowledge about species	Beliefs about species and habitats
		Place identity	Emotions towards species and habitats
			Socio-political identity
			Visits to natural areas and conservation parks
Low evidence	General human values	Individual emotional states	Perceived trustworthiness of wildlife managers
	Exposure to domesticated species	Social norms	Emotions towards conservation issues
			Perceived behavioural control

Table 1. Summary findings of psychological factors investigated in relation to conservation policy support among the 66 reviewed studies, classified along two dimensions: association strength (majority/minority of significant results: more/less studies reporting significant results than studies reporting non-significant results with a difference greater or equal to 2, mixed results: equal number of studies reporting significant and non-significant results, or differing by 1) and evidence strength (low evidence: less than 5 studies, medium evidence: between 5 and 9 studies, high evidence: 10 or more studies).

4. Conclusion and discussion

This systematic scoping review analyzed findings from 66 empirical studies measuring associations between psychological factors and support for conservation policies. This review first provided relevant insights regarding the characteristics of the studies belonging to this research field. A vast majority of the reviewed sources were published after 2010, with many studies published after 2020. This shows that studying psychological determinants of conservation policy support is a relatively recent research focus. A majority of studies were conducted in North America and Western Europe, demonstrating an imbalance towards specific societies. Survey questionnaires were the only methodology used in the reviewed sources, with an overwhelming majority of cross-sectional observational designs. As a result, findings from this research field are mostly correlational and more research is needed to establish causal relationships between psychological factors and conservation policy support.

Turning to the identification of psychological factors investigated in relation with conservation policy support, we found that the most studied factors were mental representations (i.e. beliefs, perceptions), present in half of the reviewed sources, and that normative factors were the least studied. Interestingly, cognitive biases (such as loss aversion, time discounting or confirmation bias) and personality traits (such as conscientiousness or neuroticism) have not yet received attention from scholars and thus constitute knowledge gaps to be addressed. Within the categories of psychological factors covered by the existing literature, this review also highlighted the large diversity of constructs investigated, ranging from risk perception to wildlife value

orientations and place identity. Policy contexts were also extremely varied, covering support for protected area expansion, river revitalization and invasive species management to cite but a few examples. The diversity of policy situations and psychological mechanisms investigated in the reviewed sources allow for a broad understanding and generalization of policy support determinants across different contexts.

By focusing on quantitative studies, this review allows to determine which psychological factors are statistically associated with conservation policy support. Results for the various psychological factors identified in this review can be differentiated along two dimensions: evidence strength (i.e. the number of studies testing a given factor), and association strength (i.e. whether a majority or a minority of significant effects were found, or whether findings are mixed), as visualized in Table 1. Among the factors with high evidence strength (at least ten relevant studies), wildlife value orientations, knowledge about conservation or environmental issues, and general policy attitudes were found to be highly associated with conservation policy support. Results for environmental value orientations, perceived policy costs and impacts, and environmental engagement, were mixed. Finally, engaging in nature-related activities (e.g. fishing, hunting, birdwatching) was most often a non-significant predictor of conservation policy support. Turning to factors with medium evidence strength (between five and nine relevant studies), moral norms and positive attitudes towards target species were always associated with higher conservation policy support. Beliefs about species, emotions towards species, socio-political identity, and visits to natural areas or conservation parks were also consistent predictors of conservation policy support. Results were mixed for risk perception, beliefs about conservation and the environment, knowledge about species

and place identity. Finally, a majority of non-significant effects were reported regarding familiarity with wildlife and exposure to domesticated species. All other psychological factors identified in this review present a low level of evidence strength. Hence, more research is needed to draw robust conclusions about their relationship towards conservation policy support.

Some of the results obtained in this review are in line with those obtained in reviews investigating the determinants of public support for environmental domains other than conservation (Drews & van den Bergh, 2016; Ejelöv & Nilsson, 2020), such as the importance of moral norms, political identity and knowledge about environmental issues. On the other hand, some psychological factors that were found to be significant predictors of policy support in other domains do not display consistent effects regarding conservation policy support, such as risk perception, environmental value orientations and perceived policy impacts. Finally, some psychological factors are specific to the literature about conservation policies, such as wildlife value orientations or visits to natural areas and conservation parks.

We hope that insights from this review can inform policy-making by better integrating citizens' perceptions, preferences, experiences and behaviors into the design and implementation of effective conservation policies. For instance, given that knowledge about environmental and conservation issues is a robust predictor of conservation policy support, the integration of such knowledge into educational programs or campaigns could be a relevant avenue for policy-makers.

Pre-registration. This scoping review was pre-registered at https://osf.io/fqzvx/.

Data and code availability. Data and analysis code to reproduce the presented analyses are available at https://osf.io/fqzvx/.

Financial disclosure. This work was supported by the French National Research Agency (ANR-17-EURE-0017 to Frontiers in Cognition, ANR-10-IDEX-0001-02 to Paris Sciences & Lettres, ANR-21-CE28-0016-01 to HM and ANR-21-CE28-0009 to CC). The funders had no role in the review methodology, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests. The authors have declared that no competing interests exist.

Extended Table A. References of all included studies and correspondent identification number

ID	Reference of the study (APA)
1	Alif, Ž., Crees, J. J., White, R. L., Quinlan, M. M., Kennerley, R. J., Dando, T. R., & Turvey, S. T. (2023). Understanding local knowledge and attitudes toward potential reintroduction of a former British wetland bird. *People and Nature*, *5*(4), 1220–1233.
2	Buteau, R. J., Urbanek, R. E., & Dumas, C. (2022). Public interactions, attitudes, and conflict regarding management of a "novel" urban species. *Human Dimensions of Wildlife*, *27*(1), 16–31.
3	Chen, W. Y., Aertsens, J., Liekens, I., Broekx, S., & De Nocker, L. (2014). Impact of Perceived Importance of Ecosystem Services and Stated Financial Constraints on Willingness to Pay for Riparian Meadow Restoration in Flanders (Belgium). *Environmental Management*, *54*(2), 346–359.
4	Chen, W. Y., & Jim, C. Y. (2010). Resident Motivations and Willingness-to-Pay for Urban Biodiversity Conservation in Guangzhou (China). *Environmental Management*, *45*(5), 1052–1064.
5	Cislak, A., Wojcik, A. D., & Cichocka, A. (2018). Cutting the forest down to save your face: Narcissistic national identification predicts support for anti-conservation policies. *Journal of Environmental Psychology*, *59*, 65–73. [Study 2]
6	Cislak, A., Wojcik, A. D., & Cichocka, A. (2018). Cutting the forest down to save your face: Narcissistic national identification predicts support for anti-conservation policies. *Journal of Environmental Psychology*, *59*, 65–73. [Study 3]
7	Dietsch, A. M., Teel, T. L., & Manfredo, M. J. (2016). Social values and biodiversity conservation in a dynamic world. *Conservation Biology*, *30*(6), 1212–1221.
8	Faccioli, M., Czajkowski, M., Glenk, K., & Martin-Ortega, J. (2020). Environmental attitudes and place identity as determinants of preferences for ecosystem services. *Ecological Economics*, *174*, 106600.
9	Greenspan, E., Giordano, A. J., Nielsen, C. K., Sun, N. C.-M., & Pei, K. J.-C. (2020). Evaluating Support for Clouded Leopard Reintroduction in Taiwan: Insights from Surveys of Indigenous and Urban Communities. *Human Ecology*, *48*(6), 733–747. [Urban sample study]
10	Greenspan, E., Giordano, A. J., Nielsen, C. K., Sun, N. C.-M., & Pei, K. J.-C. (2020). Evaluating Support for Clouded Leopard Reintroduction in Taiwan: Insights from Surveys of Indigenous and Urban Communities. *Human Ecology*, *48*(6), 733–747. [Rural sample study]
11	Hiroyasu, E. H. T., Miljanich, C. P., & Anderson, S. E. (2019). Drivers of support: The case of species reintroductions with an ill-informed public. *Human Dimensions of Wildlife*, *24*(5), 401–417.
12	Jacobs, M. H., Vaske, J. J., & Sijtsma, M. T. J. (2014). Predictive potential of wildlife value orientations for acceptability of management interventions. *Journal for Nature Conservation*, *22*(4), 377–383.
13	Johnston, R. J., Opaluch, J. J., Magnusson, G., & Mazzotta, M. J. (2005). Who are resource nonusers and what can they tell us about nonuse values? Decomposing user and nonuser willingness to pay for coastal wetland restoration. *Water Resources Research*, *41*(7).
14	Junge, X., Hunziker, M., Bauer, N., Arnberger, A., & Olschewski, R. (2019). Invasive Alien Species in Switzerland: Awareness and Preferences of Experts and the Public. *Environmental Management*, *63*(1), 80–93.
15	Lee, F. Y. S., Ma, A. T. H., & Cheung, L. T. O. (2021). Resident Perception and Willingness to Pay for the Restoration and Revitalization of Urban Rivers. *Water*, *13*(19), 2649.
16	Lehtoranta, V., Sarvilinna, A., Väisänen, S., Aroviita, J., & Muotka, T. (2017). Public values and preference certainty for stream restoration in forested watersheds in Finland. *Water Resources and Economics*, *17*, 56–66.

17	Lindemann-Matthies, P. (2016). Beasts or beauties? Laypersons' perception of invasive alien plant species in Switzerland and attitudes towards their management. *NeoBiota*, *29*, 15–33.
18	López-Mosquera, N., García, T., & Barrena, R. (2014). An extension of the Theory of Planned Behavior to predict willingness to pay for the conservation of an urban park. *Journal of Environmental Management*, *135*, 91–99.
19	Lute, M. L., & Attari, S. Z. (2017). Public preferences for species conservation: Choosing between lethal control, habitat protection and no action. *Environmental Conservation*, *44*(2), 139–147
20	Ma, K., Liu, D., Wei, R., Zhang, G., Xie, H., Huang, Y., Li, D., Zhang, H., & Xu, H. (2016). Giant panda reintroduction: Factors affecting public support. *Biodiversity and Conservation*, *25*(14), 2987–3004.
21	Manson, P., Nielsen-Pincus, M., Granek, E. F., & Swearingen, T. C. (2021). Public perceptions of ocean health and marine protection: Drivers of support for Oregon's marine reserves. *Ocean & Coastal Management*, *201*, 105480.
22	Massingham, E. J., Wilson, K. A., Meijaard, E., Ancrenaz, M., Santika, T., Friedman, R., Possingham, H. P., & Dean, A. J. (2023). Public opinion on protecting iconic species depends on individual wellbeing: Perceptions about orangutan conservation in Indonesia and Malaysia. *Environmental Science & Policy*, *150*, 103588.
23	Matzek, V., & Wilson, K. A. (2021). Public support for restoration: Does including ecosystem services as a goal engage a different set of values and attitudes than biodiversity protection alone? *PLOS ONE*, *16*(1), e0245074.
24	Mormile, J., & Hill, C. (2016). Living With Urban Baboons: Exploring Attitudes and Their Implications for Local Baboon Conservation and Management in Knysna, South Africa. *Human Dimensions of Wildlife*, *22*.
25	Notaro, S., Mastrogregori, G., & Paletto, A. (2023). People's perceptions and willingness to pay to protect saproxylic species in Alpine production forests. *Journal for Nature Conservation*, *76*, 126514.
26	Novoa, A., Dehnen-Schmutz, K., Fried, J., & Vimercati, G. (2017). Does public awareness increase support for invasive species management? Promising evidence across taxa and landscape types. *Biological Invasions*, *19*(12), 3691–3705.
27	Obeng, E. A., & Aguilar, F. X. (2018). Value orientation and payment for ecosystem services: Perceived detrimental consequences lead to willingness-to-pay for ecosystem services. *Journal of Environmental Management*, *206*, 458–471.
28	Ojea, E., & Loureiro, M. L. (2007). Altruistic, egoistic and biospheric values in willingness to pay (WTP) for wildlife. *Ecological Economics*, *63*(4), 807–814.
29	Park, J. J., Jorgensen, A., Selman, P., & Swanwick, C. (2008). Relationships between Environmental Values and the Acceptability of Mobile Telecommunications Development in a Protected Area. *Landscape Research*, *33*(5), 587–604.
30	Park, S., Zielinski, S., Jeong, Y., & Kim, S. (2020). Factors Affecting Residents' Support for Protected Area Designation. *Sustainability*, *12*(7), 2800
31	Richards, D. R., Warren, P. H., Maltby, L., & Moggridge, H. L. (2017). Awareness of greater numbers of ecosystem services affects preferences for floodplain management. *Ecosystem Services*, *24*, 138–146.
32	Rogers, A. A. (2012). Conservation values and management preferences for the Ningaloo Marine Park: a discrete choice experiment.
33	Safford, T. G., Norman, K. C., Henly, M., Mills, K. E., & Levin, P. S. (2014). Environmental Awareness and Public Support for Protecting and Restoring Puget Sound. *Environmental Management*, *53*(4), 757–768.
34	Sanderson, M. R., Bergtold, J. S., Heier Stamm, J. L., Caldas, M. M., & Ramsey, S. M. (2017). Bringing the "social" into sociohydrology: Conservation policy support in the Central Great Plains of Kansas, USA. *Water Resources Research*, *53*(8), 6725–6743.

35	Straka, T. M., Bach, L., Klisch, U., Egerer, M. H., Fischer, L. K., & Kowarik, I. (2022). Beyond values: How emotions, anthropomorphism, beliefs and knowledge relate to the acceptability of native and non-native species management in cities. *People and Nature*, *4*(6), 1485–1499.
36	Swim, J. K., Zawadzki, S. J., Cundiff, J. L., & Lord, B. (2014). Environmental Identity and Community Support for the Preservation of Open Space. *Human Ecology Review*, *20*(2), 133–155.
37	Symmank, L., Profeta, A., & Niens, C. (2021). Valuation of river restoration measures – Do residential preferences depend on leisure behaviour? *European Planning Studies*, *29*(3), 580–600.
38	Tam, J., & McDaniels, T. L. (2013). Understanding individual risk perceptions and preferences for climate change adaptations in biological conservation. *Environmental Science & Policy*, *27*, 114–123.
39	Tavárez, H., Abelleira, O., & Elbakidze, L. (2024). Environmental awareness and willingness to pay for biodiversity improvement in Puerto Rico. *Journal of Environmental Studies and Sciences*, *14*(1), 154–166.
40	Tokunaga, K., Sugino, H., Nomura, H., & Michida, Y. (2020). Norms and the willingness to pay for coastal ecosystem restoration: A case of the Tokyo Bay intertidal flats. *Ecological Economics*, *169*, 106423.
41	van Eeden, L. M., Newsome, T. M., Crowther, M. S., Dickman, C. R., & Bruskotter, J. (2019). Social identity shapes support for management of wildlife and pests. *Biological Conservation*, *231*, 167–173.
42	Vaske, J. (1999). A Value-Attitude-Behavior Model Predicting Wildland Preservation Voting Intentions. *Society & Natural Resources*, *12*(6), 523–537.
43	Vaske, J. J., Roemer, J. M., & Taylor, J. G. (2013). Situational and emotional influences on the acceptability of wolf management actions in the Greater Yellowstone Ecosystem. *Wildlife Society Bulletin*, *37*(1), 122–128.
44	Vo Trung, H., Viet Nguyen, T., & Simioni, M. (2020). Willingness to pay for mangrove preservation in Xuan Thuy National Park, Vietnam: Do household knowledge and interest play a role? *Journal of Environmental Economics and Policy*, *9*(4), 402–420.
45	Ward, B. M., Doney, E. D., Vodden, K., & Bath, A. J. (2018). The importance of beliefs in predicting support for a South Coast National Marine Conservation Area in Newfoundland and Labrador, Canada. *Ocean & Coastal Management*, *162*, 6–12.
46	Whittaker, D., Manfredo, M. J., Fix, P. J., Sinnott, R., Miller, S., & Vaske, J. J. (2001). Understanding Beliefs and Attitudes about an Urban Wildlife Hunt near Anchorage, Alaska. *Wildlife Society Bulletin (1973-2006)*, *29*(4), 1114–1124.
47	Whittaker, D., Vaske, J. J., & Manfredo, M. J. (2006). Specificity and the Cognitive Hierarchy: Value Orientations and the Acceptability of Urban Wildlife Management Actions. *Society & Natural Resources*, *19*(6), 515–530.
48	Wywialowski, A. P., & Dahlgren, R. B. (1985). Beliefs about Wildlife Management among Iowans with Differing Attitudes toward Hunting. *Wildlife Society Bulletin (1973-2006)*, *13*(3), 328–332.
49	Xi, Z., Xu, W., & Wei, Q. (2018). Value attributes and user preferences for the coastal wetland ecosystem in Caofeidian, China. *IOP Conference Series: Materials Science and Engineering*, *392*, 042017.
50	Sponarski, C. C., Vaske, J. J., Bath, A. J., & Musiani, M. (2014). Salient values, social trust, and attitudes toward wolf management in south-western Alberta, Canada. *Environmental Conservation*, *41*(4), 303–310.
51	Gobster, P. H., Floress, K., Westphal, L. M., Watkins, C., Vining, J., & Wali, A. (2016). Resident and user support for urban natural areas restoration practices. *Biological Conservation*, *203*, 216–225.
52	Vincenot, C. E., Collazo, A. M.,Wallmo, K. & Koyama, L. (2015). Public awareness and perceptual factors in the conservation of elusive species: The case of the endangered Ryukyu flying fox. *Global Ecology and Conservation*, *3*, 526–540.

53	Fulton, D. C., Skerl, K., Shank, E. M., & Lime, D. W. (2004). Beliefs and Attitudes toward Lethal Management of Deer in Cuyahoga Valley National Park. *Wildlife Society Bulletin (1973-2006)*, *32*(4), 1166–1176.
54	Shanahan, E. A., Raile, E. D., Naughton, H. T., Wallner, M. P. & Houghton, K. A. (2020). *Public opinion about management strategies for a low-profile species across multiple jurisdictions: Whitebark pine in the northern Rockies*. *2*(3), 784–796.
55	Doney, E. D., Vaske, J. J., Bath, A. J., Engel, M. T. & Downer, B. R. (2020). Predicting acceptance of lethal management of wood bison in Alaska, USA. *AMBIO: A Journal of the Human Environment*, *49*(1), 271–280.
56	Agee, J. D., & Miller, C. A. (2009). Factors contributing toward acceptance of lethal control of black bears in central Georgia, USA. *Human Dimensions of Wildlife*, *14*(3), 198-205.
57	Loyd, K. A. T. & Miller, C. A. (2010). Influence of Demographics, Experience and Value Orientations on Preferences for Lethal Management of Feral Cats. *Human Dimensions of Wildlife*, *15*(4), 262–273.
58	Nastran, M., & Istenič, M. Č. (2015). Who Is For or Against the Park? Factors Influencing the Public's Perception of a Regional Park: A Slovenian Case Study. *Human Ecology Review*, *21*(2).
59	Vaske, J. J., Miller, C. A., Pallazza, S. G., & Williams, B. A. (2021). Attitudes and emotions as predictors of support for wolf management. *Journal of Environmental Psychology*, *78*, 101695.
60	Donnelly, M. P., & Vaske, J. J. (1995). Predicting attitudes toward a proposed moose hunt. *Society & Natural Resources*, *8*(4), 307–319.
61	Bruskotter, J., Vaske, J., & Schmidt, R. (2009). Social and Cognitive Correlates of Utah Residents' Acceptance of the Lethal Control of Wolves. *Human Dimensions of Wildlife*, *14*, 119–132.
62	Ford, R. M., Williams, K. J. H., Smith, E. L. & Bishop, I. D. (2014). Beauty, Belief, and Trust: Toward a Model of Psychological Processes in Public Acceptance of Forest Management. *Environment and Behavior*, *46*(4), 476–506.
63	Wilson, R. S., & Bruskotter, J. T. (2009). Assessing the Impact of Decision Frame and Existing Attitudes on Support for Wolf Restoration in the United States. *Human Dimensions of Wildlife*, *14*(5), 353–365.
64	Kontsiotis, V. J., Triantafyllidis, A., Telidis, S.,, Eleftheriadou, I. & Liordos, V. (2021). The Predictive Ability of Wildlife Value Orientations for Mammal Management Varies with Species Conservation Status and Provenance. *Sustainability*, *13*(20), 11335.
65	García-Llorente, M., Martín-López, B., Nunes, P. A., González, J. A., Alcorlo, P., & Montes, C. (2011). Analyzing the social factors that influence willingness to pay for invasive alien species management under two different strategies: eradication and prevention. *Environmental management*, *48*, 418-435..
66	Boulet, M., Borg, K., Faulkner, N., & Smith, L. (2021). Evenly split: Exploring the highly polarized public response to the use of lethal methods to manage overabundant native wildlife in Australia. *Journal for Nature Conservation*, *61*, 125995.

5. Supplementary information

Contents:

Supplementary Note 1 - Search queries

To explore our primary research questions, the search query was divided in three parts :

a) Terms relating to behavioral, affective and cognitive factors (i.e. psychological factors), which are generic instances encompassing several psychological mechanisms (eg. beliefs, norms, heuristics). These terms were not included in the search on PsycINFO and PsyArXiv as a filter on psychological content is already applied in these registries.

b) Terms relating to public attitudes, acceptability and support.

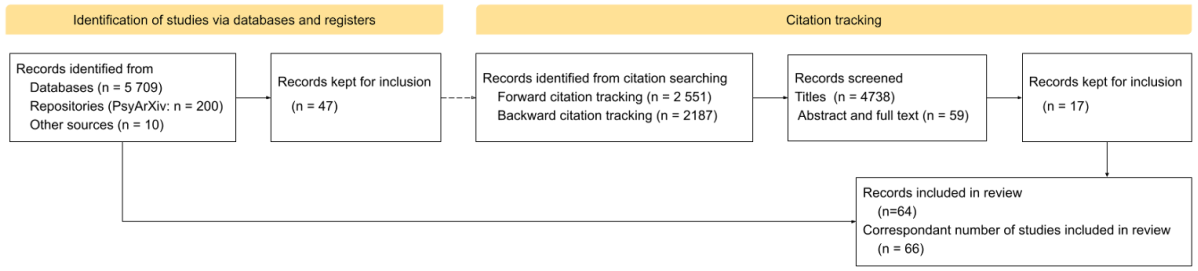
c) Terms relating to biodiversity and conservation measures, which are generic instances encompassing different species/areas (eg. wildlife, wilderness) and conservation policies (eg. restoration, protection).

We excluded terms which were too specific instances of each part mentioned above (eg. subcategories of affective factors such as anger or joy; subcategories of biodiversity domains such as primates or fungi), in order to encompass the diversity of psychological factors and conservation fields, and to limit selection biases. We also excluded terms that mainly retrieved results out of the scope of this review during the pilot stages, because they were too broad (e.g. "environment", "area") or polysemic (e.g. "nature", "activity", "management"). In order not to miss relevant sources using these terms, we performed a systematic citation-tracking process using the included sources from our database search (see Supplementary Note 2).

Database	Field	Search query	Number of results
Scopus	Title	TITLE((psych* OR behavio* OR cognit* OR bias* OR *percept* OR perceived OR mental OR heuristic* OR representation* OR belief* OR norms OR concern* OR value* OR knowledge OR identit* OR emotion* OR feeling* OR affects OR affective OR motivation* OR awareness OR engagement OR involvement OR judg*ment* OR experience*) AND (support OR accepta* OR preference* OR attitude* OR opinion* OR willingness OR views) AND (ecosystem OR biodivers* OR specie* OR wildlife OR wilderness) OR (conservation OR protect* OR restoration OR revitali* OR reintroduc* OR preservation))	1905
Web of Science	Title	(psych* OR behavio* OR cognit* OR bias* OR *percept* OR perceived OR mental OR heuristic* OR representation* OR belief* OR norms OR concern* OR value* OR knowledge OR identit* OR emotion* OR feeling* OR affects OR affective OR motivation* OR awareness OR engagement OR involvement OR judg*ment* OR experience*)	1915
	Title	AND (support OR accepta* OR preference* OR attitude* OR opinion* OR willingness OR views)	
	Title	AND (ecosystem OR biodivers* OR specie* OR wildlife OR wilderness) OR (conservation OR protect* OR restoration OR revitali* OR reintroduc* OR preservation)	
PsycInfo	Title	(support OR accepta* OR preference* OR attitude* OR opinion* OR willingness OR views)	1275
	Title	AND (ecosystem OR biodivers* OR specie* OR wildlife OR wilderness) OR (conservation OR protect* OR restoration OR revitali* OR reintroduc* OR preservation)	
PubMed	Title	("psych*"[Title] OR "behavio*"[Title] OR "cognit*"[Title] OR "bias*"[Title] OR "percept"[Title] OR "perceived"[Title] OR "mental"[Title] OR "heuristic*"[Title] OR "representation*"[Title] OR "belief*"[Title] OR "norms"[Title] OR "concern*"[Title] OR "value*"[Title] OR "knowledge"[Title] OR "identit*"[Title] OR "emotion*"[Title] OR "feeling*"[Title] OR "affects"[Title] OR "affective"[Title] OR "motivation*"[Title] OR "awareness"[Title] OR "engagement"[Title] OR "involvement"[Title] OR "judgment*"[Title] OR "judgement*"[Title] OR "experience*"[Title]) AND ("support"[Title] OR "accepta*"[Title] OR "preference*"[Title] OR "attitude*"[Title] OR "opinion*"[Title] OR "willingness"[Title] OR "views"[Title]) AND ("ecosystem"[Title] OR "biodivers*"[Title] OR "specie*"[Title] OR "wildlife"[Title] OR "wilderness"[Title] OR "conservation"[Title] OR "protect*"[Title] OR "restoration"[Title] OR "revitali*"[Title] OR "reintroduc*"[Title] OR "preservation"[Title])	568
ProQuest	Title	TITLE((psych* OR behavio* OR cognit* OR bias* OR percept* OR perceived OR mental OR heuristic* OR representation* OR belief* OR norms OR concern* OR value* OR knowledge OR identit* OR emotion* OR feeling* OR affects OR affective OR motivation* OR awareness OR engagement OR involvement OR judg*ment* OR experience*) AND (support OR accepta* OR preference* OR attitude* OR opinion* OR willingness OR views) AND (ecosystem OR biodivers* OR specie* OR wildlife OR wilderness) OR (conservation OR protect* OR restoration OR revitali* OR reintroduc* OR preservation))	46
PsyArXiV	No available filters	support , acceptance , acceptability, preference , attitude , opinion , willingness , views, ecosystem , biodiversity , species , wildlife , wilderness, conservation , protection, protected , restoration , revitalization , reintroduction , preservation	200

Supplementary Note 2 - Backward and forward citation-tracking

47 sources obtained through database and repository searching met the eligibility criteria and were used to perform a systematic backward and forward citation-tracking. For each source, all cited references (“forward”) and citing references (“backward”) were assessed using Research Rabbit, resulting in a total of 4738 references. A first screening stage using titles resulted in 59 sources being then screened using abstracts and full texts. Among them, 17 sources met the eligibility criteria and were included in the review.



Supplementary Note 3 - Quality assessment

To critically appraise the quality of the included sources, we used the Mixed Methods Appraisal Tool (MMAT, 2018), which assesses study quality with a list of evaluation criteria specific to study type (quantitative randomized study, cross-sectional observational study, etc). Each criterion is noted by affirmative or negative response, or ‘Can’t tell’. The ‘Can’t tell’ response category means that the reviewed source does not contain enough information to answer ‘Yes’ or ‘No’, or reports unclear information related to the criterion.

Criteria	Question
Quantitative randomized controlled trials study design	
Randomization	Is randomization appropriately performed?
Group comparability	Are the groups comparable at baseline?
Outcome data completeness	Is there complete outcome data?
Blinding	Are outcome assessors blinded to the group assignment?
Participant’s adherence	Did the participants adhere to the assigned intervention/condition?
Quantitative descriptive study design	
Sampling strategy	Is the sampling strategy relevant to address the research question?
Sample representativity	Is the sample representative of the target population?
Appropriate measurement	Are the measurements appropriate?
Risk of low response bias	Is the risk of nonresponse bias low?
Statistical analysis	Is the statistical analysis appropriate to answer the research question?

Table A. MMAT criteria for quantitative randomized controlled trials study designs and quantitative descriptive study design. As recommended, questions were adapted to reflect the standards and practices of the reviewed research field.

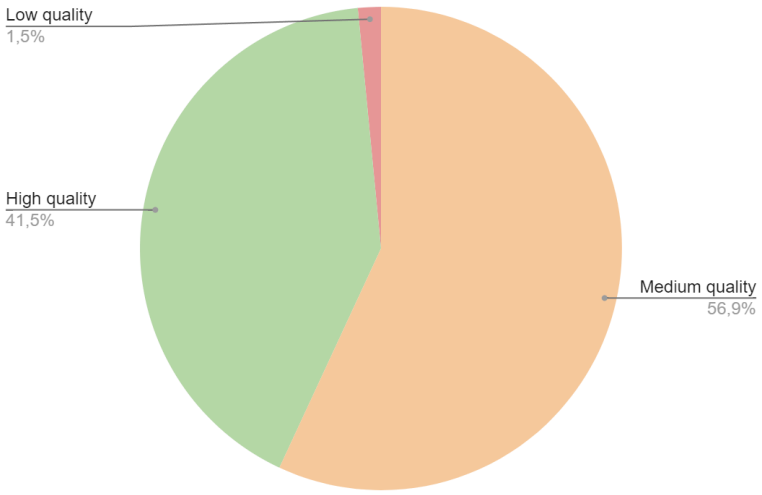


Figure A. Pie chart showing the prevalence of each quality category among the reviewed sources using the MMAT framework.

Supplementary Note 4 - Additional analyses and data visualizations regarding study characteristics

1. Additional data visualizations

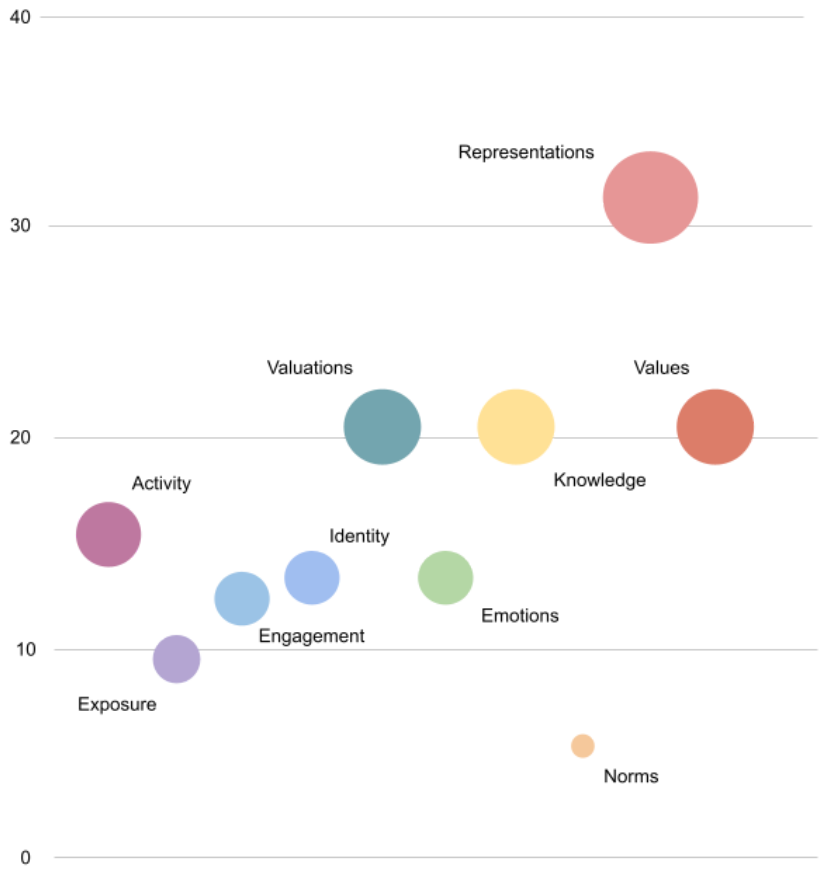


Figure A. Frequency of included studies per type of psychological factor investigated.

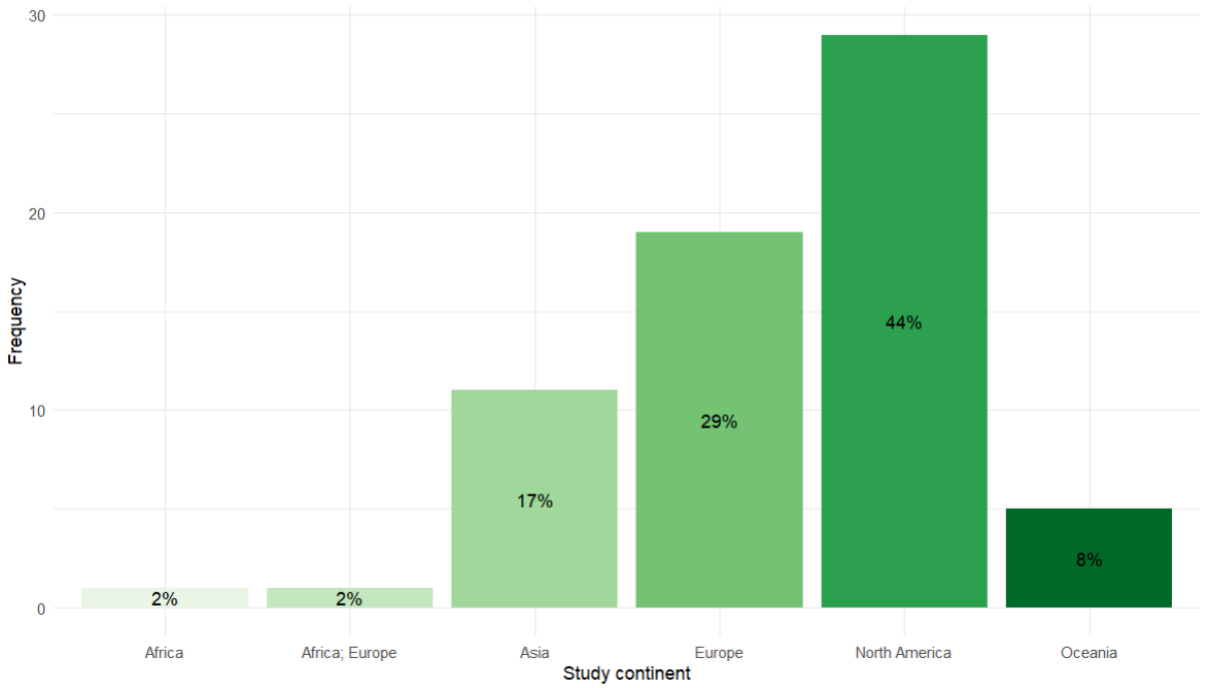


Figure B. Frequency of study locations per continental area in the reviewed sources.

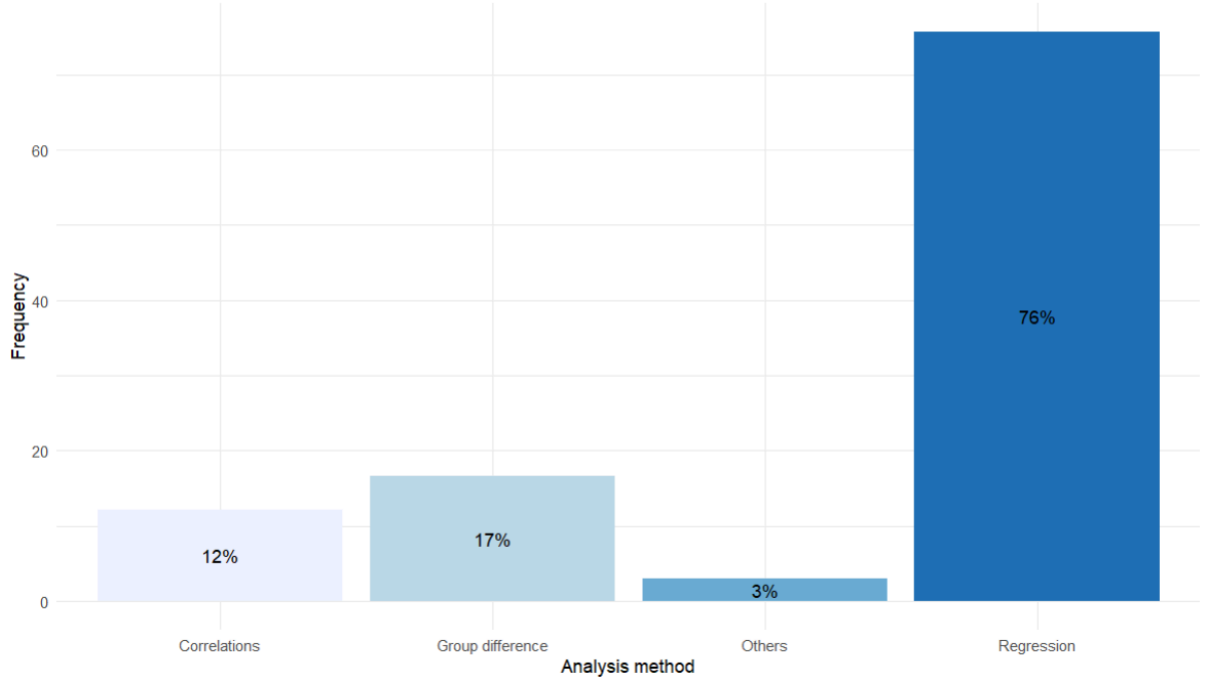


Figure C. Frequency of statistical analysis methods used across all included studies to test the effect of psychological variables on conservation policy support.

2. Additional analyses

Regarding data collection procedures, responses were mostly retrieved by postal format (38%), followed by online procedures (33%), face-to-face interviews (29%) and finally by telephone (5%). The most frequent sampling unit was the individual level (77%) but the household level was also used in several studies (23%).

General discussion

Overview, strengths and limitations

In this thesis, I have provided new empirical evidence that psychological factors play an important role in explaining public support for various environmental policies. In Chapter 1, I showed experimentally that mental accounting theory can both explain systematic patterns in citizens' preferences, such as the support for environmental earmarking, and help design an acceptable and socially fair carbon tax scheme. In Chapter 2, I demonstrated the causal impact of four policy misperceptions on public support for various temporary energy policies in the context of the recent energy crisis, and showed that a one-shot informational treatment could be an effective lever to counter these misperceptions in the UK at least. In Chapter 3, I systematically reviewed all empirical quantitative studies investigating psychological factors associated with conservation policy support using the PRISMA framework for scoping reviews. I found that wildlife value orientations, knowledge about environmental and conservation issues, as well as general policy attitudes were the psychological factors most robustly associated with conservation policy support. These three chapters demonstrate that adopting a cognitive science approach in order to better understand citizen preferences is a relevant perspective both for researchers and policy-makers.

The studies compiled in this dissertation present general strengths and limitations that I would like to discuss, in complement to the specific discussions of each chapter presented before. A major strength of all chapters is their rigorous methodology. Chapters 1 and 2 use a randomized experimental research design to

test causal relationships between several cognitive factors and environmental policy support. As underlined in the introduction and in the scoping review presented in Chapter 3, causal studies are still scarce in the literature about environmental policy support, even though they are very valuable in at least two ways. Research-wise, causal studies allow to test for directional hypotheses and limit potential confounds by directly manipulating the variables of interest using randomized treatments. Policy-wise, by determining which psychological variables are causal predictors of policy support, it is possible to design policy proposals that specifically address these factors and are thus more likely to align with actual citizens' preferences. Another methodological strength of Chapters 1 and 2 is that by employing a cross-cultural approach, they achieve a higher level of external validity and help detect heterogeneous effects across countries. Finally, by using large representative samples of the French and British population with regards to age and gender (and ethnicity in the UK), the results obtained are more likely to reflect population-wide preferences than if convenience samples had been used. Turning to Chapter 3, the systematic nature of the review constitutes an important methodological strength. Systematic reviews are methodologically superior to non-systematic reviews because they employ rigorous, transparent, and reproducible methods to minimize bias and therefore provide a more reliable and comprehensive evidence synthesis of a research field (Moher et al., 2009).

Another strength of all chapters is their focus on socially and politically relevant policies, chosen for their environmental effectiveness and their presence in recent public debates. For instance, Chapter 1 was directly inspired from the context of the Yellow Vest movement in France, and Chapter 2 from the ongoing energy crisis taking place in Europe since 2021. This focus on timely socio-political topics is in line with

the call for an impact-oriented approach of environmental psychology research (Nielsen, Clayton, et al., 2021; Nielsen, Cologna, et al., 2021).

Finally, by committing to open practices such as the systematic pre-registration of all research projects on public repositories, data sharing and reproducibility of all the presented analyses, this dissertation contributes to the movement of opening science to improve research quality and increase trust in scientific output.

The works presented in this dissertation are also subject to several limitations which could be addressed by future research. In all experimental studies that I conducted, as well as in many sources reviewed in Chapter 3, public support is measured through declarative questions of agreement with policy scenario proposals. This can have several consequences related to ecological validity. First, baseline levels of environmental policy support obtained in the presented studies may be higher than those obtained with similar non-declarative tasks, due to a social desirability bias (Larson, 2019) and the absence of salient decision costs (Bakaki & Bernauer, 2017). Future work could attempt to replicate the studies presented in this dissertation by measuring policy support with willingness-to-pay tasks or policy choice experiments, which are standard non-declarative alternatives used in the literature to measure policy support (Kotchen et al., 2013; Wicki et al., 2020). It is important to note, however, that overestimated support baselines would not impact the internal validity of reported findings as the studies presented in this dissertation rely on variations in support, and not absolute values.

Second, although participant samples used in the presented experimental studies were representative of the general population with regards to age and gender, there may be sampling biases regarding socioeconomic status, education level or

political ideology that could limit the generalizability of the experimental results obtained. Nevertheless, I measured many sociodemographic and attitudinal variables in all conducted experiments and found very few heterogeneous treatment effects across studies.

Third, because of the well documented intention-action gap in environmental psychology (for a review see Grandin et al., 2021), actual voting behavior regarding environmental policies cannot be directly inferred from the stated policy support levels measured in the presented studies. Field studies investigating the psychological determinants of actual voting behavior are scarce because of feasibility issues, but it is worth noting one study which analyzed real voting behavior in the context of a large ballot on energy taxes that took place in Switzerland in 2015 (Carattini et al., 2017). This study found that distributional, effectiveness, and competitiveness concerns reduced the acceptability of energy taxes, and that most people would have preferred tax revenues to be allocated for environmental purposes, in line with the evidence presented in Chapter 1.

Finally, the works compiled in this thesis correspond to case studies and thus do not tackle all possible environmental policies nor all psychological factors underlying acceptability judgments. Future research could focus on other policies addressing environmental issues such as agricultural policies for example, as recent protests in the agricultural world have again made salient the importance of taking into account social dimensions when designing reforms aiming to protect the environment. Experimental research could also try to provide causal evidence for other cognitive mechanisms than mental accounting or policy misperceptions, to improve the understanding of environmental policy support across more variables.

The “i-frame” and the “s-frame” in behavioral science

I would now like to discuss how this dissertation fits in the broader field of psychology applied to public policies. In a recent prominent paper widely discussed in the behavioral science community, Chater and Lowenstein (2023) argue that “*an influential line of thinking in behavioral science (...) is that many of society's most pressing problems can be addressed cheaply and effectively at the level of the individual, without modifying the system in which the individual operates. (...) Results from such interventions have been disappointingly modest. But more importantly, they have guided many (though by no means all) behavioral scientists to frame policy problems in individual, not systemic, terms: To adopt what we call the “i-frame,” rather than the “s-frame.” The difference may be more consequential than i-frame advocates have realized, by deflecting attention and support away from s-frame policies (...) such as regulation and taxation. (...) We argue that the most important way in which behavioral scientists can contribute to public policy is by employing their skills to develop and implement value-creating system-level change.*”.

Although various commentaries have stressed the oversimplification of the presented contrast between i- and s-frames, as well as the necessity of combining both approaches to design effective policy measures, many cognitive and behavioral scientists share the observation that systemic policies are under-studied in the field of psychology applied to public policy. In this dissertation, I tried to make the case for a “s-frame”-centered perspective in environmental psychology research by focusing on systemic environmental policies such as carbon taxation, energy subsidies and biodiversity conservation measures. Along with traditional social sciences such as

sociology, economics and political science, I defend the idea that cognitive science brings relevant frameworks and methodologies to the study of environmental public policies, given the prevalence of psychological factors involved.

Integrating citizens in environmental policy-making

In addition to enriching the existing literature on the psychological determinants of public support for environmental policies, another goal of this dissertation was to inform policy-making. Scientific studies are a very relevant way to provide insights about citizens' preferences which can be integrated into policy proposals, as I hope to have demonstrated by the works compiled in this thesis. However, I argue that approaches where citizens are directly involved in the environmental policy-making process, such as public participation practices, should be used in complement to scientific studies in order to strengthen the democratic legitimacy of the environmental policy proposals under consideration. In this section, I would like to discuss the evolution of public participation approaches in environmental policy-making in recent years.

In his notes for the field "*Public Participation as Participatory Communication in Environmental Policy Decision-Making: From Concepts to Structured Conversations*", Walker (2007) distinguishes between traditional public participation practices such as town meetings or public hearings where citizen preferences are passively transferred to administrative authorities, from active participatory approaches that consider people as dynamic negotiation actors of social and environmental change. In the last decade, active participatory practices have been increasingly used in policy-making, and

especially in the environmental domain. For instance, local and national authorities increasingly rely on citizen assemblies to discuss climate change issues and associated policies (King & Wilson, 2023). In the French context, for example, the national Citizens' Convention on Climate that took place from October 2019 to June 2020 was an unprecedented democratic experiment in France in which a panel of 150 citizens representative of the French population worked together to propose more than a hundred measures to mitigate climate change (Convention Citoyenne pour le Climat, 2020). However, it should be noted that participants expressed disappointment regarding the limited and partial integration of the proposed measures in the Climate and Resilience law proposal following the convention (Convention Citoyenne pour le Climat, 2021). Participatory budgeting has also been an increasingly used instrument worldwide to gather support for environmental initiatives and prioritize projects with high public expectations (Calisto Friant, 2019; Falanga, 2023). Finally, public consultations on specific environmental measures organized by national or local authorities have also gained momentum. For example, a local vote in favor or against the implementation of a tripled rate for SUV parking in Paris was organized in February 2024, and the majority decision - in favor of the measure - was enacted by the city council for a planned launch in October 2024.

This increased integration of citizens in environmental policy-making provides additional hope for the implementation of environmentally effective policies that take into account citizens' viewpoints, expectations and needs. Moreover, integrating scientists in public participation initiatives can result in a fruitful collaboration, for example to propose innovative policy scenarios, identify and debunk widespread misperceptions, and collect field data about citizen preferences to inform future decisions.

Concluding remarks

I hope that the works compiled in this dissertation, despite their limitations, demonstrate the importance of psychological research to study the determinants of environmental policy support in the context of an unprecedented environmental crisis. I believe that cognitive scientists, along with other scientists, have an important role to play by conducting impact-oriented research and disseminating their findings outside the academic world. I can only rejoice that more and more interfaces between cognitive science research and public action have been developing in recent years, such as the International Panel on Behavior Change (IPBC) and the Behavioral Science Team of the Inter-ministerial Direction of Public Transformation (DITP). I would like to end this dissertation on this hopeful perspective, as well as that of an increased integration of citizens in environmental policy-making, which I believe is a necessary democratic condition to successfully preserve our planet and all the living beings which inhabit it.

Bibliography

Abeler, J., & Marklein, F. (2008). Fungibility, Labels, and Consumption. *IZA Discussion Paper No. 3500*. https://doi.org/10.2139/ssrn.1139870

Alesina, A., & Perotti, R. (1995). The Political Economy of Budget Deficits. *Staff Papers*, *42*(1), 1–31. https://doi.org/10.2307/3867338

Amdur, D., Rabe, B. G., & Borick, C. P. (2014). Public Views on a Carbon Tax Depend on the Proposed Use of Revenue. *Issues in Energy and Environmental Policy*, *13*. https://papers.ssrn.com/abstract=2652403

Appelbaum, L. D., Lennon, M. C., & Lawrence Aber, J. (2006). When Effort is Threatening: The Influence of the Belief in a Just World on Americans' Attitudes Toward Antipoverty Policy. *Political Psychology*, *27*(3), 387–402. https://doi.org/10.1111/j.1467-9221.2006.00506.x

Ardanaz, M., Huebscher, E., Keefer, P., & Sattler, T. (2022). *Policy Misperceptions, Information, and the Demand for Redistributive Tax Reform: Experimental Evidence from Latin American Countries* (SSRN Scholarly Paper 4321786). https://doi.org/10.2139/ssrn.4321786

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, *8*(1), 19–32. https://doi.org/10.1080/1364557032000119616

Bakaki, Z., & Bernauer, T. (2017). Citizens show strong support for climate policy, but are they also willing to pay? *Climatic Change*, *145*(1), 15–26. https://doi.org/10.1007/s10584-017-2078-x

Baranzini, A., & Carattini, S. (2017). Effectiveness, earmarking and labeling: Testing the acceptability of carbon taxes with survey data. *Environmental Economics*

and Policy Studies, *19*(1), 197–227. https://doi.org/10.1007/s10018-016-0144-7

Beatty, T. K. M., Blow, L., Crossley, T. F., & O'Dea, C. (2014). Cash by any other name? Evidence on labeling from the UK Winter Fuel Payment. *Journal of Public Economics*, *118*, 86–96. https://doi.org/10.1016/j.jpubeco.2014.06.007

Bechtel, M. M., Scheve, K. F., & van Lieshout, E. (2020). Constant carbon pricing increases support for climate action compared to ramping up costs over time. *Nature Climate Change*, *10*(11), 1004–1009. https://doi.org/10.1038/s41558-020-00914-6

Beiser-McGrath, L. F., & Bernauer, T. (2019). Could revenue recycling make effective carbon taxation politically feasible? *Science Advances*, *5*(9), eaax3323. https://doi.org/10.1126/sciadv.aax3323

Bergquist, M., Nilsson, A., Harring, N., & Jagers, S. C. (2022). Meta-analyses of fifteen determinants of public opinion about climate change taxes and laws. *Nature Climate Change*, *12*(3), 235–240. https://doi.org/10.1038/s41558-022-01297-6

Berkes, F., Colding, J., & Folke, C. (2008). *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge University Press.

Berry, A. (2019). The distributional effects of a carbon tax and its impact on fuel poverty: A microsimulation study in the French context. *Energy Policy*, *124*, 81–94. https://doi.org/10.1016/j.enpol.2018.09.021

Borissov, N., Haas, Q., Minder, B., Kopp-Heim, D., von Gernler, M., Janka, H., Teodoro, D., & Amini, P. (2022). Reducing systematic review burden using Deduklick: A novel, automated, reliable, and explainable deduplication algorithm to foster medical research. *Systematic Reviews*, *11*(1), 172.

https://doi.org/10.1186/s13643-022-02045-9

Bowgen, K. M., Kettel, E. F., Butchart, S. H. M., Carr, J. A., Foden, W. B., Magin, G., Morecroft, M. D., Smith, R. K., Stein, B. A., Sutherland, W. J., Thaxter, C. B., & Pearce-Higgins, J. W. (2022). Conservation interventions can benefit species impacted by climate change. *Biological Conservation*, *269*, 109524. https://doi.org/10.1016/j.biocon.2022.109524

Brannlund, R., & Persson, L. (2012). To tax, or not to tax: Preferences for climate policy attributes. *Climate Policy*, *12*(6), 704–721. https://doi.org/10.1080/14693062.2012.675732

Braver, S. L., Thoemmes, F. J., & Rosenthal, R. (2014). Continuously Cumulating Meta-Analysis and Replicability. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *9*(3), 333–342. https://doi.org/10.1177/1745691614529796

Bristow, A. L., Wardman, M., Zanni, A. M., & Chintakayala, P. K. (2010). Public acceptability of personal carbon trading and carbon tax. *Ecological Economics*, *69*(9), 1824–1837. https://doi.org/10.1016/j.ecolecon.2010.04.021

Calisto Friant, M. (2019). Deliberating for sustainability: Lessons from the Porto Alegre experiment with participatory budgeting. *International Journal of Urban Sustainable Development*, *11*(1), 81–99. https://doi.org/10.1080/19463138.2019.1570219

Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., … Péan, C. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment*

Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland. (First). Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327/IPCC/AR6-9789291691647

Campbell, L., DiLorenzo, M., Atkinson, N., & Riddell, R. P. (2017). Systematic Review: A Systematic Review of the Interrelationships Among Children's Coping Responses, Children's Coping Outcomes, and Parent Cognitive-Affective, Behavioral, and Contextual Variables in the Needle-Related Procedures Context. *Journal of Pediatric Psychology*, *42*(6), 611–621. https://doi.org/10.1093/jpepsy/jsx054

Carattini, S., Baranzini, A., Thalmann, P., Varone, F., & Vöhringer, F. (2017). Green Taxes in a Post-Paris World: Are Millions of Nays Inevitable? *Environmental and Resource Economics*, *68*(1), 97–128. https://doi.org/10.1007/s10640-017-0133-8

Carattini, S., Carvalho, M., & Fankhauser, S. (2018). Overcoming public resistance to carbon taxes. *WIREs Climate Change*, *9*(5), e531. https://doi.org/10.1002/wcc.531

Carattini, S., Kallbekken, S., & Orlov, A. (2019). How to win public support for a global carbon tax. *Nature*, *565*(7739), 289–291. https://doi.org/10.1038/d41586-019-00124-x

CEVIPOF. (2023). *Political Trust Barometer*. Science Po. https://www.sciencespo.fr/cevipof/fr/content/le-barometre-de-la-confiance-politique.html

Chan, K. M. A., Pringle, R. M., Ranganathan, J., Boggs, C. L., Chan, Y. L., Ehrlich, P. R., Haff, P. K., Heller, N. E., Al-Khafaji, K., & Macmynowski, D. P. (2007). When

Agendas Collide: Human Welfare and Biological Conservation. *Conservation Biology*, *21*(1), 59–68. https://doi.org/10.1111/j.1523-1739.2006.00570.x

Chater, N., & Loewenstein, G. (2023). The i-frame and the s-frame: How focusing on individual-level solutions has led behavioral public policy astray. *Behavioral and Brain Sciences*, *46*, e147. https://doi.org/10.1017/S0140525X22002023

Cherry, T. L., Kallbekken, S., & Kroll, S. (2012). *The acceptability of efficiency-enhancing environmental taxes, subsidies and regulation: An experimental investigation*. https://pubag.nal.usda.gov/catalog/866023

Choi, J. J., Laibson, D., & Madrian, B. C. (2009). Mental Accounting in Portfolio Choice: Evidence from a Flypaper Effect. *American Economic Review*, *99*(5), 2085–2095. https://doi.org/10.1257/aer.99.5.2085

Clayton, S. (2018). The Role of Perceived Justice, Political Ideology, and Individual or Collective Framing in Support for Environmental Policies. *Social Justice Research*, *31*(3), 219–237. https://doi.org/10.1007/s11211-018-0303-z

Coady, D., Parry, I., Sears, L., & Shang, B. (2017). How Large Are Global Fossil Fuel Subsidies? *World Development*, *91*, 11–27. https://doi.org/10.1016/j.worlddev.2016.10.004

Cohen, J. (1960). *A Coefficient of Agreement for Nominal Scales*. https://journals.sagepub.com/doi/abs/10.1177/001316446002000104?casa_token=yJx7RTyNtDYAAAAA:9aEm-Cf4eXIJzjZDy8sy6V8458lKpZvvApDDcH2yJhFc9IBvG6g-sY7LjY-fElkK44Z-LZKY7E2Y0g

Connelly, N. A., Bruce Lauber, T., & Stedman, R. C. (2022). Public involvement, trust, and support for endangered species programs. *Wildlife Society Bulletin*, *46*(4), e1337. https://doi.org/10.1002/wsb.1337

Convention Citoyenne pour le Climat. (2020). *Convention Citoyenne pour le Climat*.

Convention Citoyenne Pour Le Climat. https://www.conventioncitoyennepourleclimat.fr/en/

Cools, M., Brijs, K., Tormans, H., Moons, E., Janssens, D., & Wets, G. (2011). The socio-cognitive links between road pricing acceptability and changes in travel-behavior. *Transportation Research Part A: Policy and Practice*, *45*(8), 779–788. https://doi.org/10.1016/j.tra.2011.06.006

Cowie, R. H., Bouchet, P., & Fontaine, B. (2022). The Sixth Mass Extinction: Fact, fiction or speculation? *Biological Reviews*, *97*(2), 640–663. https://doi.org/10.1111/brv.12816

Cullis, J. G., & Jones, P. R. (1987). Fiscal Illusion and “Excessive” Budgets: Some Indirect Evidence. *Public Finance Quarterly*, *15*(2), 219–228. https://doi.org/10.1177/109114218701500206

De Groot, J. I. M., & Steg, L. (2007). Value Orientations and Environmental Beliefs in Five Countries: Validity of an Instrument to Measure Egoistic, Altruistic and Biospheric Value Orientations. *Journal of Cross-Cultural Psychology*, *38*(3), 318–332. https://doi.org/10.1177/0022022107300278

Dell’Anno, R., & Dollery, B. E. (2014). Comparative fiscal illusion: A fiscal illusion index for the European Union. *Empirical Economics*, *46*(3), 937–960. https://doi.org/10.1007/s00181-013-0701-x

Deroubaix, J.-F., & Lévêque, F. (2006). The rise and fall of French Ecological Tax Reform: Social acceptability versus political feasibility in the energy tax implementation process. *Energy Policy*, *34*(8), 940–949. https://doi.org/10.1016/j.enpol.2004.08.047

Devereux, S. (2002). Can Social Safety Nets Reduce Chronic Poverty? *Development Policy Review*, *20*(5), 657–675. https://doi.org/10.1111/1467-7679.00194

Díaz, S. M., Settele, J., Brondízio, E., Ngo, H., Guèze, M., Agard, J., Arneth, A., Balvanera, P., Brauman, K., Butchart, S., Chan, K. M. A., Garibaldi, L. A., Ichii, K., Liu, J., Subramanian, S., Midgley, G., Miloslavich, P., Molnár, Z., Obura, D., … Zayas, C. (2019). *The global assessment report on biodiversity and ecosystem services: Summary for policy makers*. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. https://ri.conicet.gov.ar/handle/11336/116171

Dietsch, A. M., Teel, T. L., & Manfredo, M. J. (2016). Social values and biodiversity conservation in a dynamic world. *Conservation Biology*, *30*(6), Article 6. https://doi.org/10.1111/cobi.12742

Dollery, B. E., & Worthington, A. C. (1996). The Empirical Analysis of Fiscal Illusion. *Journal of Economic Surveys*, *10*(3), 261–297. https://doi.org/10.1111/j.1467-6419.1996.tb00014.x

Douenne, T., & Fabre, A. (2020). French attitudes on climate change, carbon taxation and other climate policies. *Ecological Economics*, *169*, 106496. https://doi.org/10.1016/j.ecolecon.2019.106496

Douenne, T., & Fabre, A. (2022). Yellow Vests, Pessimistic Beliefs, and Carbon Tax Aversion. *American Economic Journal: Economic Policy*, *14*(1), 81–110. https://doi.org/10.1257/pol.20200092

Dresner, S., Dunne, L., Clinch, P., & Beuermann, C. (2006). Social and political responses to ecological tax reform in Europe: An introduction to the special issue. *Energy Policy*, *34*(8), 895–904. https://doi.org/10.1016/j.enpol.2004.08.043

Dresner, S., Jackson, T., & Gilbert, N. (2006). History and social responses to environmental tax reform in the United Kingdom. *Energy Policy*, *34*(8),

930–939. https://doi.org/10.1016/j.enpol.2004.08.046

Drews, S., & van den Bergh, J. C. J. M. (2016). What explains public support for climate policies? A review of empirical and experimental studies. *Climate Policy*, *16*(7), 855–876. https://doi.org/10.1080/14693062.2015.1058240

Dreyer, S. J., & Walker, I. (2013). Acceptance and Support of the Australian Carbon Policy. *Social Justice Research*, *26*(3), Article 3. https://doi.org/10.1007/s11211-013-0191-1

Dubois, G., Sovacool, B., Aall, C., Nilsson, M., Barbier, C., Herrmann, A., Bruyère, S., Andersson, C., Skold, B., Nadaud, F., Dorner, F., Moberg, K. R., Ceron, J. P., Fischer, H., Amelung, D., Baltruszewicz, M., Fischer, J., Benevise, F., Louis, V. R., & Sauerborn, R. (2019). It starts at home? Climate policies targeting household consumption and behavioral decisions are key to low-carbon futures. *Energy Research & Social Science*, *52*, 144–158. https://doi.org/10.1016/j.erss.2019.02.001

Dubois, M., & Allacker, K. (2015). Energy savings from housing: Ineffective renovation subsidies vs efficient demolition and reconstruction incentives. *Energy Policy*, *86*, 697–704. https://doi.org/10.1016/j.enpol.2015.07.029

Duff, D., & Hsu, S.-L. (2010). Carbon Taxation in Theory and in Practice. In *Critical Issues in Environmental Taxation: International and Comparative Perspectives* (Oxford University Press, Vol. 8, pp. 261–276). https://commons.allard.ubc.ca/fac_pubs/1994

Dussaux, D. (2020). The joint effects of energy prices and carbon taxes on environmental and economic performance: Evidence from the French manufacturing sector. *OECD Environment Working Papers*. https://doi.org/10.1787/b84b1b7d-en

Duygan, M., Kachi, A., Oeri, F., Oliveira, T. D., & Rinscheid, A. (2022). A Survey of Stakeholders' Views and Practices. In P. Hettich & A. Kachi (Eds.), *Swiss Energy Governance: Political, Economic and Legal Challenges and Opportunities in the Energy Transition* (pp. 369–394). Springer International Publishing. https://doi.org/10.1007/978-3-030-80787-0_15

Ejelöv, E., & Nilsson, A. (2020). Individual Factors Influencing Acceptability for Environmental Policies: A Review and Research Agenda. *Sustainability*, *12*(6), Article 6. https://doi.org/10.3390/su12062404

Eriksson, L., Garvill, J., & Nordlund, A. M. (2006). Acceptability of travel demand management measures: The importance of problem awareness, personal norm, freedom, and fairness. *Journal of Environmental Psychology*, *26*(1), 15–26. https://doi.org/10.1016/j.jenvp.2006.05.003

Evans, D. K., & Popova, A. (2017). Cash Transfers and Temptation Goods. *Economic Development and Cultural Change*, *65*(2), 189–221. https://doi.org/10.1086/689575

Fabrigar, L. R., & Petty, R. E. (1999). The Role of the Affective and Cognitive Bases of Attitudes in Susceptibility to Affectively and Cognitively Based Persuasion. *Personality and Social Psychology Bulletin*, *25*(3), 363–381. https://doi.org/10.1177/0146167299025003008

Fairbrother, M. (2019). When Will People Pay to Pollute? Environmental Taxes, Political Trust and Experimental Evidence from Britain. *British Journal of Political Science*, *49*(2), 661–682. https://doi.org/10.1017/S0007123416000727

Falanga, R. (2023). Youth participation in environmental sustainability: Insights from the Lisbon participatory budget. *Journal of Public Budgeting, Accounting & Financial Management*, *36*(1), 20–39.

https://doi.org/10.1108/JPBAFM-12-2021-0176

Fattouh, B., & El-Katiri, L. (2013). Energy subsidies in the Middle East and North Africa. *Energy Strategy Reviews*, *2*(1), 108–115. https://doi.org/10.1016/j.esr.2012.11.004

Feng, K., Hubacek, K., Liu, Y., Marchán, E., & Vogt-Schilb, A. (2018). Managing the distributional effects of energy taxes and subsidy removal in Latin America and the Caribbean. *Applied Energy*, *225*, 424–436. https://doi.org/10.1016/j.apenergy.2018.04.116

Fenton, L., Lauckner, H., & Gilbert, R. (2015). The QATSDD critical appraisal tool: Comments and critiques. *Journal of Evaluation in Clinical Practice*, *21*(6), 1125–1128. https://doi.org/10.1111/jep.12487

Frings, N., Helm, J., & Hahnel, U. J. J. (2023). *Unraveling the multidimensional impacts of the energy crisis on citizens' judgment and decision-making*. https://doi.org/10.21203/rs.3.rs-3705261/v1

Gevrek, Z. E., & Uyduranoglu, A. (2015). Public preferences for carbon tax attributes. *Ecological Economics*, *118*, 186–197. https://doi.org/10.1016/j.ecolecon.2015.07.020

Gould, R. K., Shrum, T. R., Ramirez Harrington, D., & Iglesias, V. (2024). Experience with extreme weather events increases willingness-to-pay for climate mitigation policy. *Global Environmental Change*, *85*, 102795. https://doi.org/10.1016/j.gloenvcha.2023.102795

Grandin, A., Boon-Falleur, M., & Chevallier, C. (2021). *The belief-action gap in environmental psychology: How wide? How irrational?* OSF. https://doi.org/10.31234/osf.io/chqug

Gross, C., Lorek, K., & Richter, F. (2017). Attitudes towards inheritance taxation –

results from a survey experiment. *The Journal of Economic Inequality*, *15*(1), 93–112. https://doi.org/10.1007/s10888-016-9344-4

Hahnel, U. J. J., Chatelain, G., Conte, B., Piana, V., & Brosch, T. (2020). Mental accounting mechanisms in energy decision-making and behaviour. *Nature Energy*, *5*(12), 952–958. https://doi.org/10.1038/s41560-020-00704-6

Halter, F. E. (2014). *Earmarking of inheritance tax: Normative principles and tax compliance* [Universität Wien]. https://utheses.univie.ac.at/detail/30745

Hardisty, D. J., Beall, A. T., Lubowski, R., Petsonk, A., & Romero-Canyas, R. (2019). A carbon price by another name may seem sweeter: Consumers prefer upstream offsets to downstream taxes. *Journal of Environmental Psychology*, *66*, 101342. https://doi.org/10.1016/j.jenvp.2019.101342

Harring, N., & Jagers, S. C. (2013). Should We Trust in Values? Explaining Public Support for Pro-Environmental Taxes. *Sustainability*, *5*(1), Article 1. https://doi.org/10.3390/su5010210

Harring, N., Jagers, S. C., & Matti, S. (2017). Public Support for Pro-Environmental Policy Measures: Examining the Impact of Personal Values and Ideology. In *SUSTAINABILITY* (Vol. 9, Issue 5). MDPI. https://doi.org/10.3390/su9050679

Harring, N., Torbjornsson, T., & Lundholm, C. (2018). Solving Environmental Problems Together? The Roles of Value Orientations and Trust in the State in Environmental Policy Support among Swedish Undergraduate Students. In *EDUCATION SCIENCES* (Vol. 8, Issue 3). MDPI. https://doi.org/10.3390/educsci8030124

Heidtmann, K. F. F., & Selck, T. J. (2024). Local level failure? Non-compliance of EU environmental policy within EU multi-level governance. *Regional & Federal Studies*, *34*(1), 23–42. https://doi.org/10.1080/13597566.2021.1998006

Hensher, D. A., & Li, Z. (2013). Referendum voting in road pricing reform: A review of the evidence. *Transport Policy*, *25*, 186–197. https://doi.org/10.1016/j.tranpol.2012.11.012

Herati, H., Burns, K. E., Nascimento, M., Brown, P., Calnan, M., Dubé, È., Ward, P. R., Filice, E., Rotolo, B., Ike, N., & Meyer, S. B. (2023). Canadians' trust in government in a time of crisis: Does it matter? *PLOS ONE*, *18*(9), e0290664. https://doi.org/10.1371/journal.pone.0290664

Hignell, B., Saleemi, Z., & Valentini, E. (2022). *The role of emotions on policy support and environmental engagement*. PsyArXiv. https://doi.org/10.31234/osf.io/4r25f

Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M.-P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M.-C., Vedel, I., & Pluye, P. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for Information*, *34*(4), 285–291. https://doi.org/10.3233/EFI-180221

Huijts, N. M. A., Molin, E. J. E., & Steg, L. (2012). Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. *Renewable and Sustainable Energy Reviews*, *16*(1), 525–531. https://doi.org/10.1016/j.rser.2011.08.018

Ihemezie, E. J., Nawrath, M., Strauß, L., Stringer, L. C., & Dallimer, M. (2021). The influence of human values on attitudes and behaviours towards forest conservation. *Journal of Environmental Management*, *292*. https://doi.org/10.1016/j.jenvman.2021.112857

Ikiara, G. K. (2009). *Political economy of cash transfers in Kenya*. Overseas Development Institute. https://socialprotection.org/fr/discover/publications/political-economy-cash-tran

sfers-kenya

International Energy Agency. (2022). *Global Energy Crisis—How the energy crisis started, how global energy markets are impacting our daily life, and what governments are doing about it*. IEA. https://www.iea.org/topics/global-energy-crisis

Jagers, S. C., Lachapelle, E., Martinsson, J., & Matti, S. (2021). Bridging the ideological gap? How fairness perceptions mediate the effect of revenue recycling on public support for carbon taxes in the United States, Canada and Germany. *Review of Policy Research*, *38*(5), 529–554. https://doi.org/10.1111/ropr.12439

Jagers, S. C., Martinsson, J., & Matti, S. (2019). The impact of compensatory measures on public support for carbon taxation: An experimental study in Sweden. *Climate Policy*, *19*(2), 147–160. https://doi.org/10.1080/14693062.2018.1470963

Jagers, S. C., Matti, S., & Nilsson, A. (2017). How exposure to policy tools transforms the mechanisms behind public acceptability and acceptance—The case of the Gothenburg congestion tax. *International Journal of Sustainable Transportation*, *11*(2), 109–119. https://doi.org/10.1080/15568318.2016.1197348

Kallbekken, S., & Aasen, M. (2010). The demand for earmarking: Results from a focus group study. *Ecological Economics*, *69*(11), 2183–2190. https://doi.org/10.1016/j.ecolecon.2010.06.003

King, M., & Wilson, R. (2023). Local government and democratic innovations: Reflections on the case of citizen assemblies on climate change. *Public Money & Management*, *43*(1), 73–76. https://doi.org/10.1080/09540962.2022.2033462

Klenert, D., Mattauch, L., Combet, E., Edenhofer, O., Hepburn, C., Rafaty, R., & Stern, N. (2018). Making carbon pricing work for citizens. *Nature Climate Change*, *8*(8), 669–677. https://doi.org/10.1038/s41558-018-0201-2

Konisky, D. M., Milyo, J., & Richardson, L. E. (2008). Environmental Policy Attitudes: Issues, Geographical Scale, and Political Trust*. *Social Science Quarterly*, *89*(5), 1066–1085. https://doi.org/10.1111/j.1540-6237.2008.00574.x

Kotchen, M. J., Boyle, K. J., & Leiserowitz, A. A. (2013). Willingness-to-pay and policy-instrument choice for climate-change policy in the United States. *Energy Policy*, *55*, 617–625. https://doi.org/10.1016/j.enpol.2012.12.058

Kotchen, M. J., Turk, Z. M., & Leiserowitz, A. A. (2017). Public willingness to pay for a US carbon tax and preferences for spending the revenue. *Environmental Research Letters*, *12*(9), 094012. https://doi.org/10.1088/1748-9326/aa822a

Larsen, F. W., Turner, W. R., & Brooks, T. M. (2012). Conserving critical sites for biodiversity provides disproportionate benefits to people. *PloS One*, *7*(5), e36971. https://doi.org/10.1371/journal.pone.0036971

Larson, R. B. (2019). Controlling social desirability bias. *International Journal of Market Research*, *61*(5), 534–547. https://doi.org/10.1177/1470785318805305

Lesch, W. C., & Wachenheim, C. J. (Eds.). (2014). *Factors Influencing Conservation Practice Adoption in Agriculture: A Review of the Literature*. https://doi.org/10.22004/ag.econ.164828

Lischka, S. A. (2018). *INTEGRATING SOCIAL AND ECOLOGICAL PREDICTORS OF HUMAN- WILDLIFE INTERACTIONS TO GUIDE CONSERVATION AND MANAGEMENT*.

Maestre-Andrés, S., Drews, S., Savin, I., & van den Bergh, J. (2021). Carbon tax acceptability with information provision and mixed revenue uses. *Nature*

Communications, *12*(1), 7017. https://doi.org/10.1038/s41467-021-27380-8

Maestre-Andrés, S., Drews, S., & van den Bergh, J. (2019). Perceived fairness and public acceptability of carbon pricing: A review of the literature. *Climate Policy*, *19*(9), 1186–1204. https://doi.org/10.1080/14693062.2019.1639490

Manfredo, M. J. (2009). *Wildlife and Society: The Science of Human Dimensions*. Island Press.

McClure, C. C., Cataldi, J. R., & O'Leary, S. T. (2017). Vaccine Hesitancy: Where We Are and Where We Are Going. *Clinical Therapeutics*, *39*(8), 1550–1562. https://doi.org/10.1016/j.clinthera.2017.07.003

McCright, A. M., Dunlap, R. E., & Marquart-Pyatt, S. T. (2016). Political ideology and views about climate change in the European Union. *Environmental Politics*, *25*(2), Article 2. https://doi.org/10.1080/09644016.2015.1090371

McCune, J. L., Carlsson, A. M., Colla, S., Davy, C., Favaro, B., Ford, A. T., Fraser, K. C., & Martins, E. G. (2017). Assessing public commitment to endangered species protection: A Canadian case study. *FACETS*, *2*, 178–194. https://doi.org/10.1139/facets-2016-0054

McFarland, W., & Whitley, S. (2014). *Fossil fuel subsidies in developing countries. A review of support to reform processes* (EPS PEAKS, UK, p. 28). Department for International Development. https://www.gov.uk/research-for-development-outputs/fossil-fuel-subsidies-in-developing-countries-a-review-of-support-to-reform-processes

McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica*, *22*(3), 276–282.

Mildenberger, M., Lachapelle, E., Harrison, K., & Stadelmann-Steffen, I. (2022). Limited impacts of carbon tax rebate programmes on public support for carbon

pricing. *Nature Climate Change*, *12*(2), 141–147. https://doi.org/10.1038/s41558-021-01268-3

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, T. P. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLOS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Monasterolo, I., & Raberto, M. (2019). The impact of phasing out fossil fuel subsidies on the low-carbon transition. *Energy Policy*, *124*, 355–370. https://doi.org/10.1016/j.enpol.2018.08.051

Morris, A., & Mathur, A. (2014). *A Carbon Tax in Broader U.S. Fiscal Reform*. Center for climate and energy solutions. https://www.brookings.edu/articles/a-carbon-tax-in-broader-u-s-fiscal-reform/

Moxnes, E., & Saysel, A. K. (2008). Misperceptions of global climate change: Information policies. *Climatic Change*, *93*(1), Article 1. https://doi.org/10.1007/s10584-008-9465-2

Muehlbacher, S., & Kirchler, E. (2019). Individual Differences in Mental Accounting. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.02866

Muhammad, I., Mohd Hasnu, N. N., & Ekins, P. (2021). Empirical Research of Public Acceptance on Environmental Tax: A Systematic Literature Review. *Environments*, *8*(10), Article 10. https://doi.org/10.3390/environments8100109

Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, *403*(6772), 853–858. https://doi.org/10.1038/35002501

Nielsen, K. S., Clayton, S., Stern, P. C., Dietz, T., Capstick, S., & Whitmarsh, L. (2021). How psychology can help limit climate change. *American Psychologist*,

76(1), 130–144. https://doi.org/10.1037/amp0000624

Nielsen, K. S., Cologna, V., Lange, F., Brick, C., & Stern, P. C. (2021). The case for impact-focused environmental psychology. *Journal of Environmental Psychology*, *74*, 101559. https://doi.org/10.1016/j.jenvp.2021.101559

Nordlund, A., Jansson, J., & Westin, K. (2018). Acceptability of electric vehicle aimed measures: Effects of norm activation, perceived justice and effectiveness. *Transportation Research Part A: Policy and Practice*, *117*, 205–213. https://doi.org/10.1016/j.tra.2018.08.033

Ostrom, T. M. (1969). The relationship between the affective, behavioral, and cognitive components of attitude. *Journal of Experimental Social Psychology*, *5*(1), 12–30. https://doi.org/10.1016/0022-1031(69)90003-1

Ouyang, X., & Lin, B. (2014). Impacts of increasing renewable energy subsidies and phasing out fossil fuel subsidies in China. *Renewable and Sustainable Energy Reviews*, *37*, 933–942. https://doi.org/10.1016/j.rser.2014.05.013

Owen, A. L., Conover, E., Videras, J., & Wu, S. (2012). Heat Waves, Droughts, and Preferences for Environmental Policy. *Journal of Policy Analysis and Management*, *31*(3), 556–577. https://doi.org/10.1002/pam.21599

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Parlevliet, J., Giuliodori, M., & Rooduijn, M. (2023). Populist attitudes, fiscal illusion and fiscal preferences: Evidence from Dutch households. *Public Choice*,

197(1), 201–225. https://doi.org/10.1007/s11127-023-01101-9

Poh, E. H. (2006). *Fiscal Misperceptions Associated with Tax Expenditure Spending: The Case of Pronatalist Tax Incentives in Singapore* (SSRN Scholarly Paper 896042). https://doi.org/10.2139/ssrn.896042

Povitkina, M., Jagers, S., Matti, S., & Martinsson, J. (2021). Why are carbon taxes unfair? Disentangling public perceptions of fairness. *Global Environmental Change*, *70*, 102356. https://doi.org/10.1016/j.gloenvcha.2021.102356

Priolo, G., Stablum, F., Vacondio, M., D'Ambrogio, S., Caserotti, M., Conte, B., Roni, P., Du Plooy, H., Grillo, V., Mastromatteo, L. Y., Tedaldi, E., Toscano, F., Aguilar-Armijo, J., Ahmadi Ghomroudi, P., Rai, A., Alexa, L., Andersen, M., Andersson, P., Barakat, K., & Rubaltelli, E. (2023). *The robustness of mental accounting: A global perspective*. OSF Preprints. https://doi.org/10.31219/osf.io/apc26

Ray, A., Hughes, L., Konisky, D. M., & Kaylor, C. (2017). Extreme weather exposure and support for climate change adaptation. *Global Environmental Change*, *46*, 104–113. https://doi.org/10.1016/j.gloenvcha.2017.07.002

Rentschler, J., & Bazilian, M. (2017). Reforming fossil fuel subsidies: Drivers, barriers and the state of progress. *Climate Policy*, *17*(7), 891–914. https://doi.org/10.1080/14693062.2016.1169393

Rieger, M. O., & Wang, M. (2022). Trust in Government Actions During the COVID-19 Crisis. *Social Indicators Research*, *159*(3), 967–989. https://doi.org/10.1007/s11205-021-02772-x

Rivers, N., & Schaufele, B. (2015). The Effect of Carbon Taxes on Agricultural Trade. *Canadian Journal of Agricultural Economics*, *63*(2), 235–257.

Sælen, H., & Kallbekken, S. (2011). A choice experiment on fuel taxation and

earmarking in Norway. *Ecological Economics*, *70*(11), 2181–2190. https://doi.org/10.1016/j.ecolecon.2011.06.024

Schultz, P. W., Gouveia, V. V., Cameron, L. D., Tankha, G., Schmuck, P., & Franěk, M. (2005). Values and their Relationship to Environmental Concern and Conservation Behavior. *Journal of Cross-Cultural Psychology*, *36*(4), 457–475. https://doi.org/10.1177/0022022105275962

Sgaravatti, G., Tagliapietra, S., Trasi, C., & Zachmann, G. (2021). *National fiscal policy responses to the energy crisis*. Bruegel | The Brussels-Based Economic Think Tank. https://www.bruegel.org/dataset/national-policies-shield-consumers-rising-energy-prices

Slemrod, J. (2006). The Role of Misconceptions in Support for Regressive Tax Reform. *National Tax Journal*, *59*(1), 57–75. https://doi.org/10.17310/ntj.2006.1.03

Smith, N., & Leiserowitz, A. (2014). The Role of Emotion in Global Warming Policy Support and Opposition. *Risk Analysis*, *34*(5), 937–948. https://doi.org/10.1111/risa.12140

Sood, M., Carnelley, K. B., & Newman-Taylor, K. (2022). How does insecure attachment lead to paranoia? A systematic critical review of cognitive, affective, and behavioural mechanisms. *British Journal of Clinical Psychology*, *61*(3), 781–815. https://doi.org/10.1111/bjc.12361

St John, F. A. V., Edwards-Jones, G., & Jones, J. P. G. (2010). Conservation and human behaviour: Lessons from social psychology. *Wildlife Research*, *37*(8), 658. https://doi.org/10.1071/WR10032

Stadelmann-Steffen, I. (2011). Citizens as veto players: Climate change policy and the

constraints of direct democracy. *Environmental Politics*, *20*(4), 485–507. https://doi.org/10.1080/09644016.2011.589577

Stark, J. A., & Kirchler, E. (2017). Inheritance tax compliance – earmarking with normative value principles. *International Journal of Sociology and Social Policy*, *37*(7/8), 452–467. https://doi.org/10.1108/IJSSP-07-2016-0086

Steg, L., Dreijerink, L., & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of Environmental Psychology*, *25*(4), 415–425. https://doi.org/10.1016/j.jenvp.2005.08.003

Stern, P. C. (2000). New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, *56*(3), 407–424. https://doi.org/10.1111/0022-4537.00175

Stern, P. C., & Dietz, T. (1994). The Value Basis of Environmental Concern. *Journal of Social Issues*, *50*(3), 65–84. https://doi.org/10.1111/j.1540-4560.1994.tb02420.x

Tatham, M., & Peters, Y. (2023). Fueling opposition? Yellow vests, urban elites, and fuel taxation. *Journal of European Public Policy*, *30*(3), 574–598. https://doi.org/10.1080/13501763.2022.2148172

Thaler, R. H. (2011). Mental Accounting Matters. In *Advances in Behavioral Economics* (pp. 75–103). Princeton University Press. https://doi.org/10.1515/9781400829118-006

Thorson, E. (2015). *Identifying and Correcting Policy Misperceptions*. https://www.americanpressinstitute.org/

Thorson, E., & Abdelaaty, L. (2023). Misperceptions about Refugee Policy. *American Political Science Review*, *117*(3), 1123–1129. https://doi.org/10.1017/S0003055422000910

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., … Straus, S. E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of Internal Medicine*, *169*(7), 467–473. https://doi.org/10.7326/M18-0850

Trung, H., Nguyen, T., & Simioni, M. (2020). Willingness to pay for mangrove preservation in Xuan Thuy National Park, Vietnam: Do household knowledge and interest play a role? *JOURNAL OF ENVIRONMENTAL ECONOMICS AND POLICY*, *9*(4), 402–420. https://doi.org/10.1080/21606544.2020.1716854

Valtchanov, D., & Ellard, C. G. (2015). Cognitive and affective responses to natural scenes: Effects of low level visual properties on preference, cognitive load and eye-movements. *Journal of Environmental Psychology*, *43*, 184–195. https://doi.org/10.1016/j.jenvp.2015.07.001

Van Cuong, C., Dart, P., & Hockings, M. (2017). Biosphere reserves: Attributes for success. *Journal of Environmental Management*, *188*, 9–17. https://doi.org/10.1016/j.jenvman.2016.11.069

van Wee, B., Annema, J. A., & van Barneveld, S. (2023). Controversial policies: Growing support after implementation. A discussion paper. *Transport Policy*, *139*, 79–86. https://doi.org/10.1016/j.tranpol.2023.05.010

Vardavas, C. I., Filippidis, F. T., Agaku, I. T., Mytaras, V., Bertic, M., Connolly, G. N., Tountas, Y., & Behrakis, P. K. (2012). Tobacco taxation: The importance of earmarking the revenue to health care and tobacco control. *Tobacco Induced Diseases*, *10*(December). https://doi.org/10.1186/1617-9625-10-21

Vonk Noordegraaf, D., Annema, J. A., & van Wee, B. (2014). Policy implementation

lessons from six road pricing cases. *Transportation Research Part A: Policy and Practice*, *59*, 172–191. https://doi.org/10.1016/j.tra.2013.11.003

Walker, G. B. (2007). Public Participation as Participatory Communication in Environmental Policy Decision-Making: From Concepts to Structured Conversations. *Environmental Communication*, *1*(1), 99–110. https://doi.org/10.1080/17524030701334342

Wan, C., Shen, G. Q., & Choi, S. (2017). A review on political factors influencing public support for urban environmental policy. *Environmental Science & Policy*, *75*, 70–80. https://doi.org/10.1016/j.envsci.2017.05.005

Wang, X., Yuen, K. F., Wong, Y. D., & Teo, C.-C. (2018). It is green, but is it fair? Investigating consumers' fairness perception of green service offerings. *Journal of Cleaner Production*, *181*, 235–248. https://doi.org/10.1016/j.jclepro.2018.01.103

Whitley, S., & Van Der Burg, L. (2015). *Fossil fuel subsidy reform: From rhetoric to reality*. https://odi.org/en/publications/fossil-fuel-subsidy-reform-from-rhetoric-to-reality/

Wicki, M., Huber, R. A., & Bernauer, T. (2020). Can policy-packaging increase public support for costly policies? Insights from a choice experiment on policies against vehicle emissions. *Journal of Public Policy*, *40*(4), 599–625. https://doi.org/10.1017/S0143814X19000205

Wilkins, V. M., & Wenger, J. B. (2014). Belief in a Just World and Attitudes Toward Affirmative Action. *Policy Studies Journal*, *42*(3), 325–343. https://doi.org/10.1111/psj.12063

Yildiz, A. (2024). *From Streets to Policies: The Impact of Yellow Vests Movement on French Public Policy* (SSRN Scholarly Paper 4765783).

https://doi.org/10.2139/ssrn.4765783

Zhang, J., Khalid, S., & Mahmood, H. (2023). Assessing the effectiveness of environmental policies in the OECD countries: An advanced panel data estimation study. *Energy & Environment*, 0958305X231155492. https://doi.org/10.1177/0958305X231155492

Résumé en français

Des politiques publiques environnementales ambitieuses et de grande envergure sont de plus en plus nécessaires pour faire face à la crise écologique mondiale. Pour que ces politiques soient mises en œuvre efficacement dans des pays démocratiques, un élément crucial est le soutien des citoyens envers les mesures considérées. Cependant, les préférences citoyennes pas toujours alignées avec l'efficacité estimée des politiques environnementales par les experts, comme le démontre la forte opposition à la taxation carbone à travers le monde. Il est donc essentiel de mieux comprendre les déterminants des jugements d'acceptabilité du public pour faciliter l'élaboration de politiques environnementales à la fois efficaces du point de vue environnemental et jugées acceptables par les citoyens. Dans cette optique, la présente thèse explore les origines psychologiques des jugements d'acceptabilité des citoyens à l'égard de trois domaines spécifiques des politiques environnementales : a) la politique climatique, b) la politique énergétique, et c) la politique de protection de la biodiversité et de conservation de la nature.

Les chapitres 1 et 2 de cette thèse s'appuient sur des recherches expérimentales visant à tester l'impact causal de divers mécanismes cognitifs sur le soutien aux politiques environnementales. Dans ces deux chapitres, une approche interculturelle est adoptée, puisque toutes les expériences sont menées à la fois en France et au Royaume-Uni, en utilisant des échantillons représentatifs de la population en termes d'âge et de genre. Le premier chapitre se concentre sur les jugements d'acceptabilité vis-à-vis de différents scénarios de taxation carbone, une politique climatique

reconnue pour son efficacité, mais dont l'adhésion citoyenne dépend largement de l'utilisation des recettes fiscales. Ce chapitre démontre que la théorie de la comptabilité mentale peut expliquer des schémas récurrents dans les préférences citoyennes, comme par exemple le soutien à l'affectation des recettes à des projets environnementaux (ce que l'on appelle le fléchage environnemental). La comptabilité mentale est un « ensemble d'opérations cognitives utilisées par les individus et les ménages pour organiser, évaluer et suivre les activités financières » (Thaler, 2011), qui joue un rôle important dans la manière dont les individus gèrent leurs budgets personnels. L'une des caractéristiques de la comptabilité mentale est que les sources de revenus et les dépenses sont traitées de manière thématique et regroupées dans des comptes mentaux distincts. Les résultats obtenus dans les différentes expérimentations confirment l'implication de la comptabilité mentale dans les jugements d'acceptabilité envers la taxation carbone, mais aussi envers d'autres types de taxes comme la taxe sur le tabac et la taxation sur l'héritage. En outre, la prise en compte de l'heuristique de comptabilité mentale permet de proposer un scénario de taxation carbone innovant à la fois acceptable et socialement équitable, basé sur le fléchage environnemental et incorporant une part de redistribution envers les ménages les plus modestes conditionnelle à des dépenses éco-responsables.

Le deuxième chapitre examine l'acceptabilité de quatre contre-mesures gouvernementales visant à protéger les citoyens de la hausse massive des prix de l'énergie survenue lors de la crise énergétique actuelle. Les résultats d'une première expérimentation montrent que les citoyens préfèrent les subventions énergétiques aux transferts monétaires, en particulier les subventions énergétiques universelles, malgré leurs effets négatifs sur le plan social et environnemental. Il est ensuite démontré que

les préférences des citoyens pour les subventions énergétiques universelles sont en partie causées par des perceptions erronées sur le coût, l'impact social et environnemental de ces subventions. Plus spécifiquement, le fait que les subventions énergétiques aient un coût pour les contribuables, qu'elles profitent davantage aux ménages aisés en raison de leur plus grande consommation d'énergie, et qu'elles ne permettent pas de diminuer les émissions de CO2 en baissant le prix des énergies fossiles n'est pas perçu par une majorité de participants. Le manque de soutien envers les transferts monétaires pour les ménages les plus vulnérables est quant à lui lié à la perception erronée que ces ménages vont utiliser cette aide monétaire pour consommer davantage d'alcool et de tabac. Pour corriger ces perceptions erronées, de l'information argumentée et sourcée est fournie de manière aléatoire à la moitié des participants (et fournie à la seconde moitié après l'expérimentation). Les résultats sont hétérogènes selon le pays considéré : recevoir de l'information argumentée et sourcée sur les politiques énergétiques diminue le soutien des participants britanniques pour les subventions énergétiques universelles et l'augmente pour les transferts monétaires en direction des ménages les plus vulnérables, tandis que les résultats ne sont pas significatifs pour les participants français.

Le troisième chapitre est une revue systématique de la littérature visant à identifier les différents facteurs psychologiques associés au soutien du public envers les politiques de protection de la biodiversité et de conservation de la nature. Les revues existantes se concentrent sur des domaines de conservation et des facteurs psychologiques spécifiques, ou ne mesurent pas le soutien politique comme variable d'intérêt. L'objectif de cette revue est double : a) identifier et cartographier les facteurs psychologiques qui ont été étudiés pour expliquer le soutien des citoyens envers les

politiques de conservation de la nature, b) déterminer quels facteurs psychologiques sont significativement associés à un plus grand soutien pour la mise en place de politiques de conservation. La méthodologie PRISMA-ScR a été employée pour mener cette revue de manière systématique, conduisant à un échantillon final de 66 études incluses dans la revue. L'analyse montre d'abord que la grande majorité des sources examinées ont été publiées après 2010, avec de nombreuses études publiées après 2020. La majorité des études ont été menées en Amérique du Nord et en Europe occidentale, ce qui montre un déséquilibre entre les sociétés étudiées. Les questionnaires d'enquête sont la seule méthodologie utilisée dans les sources examinées, avec une majorité importante de méthodes statistiques corrélationnelles. Des recherches supplémentaires sont donc nécessaires pour établir des relations de cause à effet entre les facteurs psychologiques et le soutien du public envers les politiques de conservation. Parmi les divers facteurs psychologiques explorés, les facteurs liés aux représentations, c'est-à-dire les croyances et perceptions, sont ceux qui ont reçu le plus d'attention de la part des chercheurs. De plus, les orientations de valeurs relatives à la faune sauvage (par exemple considérer les espèces non humaines sont relativement égales aux humains et ont un droit d'existence propre, ou au contraire considérer qu'elles n'ont de valeur que par rapport aux bénéfices qu'elles procurent aux humains), les connaissances sur les questions environnementales et de conservation, ainsi que des attitudes générales envers les enjeux de conservation, sont les facteurs psychologiques les plus robustement associés au soutien du public envers les politiques de conservation de la nature.

Ainsi, en combinant des recherches expérimentales avec une revue systématique de la littérature, cette thèse vise à enrichir notre compréhension des fondements

psychologiques du soutien des citoyens envers les politiques publiques environnementales. Elle contribue d'une part à complémenter la littérature existante en psychologie environnementale et politique sur ce sujet, et d'autre part à mieux intégrer les préférences citoyennes dans l'élaboration de politiques environnementales grâce à de nouveaux éclairages théoriques et empiriques.

RÉSUMÉ

Des politiques publiques environnementales ambitieuses et de grande envergure sont de plus en plus nécessaires pour faire face à la crise environnementale. Le soutien de l'opinion publique est un élément essentiel pour la mise en œuvre de ces politiques dans les pays démocratiques. Cependant, le soutien du public n'est pas toujours aligné sur l'efficacité des mesures telle que mesurée par les experts, comme le montre la forte opposition à la taxation du carbone dans le monde entier. Une meilleure compréhension des déterminants des jugements d'acceptabilité envers les politiques environnementales est donc cruciale pour informer l'action publique. Dans cette perspective, la présente thèse se concentre sur les origines psychologiques des jugements d'acceptabilité des citoyens dans trois domaines de la politique environnementale : a) la politique climatique, b) la politique énergétique, et c) les politiques de conservation de la nature et de la biodiversité.

Les chapitres 1 et 2 utilisent des approches expérimentales pour tester l'effet causal de différents mécanismes cognitifs impliqués dans l'acceptabilité des politiques environnementales. Dans ces deux chapitres, une approche cross-culturelle est adoptée : toutes les expériences sont menées parallèlement en France et au Royaume-Uni, en utilisant des échantillons représentatifs de la population en termes d'âge et de genre. Le chapitre 1 étudie les jugements d'acceptabilité à l'égard de différents scénarios de taxation du carbone, une politique climatique efficace dont l'acceptabilité dépend fortement de la manière dont les recettes fiscales sont utilisées. Ce chapitre démontre que la théorie de la comptabilité mentale peut à la fois expliquer des schémas récurrents dans les préférences citoyennes, tel que le soutien à l'affectation environnementale des revenus, et aider à concevoir un scénario de taxe carbone qui soit à la fois acceptable et socialement équitable. Le chapitre 2 étudie l'acceptabilité de quatre contre-mesures gouvernementales en réponse à la crise énergétique actuelle. Ce chapitre montre d'abord que les citoyens préfèrent les subventions énergétiques aux transferts monétaires, et en particulier les subventions énergétiques universelles, en dépit de leurs impacts sociaux et environnementaux négatifs. Il est ensuite démontré que ces préférences sont liées à des perceptions erronées concernant le coût et l'impact de ces différentes politiques.

Le chapitre 3 est une revue systématique de la littérature visant à identifier les différents facteurs psychologiques associés au soutien du public envers les politiques de conservation de la nature et de la biodiversité. Parmi les différents facteurs psychologiques étudiés dans les 66 sources examinées, les représentations mentales (comme les croyances et les perceptions) sont celles qui ont reçu le plus d'attention de la part des chercheurs. En outre, les valeurs envers les espèces non-humaines, les connaissances sur les questions d'environnement et de conservation, ainsi que certaines attitudes politiques générales, sont les prédicteurs les plus robustes du soutien aux politiques de conservation.

MOTS-CLÉS

acceptabilité; politiques environnementales; facteurs psychologiques; préférences citoyennes; sciences cognitives

ABSTRACT

Widespread and ambitious environmental public policies are increasingly required in order to address the environmental crisis. One critical element for the implementation of such policies in democratic countries is public support. However, public support is not always aligned with assessed policy effectiveness, as made salient by the strong opposition to carbon taxation worldwide. A deeper understanding of the determinants of public acceptability judgments is thus crucial for policy-making. In this perspective, the present thesis studies the psychological origins of citizens' acceptability judgments in relation to three environmental policy domains: a) climate policy, b) energy policy, and c) biodiversity protection and nature conservation policy.

Chapters 1 and 2 use experimental research designs to test the causal impact of various cognitive mechanisms on environmental policy support. In both chapters, a cross-cultural approach is adopted such that all experiments are conducted in France and in the UK, using representative samples of the population with regards to age and gender. Chapter 1 investigates acceptability judgements towards different scenarios of carbon taxation, an effective climate policy for which public support heavily depends on how tax revenues are used. This chapter provides evidence that mental accounting theory can both explain systematic patterns in citizens' preferences, such as the support for environmental earmarking (i.e. using carbon tax revenues for environmental purposes), and help design a carbon tax scheme that is both acceptable and socially fair. In Chapter 2, the acceptability of four government countermeasures in response to the energy crisis is studied. This chapter first provides evidence that citizens prefer energy subsidies to cash transfers, and especially universal energy subsidies, despite their negative social and environmental impacts. These preferences are then shown to be causally related to widespread misperceptions about policy cost and impact, as demonstrated by the presence of correction treatment effects in most of the conducted experiments.

Chapter 3 is a systematic scoping review aiming to identify the various psychological factors associated with public support for biodiversity protection and nature conservation policies. Among the different psychological factors investigated in the 66 reviewed sources, representational factors (i.e. beliefs, perceptions) have received the most attention from scholars. Moreover, wildlife value orientations, knowledge about environmental and conservation issues, as well as general policy attitudes, are the psychological factors most robustly associated with conservation policy support.

KEYWORDS

public support; environmental policies; psychological factors; citizen preferences; cognitive science