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Going Green in Stages: Psychological processes behind intention formation and action for climate mitigation

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Abstract

Mitigating the climate crisis requires changes to policy, business, and consumer behaviour in favour of sustainability. For consumers, use of private motor vehicles and consumption of meat and dairy are high-impact behaviours. To assist behaviour change, it is useful to understand where in the process of change people currently are and what motivates the next step. In a pre-registered study using a representative sample of adults (N = 1200), we measure 'stage of change' for transport and diet behaviours, then test the relationship between stage of change and a battery of psychological variables informed by previous theoretical and empirical research. Our modelling approach allows us to test whether the variables associated with change depend on the stage an individual is moving to and from. The models reveal that, for both transport and dietary behaviours, people who intend to change worry more about climate change and feel more morally responsible to act than people who see no need to change. Acting on intentions is associated with holding a strong environmental identity. We also find differences between the two behaviours in the variables associated with stage of change. For example, positive environmental attitudes predict intentions and actions only for transport behaviour, whereas belief in the effectiveness of collective action predicts intention to change diet. Sociodemographic predictors of change also differ between behaviours: urban dwellers are more likely to act on transport intentions, while being a woman predicts intentions and action for dietary change. Other psychological variables cited in the literature have little association with change, including social norms and belief in individual responsibility. The results show the benefit of conceptualising behaviour change as a multi-stage process.

Keywords: climate change; stage of change; intention-action gap; transport; diet

1. Introduction

Clear majorities worldwide believe climate change is a human-caused emergency that necessitates mitigative action (Vlasceanu et al., 2023). Despite this widespread concern, few people in high-income countries have meaningfully reduced their reliance on fossil fuels or their consumption of high-emission goods. This apparent "gap" between pro-environmental sentiment and the actions people take has received substantial attention in the scientific literature, although varying labels have been applied: the attitude-action gap (Kollmuss & Agyeman, 2002), the attitude-behaviour gap (Padel & Foster, 2005; Park & Lin, 2018; Wyss et al., 2022), the green gap (ElHaffar et al., 2020), the intention-action gap (Lee et al., 2020; Rausch & Kopplin, 2021), the intention-behaviour gap (Gardner et al., 2020; Wang & Mangmeechai, 2021), and the value-action gap (Olson, 2013).

Regardless of the label used, most studies have conceptualised the problem as one of binaries: positive attitudes or intentions are present or not and pro-environmental behaviour is present or not. Our approach is different and offers three primary contributions. First, the perspective on behaviour change that we adopt is taken from stage models of change (Velicer et al., 1998; Bamberg, 2007; Bamberg, 2013), which recognise, for example, that individuals must first become aware that behaviour is problematic, then make general intentions before forming specific ones on which to act, and lastly maintain actions once first enacted. Compared to investigating intentions or behaviour in isolation, this perspective more accurately conceptualises behaviour change as a process. Second, rather than recording variables predicted by one specific theoretical framework, we record psychological variables from multiple frameworks of pro-environmental behaviour. This approach provides a broad test of factors associated with behaviour change and how they apply depending on stage of changes (SOC). Third, we employ statistical models that allow the psychological factors associated with behaviour change to differ depending how far along the process of change an individual has come. Our focus is on everyday pro-environmental actions that matter most for an individual's carbon footprint: transport and diet (e.g., Wynes & Nichols, 2017; Lacroix, 2018).

The remainder of this section is structured as follows. First, we review literature on determinants of pro-environmental behaviour. Next, we introduce the theoretical framework proposed by stage models and discuss their advantage for understanding behaviour change. Finally, we highlight how our approach builds on existing empirical research.

2.4 *Determinants of Behaviour Change*

When seeking to explain what motivates pro-environmental behaviour, most existing research has taken a deductive approach to determine what psychological variables are analysed (Lange et al., 2021). In essence, a theoretical framework is adopted, psychological variables proposed by this framework as important are recorded and their association with behavioural intentions are tested. Thus, the theoretical framework employed dictates the psychological variables targeted for intervention.

For example, arguably the most widely applied framework is the Theory of Planned Behaviour (TPB; Ajzen, 1991). TPB argues that behaviour is the result of intentions people form, which in turn are determined by perceived attitudes (i.e., negative or positive appraisals of the behaviour), subjective norms (i.e., perceived social pressure to perform the behaviour) and behavioural control (i.e., perceived ease or difficulty of performing a behaviour). As a simple example, Laura should reduce her consumption of red meat if she (i) believes doing so is a good thing to do, (ii) perceives others to expect such a change and (iii) thinks changing some of what she eats wouldn't be too difficult. Later expansions of the theory include additional determinants of intentions such as self-identity, different types of norms, and self-efficacy (e.g., Conner & Armitage, 1998; Rise et al., 2010; Bosnjak et al., 2020). And indeed, applications of TPB to sustainable transport and diet behaviour have found support for the role of attitudes (Abrahamse et al., 2009; Donald et al., 2014; Lentz et al., 2018; Povey et al., 2001; Shi et al., 2017; Zur & Klöckner, 2014); personal, social, and moral norms (Abrahamse et al., 2009; De Boer et al., 2017; Donald et al., 2014; Graham-Rowe et al., 2015; Shi et al., 2017); self-efficacy and perceived control (Hunter & Röös, 2016; Lamm et al., 2022; Shi et al., 2017; Skarin et al., 2019); and identity (Gatersleben et al., 2012; Whitmarsh & O'Neill, 2010; Zhang et al., 2023).

By contrast, where other theoretical frameworks are adopted, such as the Value-Belief-Norm theory, Protection-Motivation theory, and social identity models, other determinants appear to matter: perceptions of responsibility (Lind et al., 2015; Ünal et al., 2019; Banos-González et al., 2021; Syropoulos & Markowitz, 2022), trust (Song et al., 2019; Caferra et al., 2021; Bergquist et al., 2022; Cologna et al., 2022; Xing et al., 2022), fairness (Eriksson et al., 2008; Cools et al., 2011; Sweetman & Whitmarsh, 2016; Bergquist et al., 2022), effectiveness beliefs (van Zomeren et al., 2008; Fritsche et al., 2018), threat appraisal (Kothe et al., 2019), and affective responses like worry about climate change (Smith & Leiserowitz, 2014; Gregersen et al., 2021). This multiplicity of theoretical frameworks and associated variables means that the literature on pro-environmental behaviour change has highlighted very many individual psychological drivers of pro-environmental behaviour. For policymakers and other stakeholders attempting to encourage pro-environmental behaviour change, identifying what matters most is a challenge.

In addition, the most widely applied models of behaviour change typically conceptualise change as a one-step decision, rather than an ongoing process. Returning to our example, Laura has either reduced – or intends to reduce – her red meat consumption, or not. Enablers and impediments are typically viewed as static predictors of behaviour, implying that the desired behaviour will occur once the same set of antecedents are present. An alternative is that, for example, the pre-conditions necessary for an intention to form might differ from those necessary for translating that intention into action (Klöckner & Nayum, 2016; Nielsen, 2017; Kwasny et al., 2022; Van Valkengoed & Van Der Werff, 2022; Strässner & Hartmann, 2023).

1.2 Stage models of change

Stage models centre on the *process* of adopting new behaviours. A person is assumed to progress through a series of stages before behaviour change is realised. An important aspect of stage models is that determinants of change can differ depending on the stage an individual is moving to and from. In general, the individual is thought first to engage in cognitive processes, such as becoming aware of problem behaviours, and later in behavioural strategies to control and alter the behaviour of interest (Velicer et al., 1998; Bamberg, 2007; Bamberg, 2013).

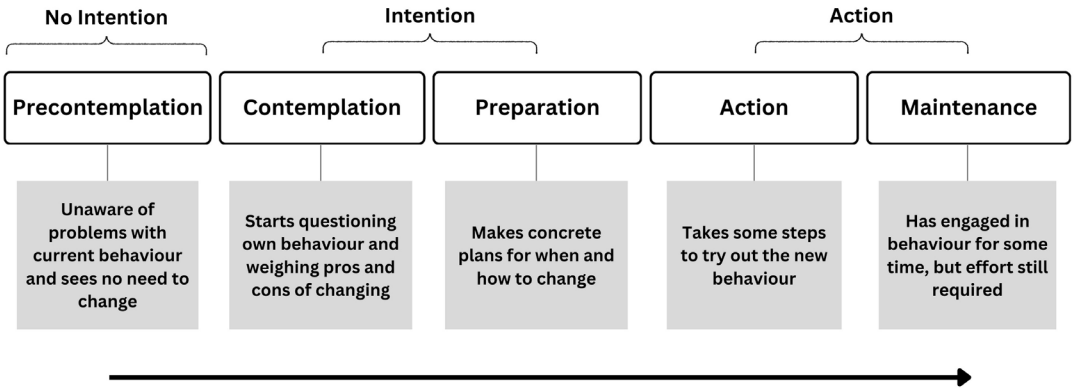


Figure 1. Transtheoretical Model of Change (adapted from Prochaska & Velicer, 1997).

The transtheoretical model of change (TTM, Prochaska & Velicer, 1997) is one of the more influential stage models and was originally developed to describe how people adopt new health behaviours. The model describes five distinct stages of change (SOC): pre-contemplation, contemplation, preparation, action, and maintenance, see Figure 1. For example, in the pre-contemplation stage, Laura is not questioning her meat intake and is not considering alternative diets. She may enter the contemplation stage once she becomes aware that eating red meat is associated with higher emissions than other food. Here, she starts questioning her diet and considering alternatives, but does not form any explicit plans to change. The preparation stage is where she begins to formulate specific plans for when and how to change, for example by pledging to take part in Meatless Mondays. Following this, in the action stage, she trials some vegetarian dinner options on Mondays. In the maintenance stage, she has refrained from meat on Mondays for some time, but some effort is still required to keep up the behaviour.

Stage models such as the TTM are relatively uncommon in the environmental psychology literature (Brick et al., 2024). Thus, compared to empirical investigations informed by static models (e.g., TPB, Value-Beliefs-Norms theory), the current evidence for determinants of pro-environmental behaviour informed by TTM is more limited. However, there is some evidence that an individual's stage of change matters for their pro-environmental behaviour (Wyker & Davison, 2010; Klöckner & Ofstad,

2017; Biehl et al., 2019; Andersson, 2020; Wolstenholme et al., 2021; Van Valkengoed & Van Der Werff, 2022). For example, Wyker and Davison (2010) take a TPB approach to measuring determinants of adopting a plant-based diet but, rather than merely recording whether participants hold an intention, they record their SOC. Their results show that, although subjective norms and perceived control were lower among those in the pre-contemplation stage compared to contemplation stage, there were no differences between the contemplation and preparation stages. One interpretation is that norms and perceived control may be important for initially contemplating behaviour change, but have no subsequent influence on making concrete plans for change. However, although there appears to be increasing recognition of the need to consider SOC over static theories of behaviour change, research on antecedents of pro-environmental behaviour predominantly employ statistical models that are unable to assess their relative influence on stage transitions.

1.3 Modelling Predictors of Change

Most research on psychological determinants of SOC explores variation in the association of psychological variables with SOC, typically by contrasting the first or last stage with remaining stages (e.g., using multinomial regression models; Weibel et al., 2019; Culliford & Bradbury, 2020) or by conducting comparisons between stage groups (e.g., ANOVAs; Lea et al., 2006; Wyker & Davison, 2010; Redding et al., 2015; Andersson, 2020; Strässner & Hartmann, 2023; binary logistic regression, Hielkema & Lund, 2021). A limitation with these methods is that, although relevant psychological variables can be associated with specific stages, their influence is not contrasted between different stage transitions. The models do not tell us whether there are different influences when people transition between stages earlier in the process compared to later. For instance, attitudinal variables may lead individuals to transition from pre-contemplation to contemplation stages, but not from the preparation stage to the action stage. A first (or last) stage reference case comparison model cannot capture this pattern. Even a post-hoc comparison of factors associated with all stage groups is limited, because it treats stage groups as independent and hence ignores the ordered structure of the change process. As a result, these models are unable to assess the relevance of different factors at each stage of the process while accounting for other stages. For example, how attitudes might influence stage progression from preparation

to action *accounting for* their influence on first progressing from pre-contemplation to contemplation and from contemplation to preparation.

An alternative modelling strategy that has been proposed for SOC is the generalised ordered regression model (or threshold of change analysis; Hedeker et al., 1999). In the standard ordered regression model, the estimated log odds associated with an increase in the explanatory variables are assumed be equal across each outcome category threshold (also known as the proportional odds or parallel lines assumption). In the generalised model the estimated log odds are instead allowed to vary across thresholds. For an outcome with *i* categories, the model simultaneously predicts the effect of an explanatory variable on the log odds of being in or above category *i* compared to being below category *i* for each of the *i*-1 thresholds. Due to the simultaneous estimation of all thresholds, the ordered nature of the outcome variable is preserved. With these models it is possible to compare an explanatory variable's association with the likelihood of crossing different SOC thresholds. For instance, it is possible to test how well attitudes predict passing the threshold for the contemplation stage compared to passing the threshold for the action stage. Another feature of these generalised models is that it is possible to allow some explanatory variables to vary across outcome categories, while others are kept constant (as in the standard ordered model). This instance of the model is sometimes called the partial proportional odds model and allows for a model that is flexible while also being parsimonious.

We located just three studies of SOC for pro-environmental behaviour that employed these models, all in the transport domain (Bamberg, 2007; Biehl et al., 2018; Yu et al., 2023). Bamberg (2007) shows, for example, that subjective (injunctive) norms were associated with the progression from the precontemplation to contemplation stage for switching from driving to public transport, whereas positive attitudes, subjective (injunctive) norms, and lower perceived costs (e.g., wait times) were associated with entering the maintenance stage. Although some factors varied by SOC, not all did; self-efficacy increased monotonically over the stages. Biehl et al. (2018) found positive effects of identity and perceived social norms for progressing to each stage of change for active travel. Perceptions of one's community (e.g., cohesion and community opinions towards mobility innovation) and place identity were associated with the

transition from preparation to action but did not predict progression from contemplation to preparation . Yu et al., (2023) investigated motivational determinants for flexi-route transport adoption. They showed that perceived comfort and flexibility, positive evaluations, and use willingness increased with SOC, whereas personal and external barriers decreased with SOC. They also found some variation across SOC for the determinants: perceived comfort and flexibility were stronger predictors for later stage progression, whereas perceived barriers were strongest for earlier stage progression.

In sum, these few studies employing statistical models that allowed the relative influence of psychological factors to vary by SOC do indeed record such variation. However, they are thus far confined to the transport domain and differ in the specific type of transport behaviour targeted, how SOC is defined, and what psychological predictors are tested. There is considerable scope to assess which factors matter for sustainable transport adoption in general and whether these generalise to other areas of impactful pro-environmental behaviour change.

1.4 Current Study

Our aim is to build on previous research on pro-environmental behaviour change by (i) adopting a SOC theoretical framework, (ii) measuring psychological factors associated with behaviour change suggested by multiple theoretical frameworks and (iii) modelling these factors using generalised ordered logistic regression models. Moreover, we follow recent calls from environmental psychologists to shift away from conceptualising pro-environmental behaviour as an index of behaviours with varying impact (Nielsen et al., 2021; Whitmarsh et al., 2021). Our focus instead is on two high-impact behaviours: how people get around day-to-day and what they eat (Lacroix, 2018). While these behaviours may have lower impact than less frequent actions, such as home retrofits or taking fewer flights, they are ones many individuals could reasonably be expected to change, at least a little. Moreover, by assessing factors associated with behaviours from different domains (transport and food) in the one sample, we incorporate a test their generalisability.

2. Method

The study was conducted online using Gorilla Experiment Builder (Anwyl-Irvine et al., 2020) and proceeded over multiple parts. Here we report findings from parts recording participants views on their own behaviour (i.e., their SOC) and a host of psychological variables deemed relevant for pro-environmental behaviour or intentions based on the literature. Results from other parts, which answered different research questions are reported separately. The study was pre-registered on the Open Science Framework: https://doi.org/10.17605/OSF.IO/Z4NX5.

2.1 Participants

The sample consists of 1,200 adults in Ireland, who were recruited by two market research and polling agencies to be broadly nationally representative.[1] Table 1 compares the socio-demographic characteristics of the sample against the latest population data from Ireland's Central Statistics Office. Importantly, the results we report control for socio-demographic characteristics, implying that any findings are not sensitive to these differences. Participants were paid €3 for completing the study, which took a median of 19 minutes.

Table 1. Sample Socio-Demographics

		n	%	Population %[a]
Gender	Men	584	48.7	49.0
	Women	613	51.1	51.0
	Non-Binary/Other	3	0.2	
Age	18-39 years	438	36.5	36.9
	40-59 years	441	36.8	36.4
	60+ years	321	26.8	26.7
Education	Degree or above	627	52.2	
	Below degree	573	47.8	
Employment	In labour force	852	71	67.4
	Of which Employed	813	95.4	96.1
	Of which not	39	4.6	3.9

[1] RED-C Research (www.redcresearch.ie) and Behaviour & Attitudes (www.banda.ie)

	Employed			
	Not in labour force	348	29	32.6
Socio-Economic Status	ABC1	614	51.2	46.0
	C2DEF	567	47.2	54.0
	Unsure	19	1.6	
Living Area	Urban	749	62.4	64.0
	Rural	451	37.6	36.0
Region	Leinster	637	53.1	56.0
	Connacht/ Ulster	229	19.1	17.0
	Munster	334	27.8	27.0

Note: [a]Employment population estimates are based on the 2023 Q1 Labour Force Survey. Population estimates are based on citizenship data from Census 2022.

2.2 Design and Procedure

Participants completed the study on their mobile phone, tablet or computer. For the tasks of interest here, participants reported on their current transport and diet behaviours (in randomised order) before answering questions about their SOC (described below). At the end of the study, participants completed a battery of questions about their climate change beliefs and attitudes, motivated by existing literature on determinants of pro-environmental behaviour.[2] These questions and associated references are presented in Table 2.

2.3 Measures

To measure participant's SOC, we adapted the instrument employed by Wolstenholme et al. (2021), who further differentiate between actions in SOC, allowing for people to have failed an action, be dissatisfied with changes made, satisfied with changes made or want to make more changes. We first asked participants if they had previously changed the relevant behaviour (e.g., how they get around) to reduce their carbon footprint before then probing their views of this change. In instances where the

[2] One stage of the study, run before the psychological variables were recorded, included an experiment in which some participants were randomised to read information on the climate impact of food. The results we report are not sensitive to experimental condition (see Table S7 and Table S12 in the Supplementary Material).

participant had not changed their behaviour, they were asked for their views of their current behaviour. Based on responses to these questions, participants could be categorised according to the transtheoretical stage model: 1) Pre-contemplation: Those who have not made any changes to their behaviour and do not see any need to change their behaviour; 2) Contemplation: Those who have not made any changes and would like to make changes but feel it's currently impossible; 3) Preparation: Those who have not made any changes but plan to in the near future; 4a) Action dissatisfied: Those who have made changes but find them difficult to maintain; 4b) Action satisfied: Those who have made changes and are satisfied with them; 4c) Further action needed: Those who have made changes and would like to make further changes; 5) Failed attempt at change: Those who have made changes but found the changes too difficult to maintain. For modelling purposes, we were interested in psychological differences between those who had not formed an intention ("pre-contemplation"), those who formed an intention that was not yet acted on ("contemplation" and "preparation") and those who had acted on an intention (all "action" groups).

We measured the following climate-related psychological variables based on the existing literature: worry about climate change, environmental identity, moral obligation, self-efficacy, perceived control, attitudes, individual effectiveness, injunctive norms, changes made by close and distant others (social and dynamic norms), collective effectiveness, perceived trade-off, fairness and cohesiveness beliefs, responsibility and perceived trust. Table 2 presents the full list of measures, the wording used and the literature on which it was based.

The following socio demographic variables were also recorded: age, gender, education, birthplace (Ireland or other), ethnicity, locality (region, county, and urban or rural setting), number of people in household, whether there are children under the age of 18 living in their household, socio-economic status, and employment status.

Table 2. Full list of measures and question wording of psychological predictors and stage of change

Measure	Wording	Adapted from
Climate worry	*In general, how worried are you about climate*	e.g., Gregersen et al.,

	change? 1 (Not at all worried) – 7 (Extremely worried)	2021
Responsibility	*In your opinion, who is responsible for tackling climate change in Ireland? Select all that apply*. (The Government, Business and Industry, The EU, Regional and Local Authorities, Environmental Groups, Individuals, Don't Know)	EUROBAROMETER
Identity	*I am the type of person who makes an effort to reduce their carbon footprint.* 1 Completely Disagree) – 7 (Completely Agree)	Randers & Thøgersen (2023); Graham-Rowe et al. (2015)
Moral obligation	*I feel a moral obligation to make changes to my day-today behaviour to reduce my carbon footprint*. 1 (Completely Disagree) – 7 (Completely Agree)	Abrahamse et al. (2009); Graham-Rowe et al (2015); Shi et al. (2017); Andersson (2020)
Self-efficacy	*I am confident that I could change my day-to-day behaviour to reduce my carbon footprint if I wanted to.* 1 (Completely Disagree) – 7 (Completely Agree)	Shi et al. (2017)
Perceived control	*The decision to change my day-to-day behaviour is completely within my control.* 1 (Completely Disagree) – 7 (Completely Agree)	Wolstenholme et al. (2021)
Attitudes	*Overall, making changes to my day-to-day behaviour to reduce my carbon footprint would be a good thing*. 1 (Completely Disagree) – 7 (Completely Agree)	Wolstenholme et al. (2021); Shi et al. (2017)
Injunctive norms	*I believe that most people in Ireland think that others should change their day-to-day behaviour to reduce their carbon footprint*. 1 (Completely Disagree) – 7 (Completely Agree)	Wolstenholme et al. (2021); Francis et al. (2004); Shi et al. (2017)
Social norms (close)	*People that are close to me are making conscious efforts to reduce their carbon footprint*. 1 (Completely Disagree) – 7 (Completely Agree)	De Groot et al. (2021); Seffen & Dohle, (2023,); Graham-Rowe et al (2015)
Dynamic norms	*I believe that more and more people in Ireland are making changes to their day-to-day behaviour to reduce their carbon footprint*. 1 (Completely Disagree) – 7 (Completely Agree)	De Groot et al. (2021)
Collective effectiveness	*I believe that people in Ireland making changes to their day-to-day behaviour to reduce their carbon footprint can help reduce emissions in a meaningful way.* 1 (Completely Disagree) – 7 (Completely Agree)	van Zomeren et al., (2010); van Zomeren et al., (2013)
Individual effectiveness	*Overall, making changes to my day-to-day behaviour to reduce my carbon footprint can help reduce emissions in a meaningful way.* 1 (Completely Disagree) – 7 (Completely Agree)	Based on van Zomeren et al., (2013); Vermeir & Verbeke (2008)

Trade-off	*The environmental benefits of changing one's day-to-day behaviour outweigh the personal hassle.* 1 (Completely Disagree) – 7 (Completely Agree)	Hunter & Röös, 2016
Fairness	*It is fair for people in Ireland to be expected to make changes to their day-to-day behaviour to reduce their carbon footprint*. 1 (Completely Disagree) – 7 (Completely Agree)	Lunn et al. (2024)
Coherence	*Taken together, all of the things being asked of the public to reduce their carbon footprint make sense as a set*. 1 (Completely Disagree) – 7 (Completely Agree)	Lunn et al. (2024)
Trust	*How much do you trust or distrust the following as a source of information about climate change?* Scientists; Environmental non-governmental organisations (NGOs); The mainstream news media; Political leaders; Corporations/businesses 1 (Completely Distrust) – 7 (Completely Trust)	Arbuckle et al. (2013); Cologna et al (2022)
Stage of change		Adapted from Wolstenholme et al. (2021)
Changed transport	*Have you ever made any changes to how you get around/travel day-to-day to reduce your carbon footprint?* (Yes, No)	
(If Changed Transport is 'Yes') Transport change views	*Which of the following best describes how you feel about the changes you made to how you get around/travel?* (I am satisfied with how I currently get around/travel day-to-day, I would like to make even more changes, I am finding the changes difficult to maintain, I found the changes too difficult to maintain)	
(If Changed Transport is 'No') Transport views	*Which of the following best describes how you feel about how you get around/travel?* (I do not see any need to change how I get around/travel to reduce my carbon footprint, I would like to make changes to how I get around/travel to reduce my carbon footprint but at the moment feel it is not possible for me, I plan to make changes to how I get around/travel to reduce my carbon footprint in the near future)	
Changed diet	*Have you ever made any changes your diet to reduce your carbon footprint?* (Yes, No)	
(If Changed Diet is 'Yes') Diet change views	*Which of the following best describes how you feel about the changes you made to your diet to reduce its carbon footprint?* (I am satisfied with my current diet, I would like to make even more changes, I am finding the	

	changes difficult to maintain, I found the changes too difficult to maintain)
(If Changed Diet is 'No') Diet views	*Which of the following best describes how you feel about your current diet?* (I do not see any need to change my diet to reduce my carbon footprint, I would like to make changes to my diet to reduce my carbon footprint but at the moment feel it is not possible for me, I plan to make changes to my diet to reduce my carbon footprint in the near future)

2.4 Analytic Approach

In our pre-registration plan, we specified that we would treat SOC as a three- or four-category variable, depending on cell sizes. Based on response distributions, described in the next section, we opt for the three-category approach: no intention (stage 1), intention (stages 2, 3 and 5, as each indicate a desire to change) and action (stages 4a, 4b and 4c). Following our pre-registration, we initially use ordered logistic regression models to predict SOC by the psychological factors, with socio-demographic controls for age, gender, educational attainment and living in an urban or rural area. We first model each factor separately before combining all significant factors in one model. Where any factor fails the assumption of proportional odds, we use a generalised partial proportional odds model specifying varying (nominal) effects for that factor using the *clm* function from the *ordinal* package (Christensen, R., 2023) in R Studio Statistical Software (R version 2.2.1, RStudio version 2024.04.1+748). We further pre-registered an alpha level of .05 for all statistical tests, but deviate from this in our interpretation of the models. Given the volume of tests conducted, we use Bonferroni correction for interpreting the results of final models. As a final robustness check we also report fully unrestricted generalised models (Table S14) to ensure the effects we find in the partial proportional odds models are not simply artefacts of the strategy used to determine which variables to relax the proportional odds assumption for.

3. Results

The distribution of participants at each stage of change for transport and diet behaviours are presented in Figure 2. For transport stage of change, 28.0% had not formed an intention to change (pre-contemplation stage), 32.4% had formed an intention that was not successfully acted on (i.e., contemplation, preparation and action-failed stages) and 39.8% had taken successful action (all other action stages).

For diet, the largest proportion of participants (45.7%) had not changed their diet to reduce their carbon footprint and did not see a need to do so (pre-contemplation stage). 27.8% was in the intention stage (contemplation, preparation, or failed action), and 26.5% were in the other action stages.

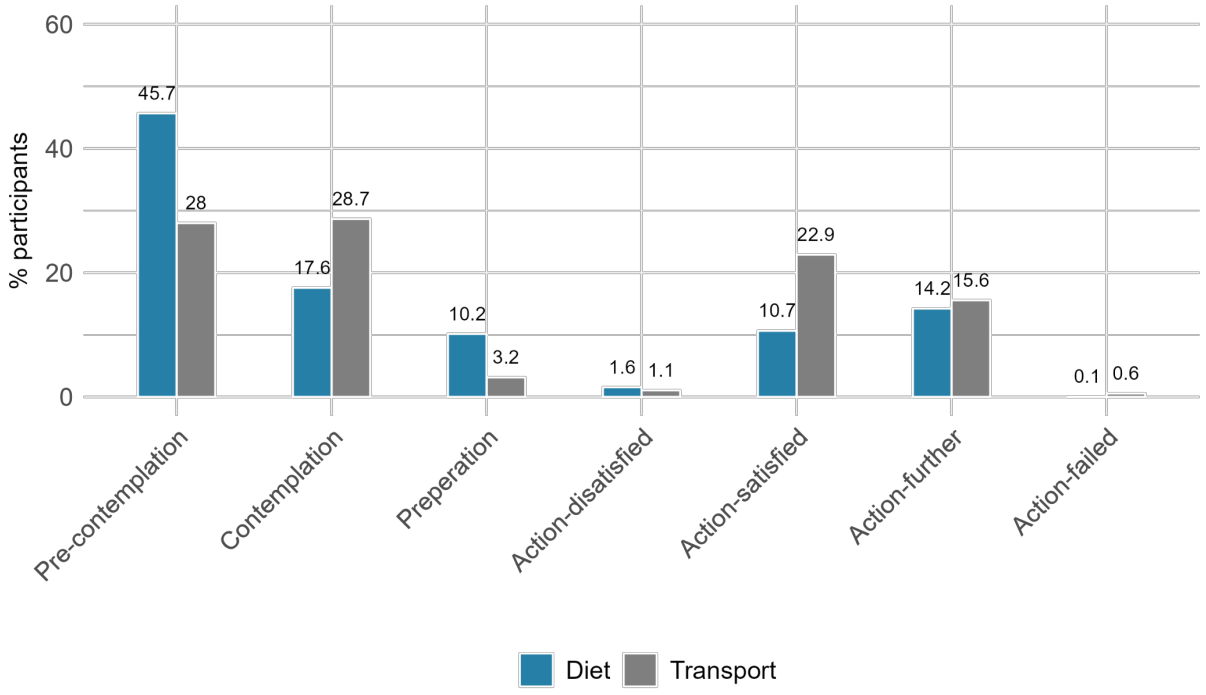


Figure 2. Stage of change for diet and transport.

The distributions of psychological variables are shown in Figure 3. To check for collinearity among predictor variables, we assessed the correlation matrix between the psychological predictors (Table S1). Of the 171 correlations, just six coefficients were above .70 and only one was above .80, suggesting no excessive interdependence among the psychological predictor variables.

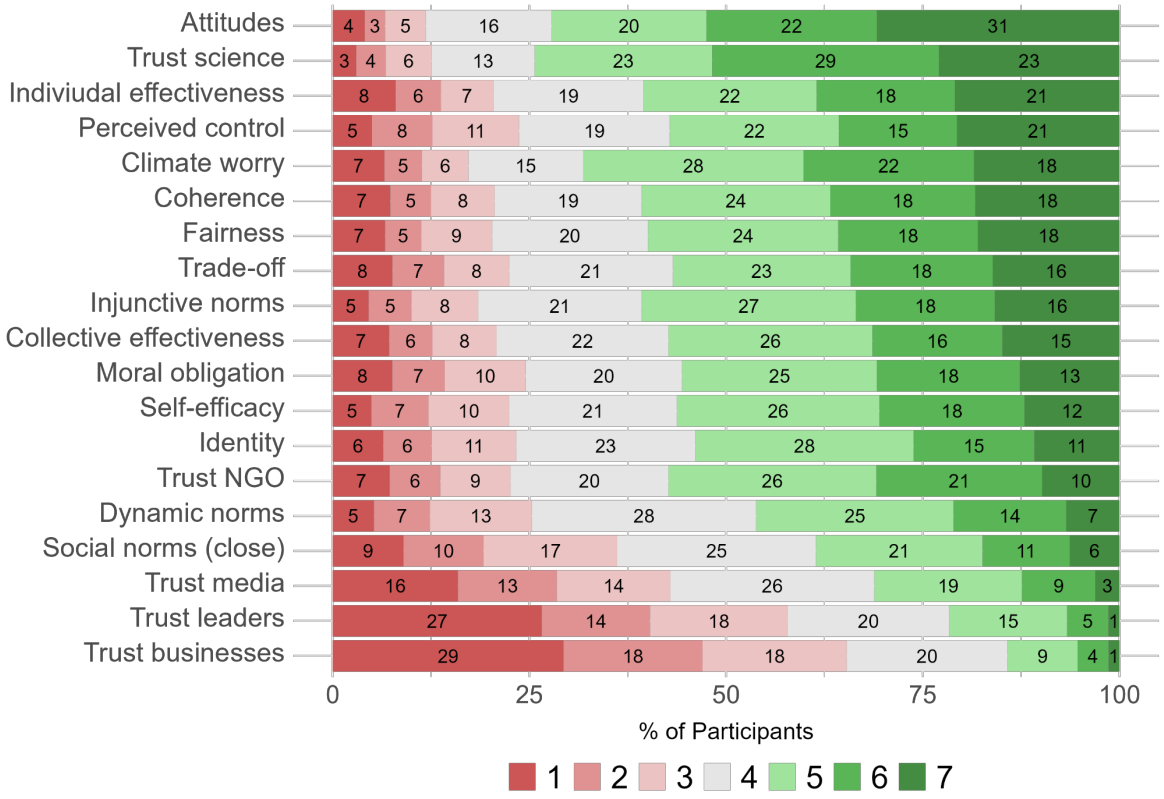


Figure 3. Distribution of psychological variables.

3.1 Transport Predictors

To model associations with transport SOC, we used the three-category SOC variable as our dependent variable. All psychological variables were significant in the separate ordered logistic regression models, controlling for socio-demographics (Table S3). We next fitted an ordered logistic regression model including all psychological variables as predictors of transport SOC with controls for sociodemographic covariates (Table S4). Tests for the proportional odds assumption showed violations for worry, self-efficacy, perceived control, age, and living area. As such, we then fitted a generalised ordered logistic regression model with nominal effects for these variables (Model 1, Table 3).

The generalised model shows that pro-environmental attitudes and believing environmental groups are responsible to mitigate climate change were consistently associated with higher transport SOC. In other words, both variables were associated with crossing the threshold from no intention to intention and from intention to action. The model also shows differential relationships between worry, pro-environmental identity, morality, self-efficacy, perceived control, and urban status across transport SOC. Worry and morality were positively associated

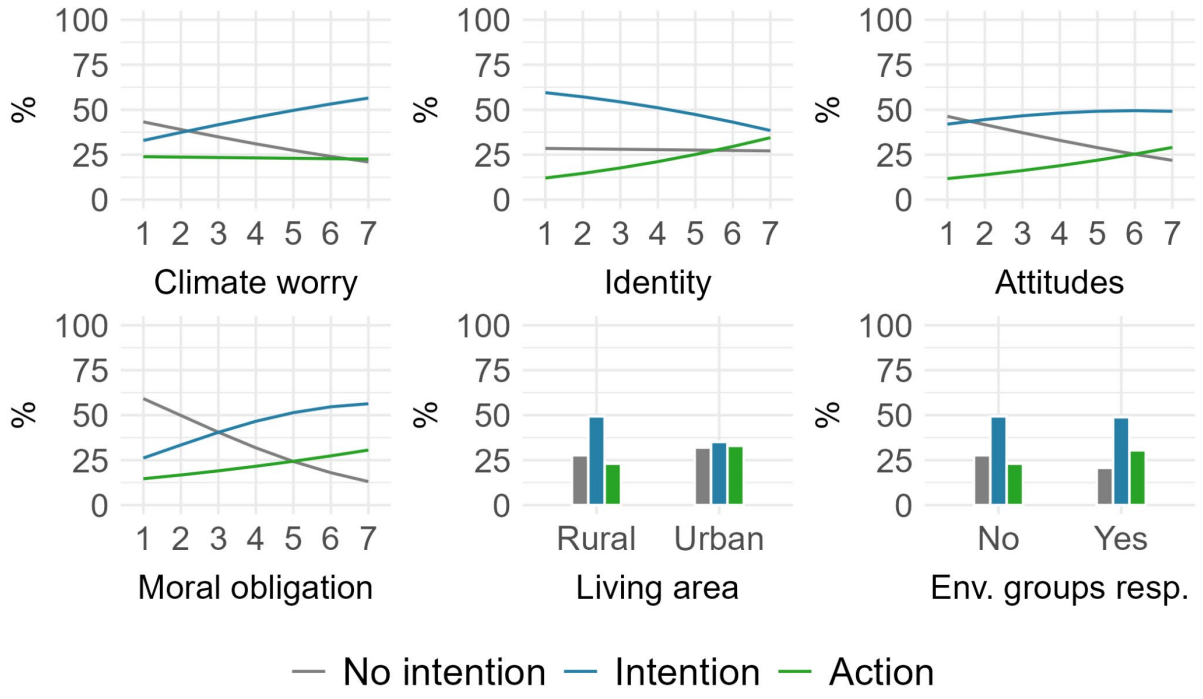
with crossing the intention stage threshold, but not the action stage threshold. Perceived control was negatively associated with crossing the intention threshold, pro-environmental identity, self-efficacy and living in an urban area were positively associated with crossing the action stage threshold, whereas these had no influence on crossing the intention threshold. Only the effect of morality on crossing the intention threshold and the effect of living in an urban area on crossing the action threshold survived Bonferroni correction.

Model 2 in Table 3 presents the same analysis excluding non-significant predictors from Model 1. A likelihood ratio test showed no evidence for a reduction in model fit compared to the full model, LR(19) = 17.13, p = .581. Results are similar across the two model specifications, although in addition to the effect of moral obligation (Log Odds = 0.64, p <.001) on intention, and urban status (Log Odds = 0.50, p<.001) on action, the effect of worry (Log Odds = 0.29, p = .001) on crossing the intention threshold and the effect of identity (Log Odds = 0.36, p <.001) on crossing the action threshold now also survive Bonferroni correction, as do the general effects of attitude and holding environmental groups responsible for acting. Fewer of those who judge environmental groups responsible for acting were in the no-action stage (18.8%) than the intention (35.2%) and action (25.9%) stages, whereas those who did not judge environmental groups responsible were more evenly split across the three groups (36.1%, 29.9% and 34.0%, respectively). Results are robust to excluding participants who reported never using private vehicles as mode of transport (Table S8) and to using fully unrestricted models (Table S14).

Figure 4 presents predicted probability plots for transport SOC by variables passing the Bonferroni-corrections from Model 2, Table 3. Grey lines and bars represent the no-intention stage, blue the intention stage, and green the action stage. Lines that are parallel indicate that change in levels of the predictor variable has equal effects on the predicted probability of being in those stages. The first column show that worry and moral obligation positively predict intention stage membership. We can see that moral obligation to a weaker extent predicts action stage membership, however the relationship did not survive the Bonferroni correction. The second column shows that environmental identity and living in an urban area positively predict action stage membership. The last columns illustrate that environmental attitudes and finding environmental groups responsible have equal effects on the predicted probability of higher stage membership.

In summary, the final model shows that while holding a general pro-environmental attitude was positively associated with both intentions and action, other psychological variables had

differential effects by SOC. Feeling worried about climate change and morally obliged to act was associated with intentions to change, but not having taken action (or, at least to a lesser degree). Acting was associated to a greater extent with identity and having a favourable environment (i.e., living in an urban area with better infrastructure). Of further note are the psychological factors that appear to have non-significant (or at least far weaker) relationships with transport stage of change, including social norms, trust in science and perceptions of fairness.



Note: Predicted probabilities based on Model 2, Table 3. All other variables are kept at mean values/ reference categories when calculating probabilities.

Figure 4. Predicted probabilities for transport SOC depending on psychological variables.

Table 3. Generalised ordered logistic models on predictors of stage of change for transport[d].

		Model 1: Full[c]			Model 2: Reduced		
Threshold effects[a]		Log Odds	95% CI	p	Log Odds	95% CI	p
Intention (1)	Intercept	-0.89	[-1.31,-0.47]	<.001	-0.96	[-1.26,-0.66]	<.001
	Climate worry	**0.30**	[0.10,0.49]	**.003**	**0.29**	[0.11,0.48]	**.001**[b]

	Individual responsible	0.32	[-0.01,0.65]	.060			
	Identity	-0.01	[-0.23,0.22]	.959	0.02	[-0.20,0.24]	.871
	Moral obligation	**0.59**	[0.32,0.85]	**<.001[b]**	**0.64**	[0.39,0.89]	**<.001[b]**
	Self-efficacy	0.07	[-0.12,0.27]	.461	0.06	[-0.14,0.25]	.571
	Control	**-0.25**	[-0.42,-0.07]	**.005**	**-0.22**	[-0.46,-0.09]	**.011**
	Urban	-0.17	[-0.47,0.13]	.265	-0.21	[-0.50,0.09]	.173
Action (2)	Intercept	1.04	[0.63,1.46]	<.001	1.21	[0.91,1.50]	<.001
	Climate worry	0.02	[-0.17,0.21]	.846	-0.02	[-0.19,0.16]	.821
	Individual responsible	-0.01	[-0.33,0.32]	.967			
	Identity	**0.33**	[0.11,0.54]	**.003**	**0.36**	[0.15,0.57]	**<.001[b]**
	Moral obligation	0.22	[-0.02,0.47]	.073	**0.27**	**[0.03,0.50]**	**.028**
	Self-efficacy	**0.27**	[0.08,0.46]	**.006**	**0.27**	[0.09,0.46]	**.004**
	Control	0.07	[-0.09,0.23]	.426	0.07	[-0.08,0.23]	.359
	Urban	**0.48**	[0.21,0.75]	**<.001[b]**	**0.50**	[0.23,0.76]	**<.001[b]**
Ordinal effects							
Env groups responsible		**0.49**	[0.17,0.81]	**.003**	**0.38**	[0.15,0.62]	**.001[b]**
Attitudes		**0.29**	[0.09,0.49]	**.005**	**0.30**	[0.13,0.47]	**<.001[b]**
Male		0.06	[-0.18,0.29]	.629	0.06	[-0.17,0.29]	.588
Age		-0.03	[-0.15,0.09]	.639	-0.01	[-0.13,0.11]	.861
Degree		0.23	[-0.01,0.46]	.060[c]	0.22	[-0.01,0.46]	.057[c]
AIC			2266.6			2245.7	

Log Likelihood	-1094.3	-1102.9
McFadden Pseudo R^2	0.16	0.16
Observations	1200	1200

Note: [a] In the first panel (1), the model predicts crossing the threshold for the intention stage, in the second panel (2) it predicts crossing the threshold for the action stage. [b] significant Bonferroni-corrected p-values. [c]Non-significant psychological ordinal predictors are omitted, see Model 1, Table S5 for complete model. [d]Standardised coefficients are displayed, see Table S6 for unstandardised models.

3.2 Diet Predictors

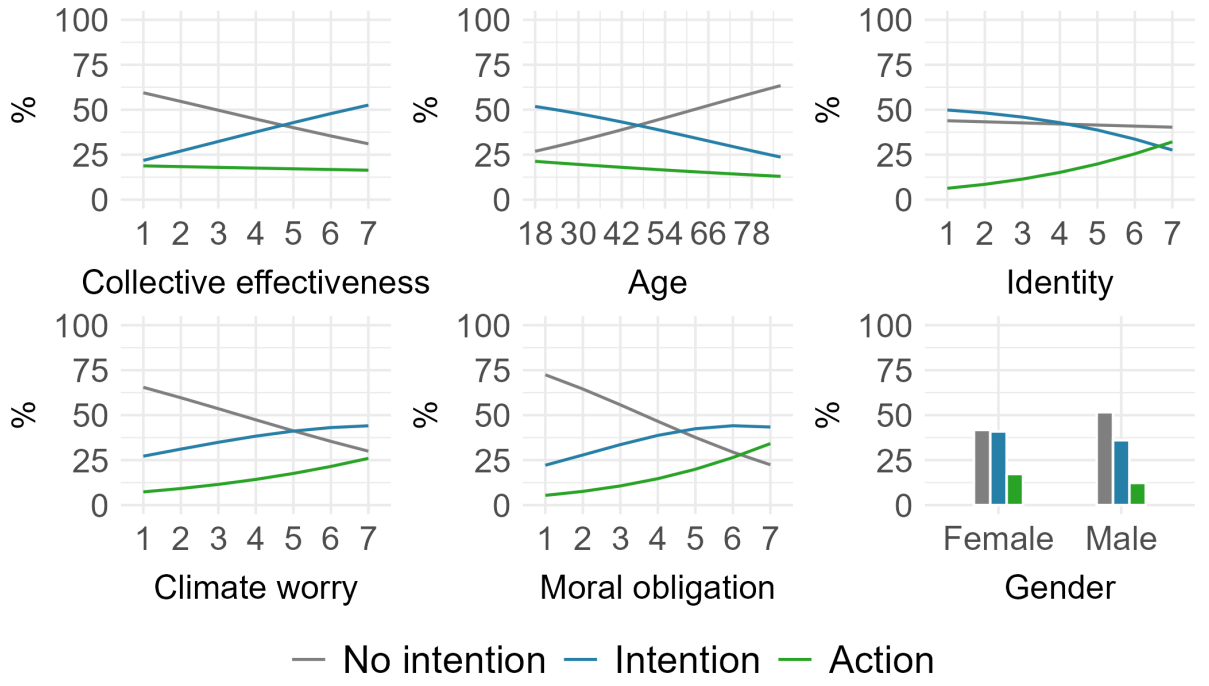
We used the same analytic strategy for diet stage of change. All psychological factors were significant in the separate ordered logistic regression models (Table S3). For the ordered logistic regression model including all factors, the proportional odds assumptions failed for perceptions of the collective effectiveness of behaviour change, perceptions that business are responsible, identity, age, and degree (Table S9). Model 1 in Table 4 shows a generalised ordered logistic regression model with nominal effects for these variables.

Worry about climate change and feeling morally obliged to act were constant positive predictors of higher SOC. Trust in science and businesses both had consistent negative associations with SOC, although neither relationship survived Bonferroni correction. Being male was a negative predictor of diet behaviour change. The model also shows differential effects of perceptions that businesses are responsible to act, collective effectiveness, identity, age, and degree between the different stages. The perception that businesses are responsible to act on climate change was negatively associated with crossing the intention threshold, whereas believing that people changing their behaviour can effectively mitigate climate change was positively associated with crossing the intention threshold. As for transport, pro-environmental identity was positively associated with crossing the action stage. Higher educational attainment was also associated with crossing the action stage compared to lower stages, but did not survive the Bonferroni correction. Age was negatively associated with crossing both stage thresholds, but had failed the proportional odds test implying stronger effects on crossing the intention threshold than action threshold. Only the intention coefficient of age passed the Bonferroni correction.

As before, we ran a reduced model including only significant factors from Model 1 (Model 2, Table 4). A likelihood ratio test shows no difference in model fit between the reduced and full model, LR = 25.71, p = .107. Considering only the relationships that survived Bonferroni

correction, worry, morality and being female were all positively associated with SOC. Belief in collective effectiveness of behaviour change (Log Odds = 0.33, p <.001) and being younger (Log Odds$_{Age}$ = -0.35, p <.001) were positively associated with entering the intention stage, while identity (Log Odds = 0.52, p <.001) was positively associated with entering the action stage. As for gender differences, 38.5% of women were in the no intention stage, 30.8% in the intention stage, and 30.3% in the action stage, the corresponding numbers for men were 52.9%, 24.5%, and 22.6%. Results are robust to excluding participants who reported not eating beef, other meat, or cheese (Table S13), and to running fully unrestricted models (Table S14).

Figure 5 presents predicted probabilities of SOC membership by the variables surviving the Bonferroni correction in Model 2, Table 4. The top row shows variables with varying effects on SOC. As belief in collective effectiveness increases, the predicted probability of being in the intention stage goes up. Conversely, the probability of being in the intention stage decreases with age. Higher identity increases the probability of being in the action stage, with little influence on being in the intention stage. The bottom row shows the constant relationships of climate worry, moral obligation, and gender on SOC.



Note: Predicted probabilities based on Model 2, Table 4. All other variables are kept at mean values/ reference categories when calculating probabilities.

Figure 5. Predicted probabilities for diet SOC by psychological and demographic variables.

The models for diet behaviour change demonstrate differences in the psychological profile of SOC compared to transport change. Whereas worry and morality were associated with only intention (and not action) for transport, they were positively associated with both intention and action for diet behaviours. Belief in the effectiveness of collective action appeared to be associated with being motivated to change one's diet, but not with changing transport behaviour. These differences perhaps reflect differences in the controllability of both behaviours; transport behaviour change depends in large part on available infrastructure, whereas diet behaviour change is less dependent on the environment. This inference is supported by the positive relationship between living in an urban area and transport action. Diet behaviours also appeared more strongly linked to sociodemographic characteristics, in particular gender and age, compared to transport behaviours. The only predictor appearing to have the same relationship with both transport and diet was having a strong green identity. Other psychological variables that are often cited in the literature appeared to have little effect, including social norms and belief that individuals are responsible for acting.

Table 4. Generalised ordered regression models on predictors of stage of change for diet[d].

		Model 1: Full[c]			Model 2: Reduced		
Threshold effects[a]		Log Odds	95% *CI*	*p*	Log Odds	95% *CI*	*p*
Intention (1)	Intercept	-0.33	[-0.73,0.73]	.109	-0.33	[-0.65,-0.01]	.042
	Business resp.	**-0.43**	[-0.79,-0.07]	**.019**	-0.13	[-0.42,0.16]	.379
	Identity	0.05	[-0.16,0.27]	.629	0.04	[-0.16,0.24]	.705
	Collective effectiveness	**0.22**	[0.02,0.43]	**.035**	**0.33**	[0.16,0.24]	**<.001[b]**
	Age	**-0.38**	[-0.52,-0.23]	**<.001[b]**	**-0.35**	[-0.49,-0.21]	**<.001[b]**
	Degree	0.09	[-0.18,0.35]	.524	0.08	[-0.18,0.34]	.529
Action	Intercept	1.58	[1.13,2.03]	<.001	1.56	[1.19,1.94]	<.001
	Business resp.	-0.12	[-0.52,0.27]	.543	0.19	[-0.14,0.52]	.263

Identity	**0.54**	[0.29,0.78]	**<.001[b]**	**0.52**	[0.29,0.75]	**<.001[b]**
Collective effectiveness	-0.14	[-0.36,0.08]	.199	-0.05	[-0.23,0.14]	.626
Age	**-0.17**	[-0.33,0.02]	**.030**	-0.13	[-0.28,0.01]	.076
Degree	**0.32**	[0.02,0.61]	**.034**	**0.33**	[0.04,0.61]	**.026**
Ordinal effects						
Climate worry	**0.35**	[0.17,0.53]	**<.001[b]**	**0.42**	[0.25,0.59]	**<.001[b]**
Moral obligation	**0.52**	[0.28,0.76]	**<.001[b]**	**0.63**	[0.41,0.84]	**<.001[b]**
Trust science	**-0.24**	[-0.41,-0.06]	**.008**	-0.12	[-0.27,0.02]	.094
Trust business	**-0.18**	[-0.35,-0.01]	**.039**	-0.04	[-0.16,0.08]	.491
Male	**-0.42**	[-0.66,-0.18]	**<.001[b]**	**-0.40**	[-0.63,-0.16]	**<.001[b]**
Urban	0.07	[-0.17,0.31]	.571	0.11	[-0.13,0.35]	.363
AIC		2217.8			2207.5	
Log Likelihood		-1071.9			-1084.7	
McFadden Pseudo R^2		0.16			0.15	
Observations		1200			1200	

Note: [a] In the first panel (1), the models predict crossing the threshold for the intention stage, in the second panel (2) they predict crossing the threshold for the action stage. [b] significant Bonferroni-corrected p-values. [c] Non-significant psychological ordinal predictors are omitted, see Model 1, Table S10 for complete model. [d] Standardised coefficients are displayed, see Table S11 for unstandardised models.

4. Discussion

Our aim was to identify psychological factors associated with transport and diet behaviour change to reduce carbon emissions. Our approach differs from much of the existing literature in environmental psychology, in that we employ a SOC theoretical framework, utilise statistical models that allow for variation in predictors across stages of change and take a bottom-up approach to identifying which predictors to test. The results show that psychological factors associated with intentions and action depend not only on the behaviour of interest but also on the individual's SOC.

Table 5 presents a summary of the factors associated with each SOC for transport and diet behaviours. Looking first at transport, holding the general belief that making changes to one's day-to-day behaviour to reduce one's carbon footprint is a good thing (i.e., having a positive attitude) is associated with both intentions and actions. Feeling worried about climate change and feeling a moral obligation to act are both associated with having an intention to change behaviour but not with having taken action. Instead, having a strong green identity and living in an urban area are associated with the transition from having an intention to acting on it. This latter effect is likely a reflection of the available infrastructure in Ireland; urban areas have far greater public transport provision and cycling infrastructure than rural ones. Thus, while affective responses to the climate crisis appear to motivate intentions to change transport behaviour, a favourable environment appears necessary for action.

Whereas feelings of worry and moral obligation are not associated with acting for transport behaviour, they appear to motivate both intentions *and* actions for diet behaviour change. Similar to transport behaviour, having a strong green identity is associated with acting on an intention to change one's diet. However, for diet behaviour, intentions are associated with stronger belief in the collective effectiveness of people making changes to their day-to-day behaviour. The socio-demographic associations with diet behaviour change are unrelated to the physical environment; being younger is associated with holding an intention (but not acting) while we replicate the well-established gender effect on dietary behaviour change, with being a woman being associated with both intentions and actions.

Table 5. Significant Predictors of Intentions and Actions for Transport and Diet Behaviour

	Transport	Diet

	Intention	Action	Intention	Action
Climate worry	+		+	+
Responsible:				
Government				
Business & Industry				
EU				
Regional and Local Authorities				
Environmental Groups	+	+		
Individuals				
Environmental identity		+		+
Moral obligation	+		+	+
Self-efficacy				
Perceived control				
Attitudes	+	+		
Injunctive norms				
Social norms (close)				
Dynamic norms				
Collective effectiveness			+	
Individual effectiveness				
Trade-off				
Fairness				
Coherence				
Trust				
Male			-	-
(Older) Age			-	
Degree				
Urban		+		

Note: + Significant Bonferroni-corrected positive coefficient; - significant Bonferroni-corrected negative coefficient.

4.1 Implications

These findings have important theoretical implications. We find partial support for the widely-applied TPB. As predicted by the theory, we find that attitudes and one type of norm (moral obligation) are associated with having an intention to change both transport and diet behaviour

to reduce one's carbon footprint. However, we do not find robust evidence that social norms nor perceived behavioural control are associated with intentions for either behaviour when alternative factors are controlled for. Whereas TPB proposes that intentions lead to action, in part through the role of perceived control, we find no evidence that perceived behavioural control helps transform intentions into actions. Instead, we find that actual behavioural control (as proxied by living in an urban area) is associated with acting on a formed intention. We also find distinct associations with action once an intention is formed. For example, having a green identity is not shown to be associated with forming an intention but instead is associated with acting on one once formed.

More importantly, however, we also find evidence for factors not specified by TPB. Feelings of worry have received much attention in the literature on pro-environmental behaviour change (e.g., Van Der Linden, 2015; 2017; Bouman et al., 2020; Gregersen et al., 2021) and appear to be associated with intentions for both transport and diet behaviour change, as well as action for the latter. Moreover, for diet behaviour change, stronger belief in the efficacy of collective action is associated with transitioning from thinking about behaviour change to acting on it, in line with social identity models of pro-environmental behaviour (e.g., van Zomeren et al., 2008; Fritsche et al., 2018). In short, while we find support for different aspects of current frameworks of pro-environmental behaviour, no single framework proves sufficient in capturing the nuance of what motivates intentions and actions.

Stage-based models appear helpful in distinguishing processes that underly intention formation and the transition to action. In turn, stage-based models can learn from previous frameworks as to what psychological factors should be considered. It is important to note that we did not set out to test which framework is 'better' at explaining pro-environmental behaviour. That said, if one framework had particularly strong explanatory power, we might expect the factors it proposes to come out in models as constant predictors of SOC. This is not what we find. Rather, our results suggest that a combination of frameworks may provide unique insight into what factors are relevant for different types of people and behaviours.

Combining aspects of multiple frameworks of pro-environmental behaviour in this way can further be beneficial for policymakers interested in promoting sustainable behaviour. First, it is necessary to identify the target behaviour, as we see the profile of psychological factors can differ depending on the behavioural domain. A stage-based framework can help diagnose

whether non-adoption is primarily due to a lack of intentions or due to insufficient prerequisites to act on them. Continued work on determinants for intentions and actions with the help of previous literature can help establish the specific impediments necessary for intentions to form and for them to turn into action. This can in turn inform whether policy should prioritise, for example, awareness raising efforts, capability-building, or through providing opportunities.

As examples, our results imply that policymakers in Ireland interested in shifting the public away from private vehicle use may be successful at motivating behaviour change by emphasising the risks of climate change and communicating the moral norm to reduce one's carbon footprint. However, such communications will prove ineffective at actual behaviour change without providing the appropriate infrastructure. For those interested in promoting sustainable diets, communicating the risks of climate change and moral norms associated with action appear to be reasonable targets also, coupled with techniques to emphasise the effectiveness of collective action. However, these inferences would naturally benefit from direct testing of causal relationships.

4.2 Limitations and Future Research

Although we believe our approach to diagnosing antecedents of behaviour change through the lens of stage-models of change is useful, there are limitations that present opportunities for future research. First, we test only associations between current psychological characteristics and self-reported changes in behaviour. Our approach would be strengthened by incorporating longitudinal measurements of these variables and through objective recording of behavioural data. Longitudinal work would also provide insight into not only causal links of stage progression, but whether similar patterns can be observed for stage regression. Second, although we pre-registered our analysis plan and applied conservative multiple corrections to the final models, the study would benefit from replication, particularly in other samples (i.e., in other countries) and for other pro-environmental behaviours. For example, the determinants of once-off transport behaviours such as buying an electric vehicle may differ from those that predict changes to day-to-day behaviour. Third, while our list of measured factors is comprehensive, it is unlikely to be exhaustive. There may be other factors important for behaviour that are worthwhile including in future studies. Fourth, the behaviour change measures and psychological factors we record explicitly specified motivations to reduce one's carbon footprint. This was a conscious decision in order to identify factors associated with pro-environmental behaviour, but people may change behaviours with climate implications for

reasons other than the environment. For example, people may shift to active modes of travel or reduce their red meat consumption for health reasons; we do not seek for our findings to generalise to these decisions.

More broadly, one challenge we faced in our efforts to review relevant literature from environmental psychology on the determinants of behaviour change was the variation in how SOC is defined and measured together with a narrow range of predictors. As a result, comparing our findings with other literature is difficult. Moreover, modelling techniques applied in studies that recognise the various steps involved in behaviour change typically neglect the ordered nature of the process, making it hard to isolate antecedents of different stage shifts. The literature would benefit from greater specificity and more appropriate statistical modelling techniques.

4.3 Conclusion

The urgency of the climate crisis requires implementing rapid change across individuals, communities, business and policy. To motivate behavioural shifts among individuals towards more sustainable diets and modes of transport, it is important to understand where in the process of change they currently are, as well as what motivates initiation and continuation of behaviour change. We show that diagnostic analysis of behaviour change benefits from employing a SOC framework as well as applying statistical models that allow for antecedents of change to vary depending on the behaviour of interest and the individual's SOC. We show also the benefits of complementing theory-driven approaches with more exploratory ones; multiple factors associated with behaviour change would have been missed had we just adopted one behaviour change theory. The findings are useful for understanding when and why people are motivated to change their behaviour.

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Supplementary Materials

Moral obligation correlated with identity (r = .78) and attitudes (r = .70), individual effectiveness correlated with attitudes (r = .74) and collective effectiveness (r = .70), trade-off correlated with fairness (r = .71) and perceived coherence (r = .71), and perceived coherence and fairness correlated (r = .82), se Table S1.

Table S1. Correlation matrix between psychological variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Climate worry	1																		
2. Attitudes	0.59	1																	
3. Identity	0.57	0.60	1																
4. Moral obligation	0.65	**0.70**	**0.78**	1															
5. Self-efficacy	0.45	0.54	0.54	0.60	1														
6. Perceived control	0.21	0.35	0.29	0.32	0.52	1													
7. Individual effectiveness	0.53	**0.74**	0.54	0.65	0.52	0.40	1												
8. Social norms (close)	0.41	0.47	0.57	0.57	0.47	0.32	0.51	1											
9. Fairness	0.58	0.67	0.56	0.68	0.53	0.38	0.68	0.53	1										
10. Trade-off	0.52	0.60	0.54	0.60	0.49	0.37	0.61	0.51	**0.71**	1									
11. Coherent	0.59	0.66	0.55	0.66	0.55	0.38	0.68	0.54	**0.82**	**0.71**	1								
12. Injunctive norms	0.42	0.45	0.41	0.45	0.33	0.23	0.40	0.39	0.47	0.42	0.44	1							
13. Dynamic norms	0.39	0.47	0.50	0.53	0.43	0.31	0.49	0.68	0.50	0.46	0.52	0.40	1						

14. Collective effectiveness	0.47	0.64	0.53	0.61	0.48	0.34	**0.70**	0.54	0.67	0.60	0.68	0.41	0.61	1					
15. Trust science	0.52	0.47	0.37	0.44	0.33	0.15	0.38	0.30	0.45	0.39	0.46	0.33	0.33	0.39	1				
16. Trust leaders	0.25	0.22	0.24	0.30	0.20	0.13	0.28	0.29	0.29	0.26	0.31	0.17	0.28	0.31	0.32	1			
17. Trust NGO	0.51	0.49	0.35	0.47	0.36	0.22	0.44	0.34	0.51	0.42	0.52	0.31	0.37	0.44	0.67	0.39	1		
18. Trust media	0.37	0.29	0.28	0.34	0.22	0.12	0.31	0.31	0.35	0.31	0.36	0.22	0.32	0.35	0.45	0.65	0.49	1	
19. Trust businesses	0.16	0.15	0.20	0.23	0.19	0.20	0.29	0.31	0.25	0.25	0.28	0.13	0.26	0.28	0.18	0.68	0.25	0.53	1

Table S2. Means and standard deviations of psychological variables by stage of change.

	Transport			Diet		
	No Intention	Intention	Action	No Intention	Intention	Action
Climate worry	3.91 (1.91)	5.14 (1.40)	5.45 (1.38)	4.25 (1.81)	5.26 (1.34)	5.71 (1.26)
Attitudes	4.34 (1.81)	5.41 (1.42)	5.97 (1.22)	4.74 (1.79)	5.66 (1.27)	5.99 (1.21)
Identity	3.63 (1.77)	4.39 (1.42)	5.18 (1.27)	3.91 (1.71)	4.55 (1.31)	5.42 (1.19)
Morality	3.38 (1.78)	4.59 (1.43)	5.29 (1.37)	3.76 (1.78)	4.80 (1.31)	5.55 (1.22)
Self-efficacy	3.94 (1.73)	4.38 (1.50)	5.23 (1.34)	4.08 (1.69)	4.75 (1.42)	5.30 (1.30)
Perceived control	4.55 (1.84)	4.34 (1.73)	5.16 (1.58)	4.49 (1.84)	4.73 (1.61)	5.11 (1.61)
Individual effectiveness	3.88 (1.91)	4.77 (1.70)	5.42 (1.50)	4.16 (1.94)	5.17 (1.46)	5.42 (1.49)
Social norms	3.33	3.89	4.51	3.53	4.12	4.61

(close)	(1.68)	(1.51)	(1.46)	(1.67)	(1.36)	(1.53)
Fairness	3.85	4.77	5.38	4.11	5.13	5.47
	(1.89)	(1.49)	(1.40)	(1.83)	(1.35)	(1.35)
Trade-off	3.81	4.64	5.20	4.01	4.99	5.31
	(1.85)	(1.62)	(1.52)	(1.86)	(1.43)	(1.46)
Coherent	3.84	4.80	5.36	4.09	5.13	5.51
	(1.89)	(1.58)	(1.44)	(1.87)	(1.39)	(1.35)
Injunctive norms	4.15	4.86	5.13	4.40	4.95	5.22
	(1.80)	(1.41)	(1.44)	(1.71)	(1.41)	(1.39)
Dynamic norms	3.71	4.26	4.77	3.86	4.52	4.86
	(1.62)	(1.39)	(1.31)	(1.57)	(1.29)	(1.29)
Collective effectiveness	3.80	4.65	5.20	4.04	5.04	5.21
	(1.79)	(1.57)	(1.42)	(1.80)	(1.38)	(1.40)
Trust science	4.66	5.39	5.59	4.94	5.43	5.66
	(1.81)	(1.31)	(1.33)	(1.69)	(1.36)	(1.24)
Trust leaders	2.62	3.12	3.29	2.80	3.16	3.36
	(1.66)	(1.57)	(1.64)	(1.65)	(1.58)	(1.64)
Trust NGO	3.93	4.63	4.92	4.11	4.78	5.05
	(1.77)	(1.54)	(1.49)	(1.73)	(1.47)	(1.47)
Trust media	3.07	3.71	3.87	3.28	3.76	3.96
	(1.67)	(1.60)	(1.62)	(1.68)	(1.59)	(1.60)
Trust businesses	2.63	2.76	2.94	2.62	2.95	2.92
	(1.56)	(1.52)	(1.60)	(1.55)	(1.47)	(1.66)

Table S3. Individual Ordered Logistic Regression Models on Stage of Change for Transport and Diet

	Transport		Diet	
	Estimate	95% CI	Estimate	95% CI
Climate worry	0.73	[0.61, 0.85]	0.85	[0.71, 0.98]
Attitudes	0.84	[0.72, 0.96]	0.77	[0.64, 0.90]

Identity	0.81	[0.69, 0.93]	0.87	[0.74, 1.00]
Moral obligation	0.96	[0.84, 1.09]	1.04	[0.91, 1.18]
Self-efficacy	0.66	[0.54, 0.77]	0.65	[0.53, 0.78]
Perceived control	0.30	[0.19, 0.41]	0.32	[0.20, 0.43]
Individual effectiveness	0.69	[0.58, 0.81]	0.66	[0.54, 0.78]
Social norms (close)	0.59	[0.47, 0.70]	0.59	[0.47, 0.71]
Fairness	0.75	[0.63, 0.87]	0.79	[0.67, 0.92]
Trade-off	0.63	[0.52, 0.75]	0.71	[0.59, 0.84]
Coherence	0.70	[0.59, 0.82]	0.78	[0.65, 0.91]
Injunctive norms	0.48	[0.37, 0.60]	0.47	[0.36, 0.59]
Dynamic norms	0.56	[0.45, 0.68]	0.60	[0.48, 0.72]
Collective effectiveness	0.66	[0.55, 0.78]	0.67	[0.55, 0.79]
Trust science	0.45	[0.34, 0.57]	0.41	[0.29, 0.53]
Trust leaders	0.29	[0.18, 0.40]	0.30	[0.19, 0.41]
Trust NGO	0.45	[0.34, 0.56]	0.50	[0.38, 0.62]
Trust media	0.33	[0.23, 0.44]	0.36	[0.25, 0.47]
Trust business	0.15[a]	[0.05, 0.26]	0.16[b]	[0.05, 0.27]
Government responsible	0.51	[0.25, 0.78]	0.60	[0.33, 0.87]
Local auth. responsible	0.52	[0.30, 0.73]	0.60	[0.38, 0.82]
Business responsible	0.48	[0.25, 0.71]	0.40	[0.16, 0.63]
Env groups responsible	0.65	[0.44, 0.86]	0.62	[0.40, 0.83]
Individuals responsible	0.77	[0.53, 1.00]	0.56	[0.32, 0.80]

Note: Each row represents a separate model. All models control for age, gender, educational attainment and living area. All p-values <.001, except [a] p = .005, [b] p = .004.

Table S4. Ordered Logistic Regression Model on Stage of Change for Transport

	Transport SOC			
	Log Odds	95% *CI*	*p*	Prop odds assumption *p*
Climate worry	0.16	[-0.01, 0.33]	.061	.016
Attitudes	0.28	[0.08, 0.48]	.007	.432
Identity	0.18	[-0.01, 0.37]	.057	.005
Moral obligation	0.37	[0.15, 0.59]	.002	.025

Self-efficacy	0.18	[0.02, 0.34]	.030	.020
Perceived control	-0.07	[-0.21, 0.08]	.369	.002
Individual effectiveness	0.00	[-0.19, 0.19]	.969	.431
Social norms (close)	0.03	[-0.14, 0.20]	.709	.979
Fairness	0.08	[-0.14, 0.30]	.467	.784
Trade-off	-0.01	[-0.19, 0.16]	.884	.929
Coherence	-0.04	[-0.25, 0.18]	.755	.519
Injunctive norms	0.03	[-0.10, 0.17]	.621	.329
Dynamic norms	0.06	[-0.11, 0.23]	.468	.672
Collective effectiveness	0.04	[-0.14, 0.23]	.652	.667
Trust science	-0.02	[-0.18, 0.15]	.822	.705
Trust leaders	0.11	[-0.06, 0.29]	.204	.445
Trust NGO	-0.11	[-0.27, 0.07]	.226	.416
Trust media	0.06	[-0.11, 0.22]	.503	.314
Trust business	-0.15	[-0.32, 0.01]	.068	.200
Government responsible	0.03	[-0.31, 0.37]	.873	.120
EU responsible	0.00	[-0.29, 0.29]	.995	.096
Business responsible	-0.13	[-0.46, 0.19]	.421	.478
Env groups responsible	0.49	[0.17, 0.81]	.003	.995
Local auth. responsible	-0.22	[-0.57, 0.12]	.199	.200
Individuals responsible	0.14	[-0.15, 0.44]	.340	.008
Male	0.05	[-0.18, 0.29]	.664	.298
Age	-0.02	[-0.15, 0.09]	.700	.046
Urban	0.22	[-0.02, 0.45]	.069	<.001
Degree	0.22	[-0.01, 0.45]	.064	.808

Table S5**.** Generalised ordered logistic regression models for transport stage of change, adjusted p-values.

		Model 1: Full				Model 2: Reduced			
Threshold effects[a]		Log Odds	95% CI	p	p_b	Log Odds	95% CI	p	p_b
Inten	Intercept	-0.89	[-1.31,-0.47]	< .001	< .001	-0.96	[-1.26,-0.66]	< .001	< .001

	Climate worry	**0.30**	[0.10,0.49]	**.003**	.117	**0.29**	[0.11,0.48]	.001	**.020**
	Individual responsible	0.32	[-0.01,0.65]	.060					
	Identity	-0.01	[-0.23,0.22]	.959		0.02	[-0.20,0.24]	.871	
	Moral obligation	**0.59**	[0.32,0.85]	**< .001**	**< .001**	**0.64**	[0.39,0.89]	**< .001**	**< .001**
	Self-efficacy	0.07	[-0.12,0.27]	.461		0.06	[-0.14,0.25]	.571	
	Perceived control	**-0.25**	[-0.42,-0.07]	**.005**	.195	**-0.22**	[-0.46,-0.09]	**.011**	.220
	Urban	-0.17	[-0.47,0.13]	.265		-0.21	[-0.50,0.09]	.173	
Action (2)	Intercept	1.04	[0.63,1.46]	< .001	< .001	1.21	[0.91,1.50]	< .001	< .001
	Climate worry	0.02	[-0.17,0.21]	.846		-0.02	[-0.19,0.16]	.821	
	Individual responsible	-0.01	[-0.33,0.32]	.967					
	Identity	**0.33**	[0.11,0.54]	**.003**	.117	**0.36**	[0.15,0.57]	**< .001**	**.020**
	Moral obligation	0.22	[-0.02,0.47]	.073		**0.27**	[0.03,0.50]	**.028**	.560
	Self-efficacy	**0.27**	[0.08,0.46]	**.006**	.234	**0.27**	[0.09,0.46]	**.004**	.080
	Perceived control	0.07	[-0.09,0.23]	.426		0.07	[-0.08,0.23]	.359	
	Urban	**0.48**	[0.21,0.75]	**< .001**	**.039**	**0.50**	[0.23,0.76]	**< .001**	**< .001**
Ordinal effects									
Env groups responsible		**0.49**	[0.17,0.81]	**.003**	.117	**0.38**	[0.15,0.62]	**.001**	**.020**
Attitudes		**0.29**	[0.09,0.49]	**.005**	.195	**0.30**	[0.13,0.47]	**< .001**	**.020**
Male		0.06	[-0.18,0.29]	.629		0.06	[-0.17,0.29]	.588	
Age		-0.03	[-0.15,0.09]	.639		-0.01	[-0.13,0.11]	.861	
Degree		0.23	[-0.01,0.46]	.060		0.22	[-0.01,0.46]	.057	
Government responsible		0.02	[-0.33,0.36]	.931					

Business responsible	-0.15	[-0.48,0.17]	.353
EU responsible	0.01	[-0.29,0.31]	.943
Local responsible	-0.20	[-0.54,0.15]	.259
Individual effectiveness	0.00	[-0.19,0.20]	.974
Injunctive norms	0.03	[-0.10,0.17]	.637
Social norms (close)	0.03	[-0.14,0.21]	.711
Dynamic norms	0.07	[-0.11,0.24]	.446
Collective effectiveness	0.02	[-0.16,0.21]	.974
Trade-off	-0.02	[-0.19,0.17]	.865
Fairness	0.11	[-0.11,0.33]	.338
Coherent	-0.03	[-0.26,0.19]	.763
Trust science	-0.03	[-0.20,0.13]	.686
Trust NGO	-0.11	[-0.28,0.07]	.224
Trust media	0.05	[-0.11,0.22]	.519
Trust leaders	0.12	[-0.06,0.29]	.198
Trust business	-0.17	[-0.33,0.00]	.053
AIC	2266.6		2245.7
Log Likelihood	-1094.3		-1102.9
McFadden Pseudo R^2	0.16		0.16
Observations	1200		1200

Note: [a] In the first panel (1), the model predicts crossing the threshold for the intention stage, in the second panel (2) it predicts crossing the threshold for the action stage. Standardised coefficients are displayed. p_b show Bonferroni-corrected p-values.

Table S6. Generalised ordered logistic regression models for transport stage of change, unstandardised.

		Model 1: Full			Model 2: Reduced		
Threshold effects[a]		Log Odds	95% *CI*	*p*	Log Odds	95% *CI*	*p*
Intention (1)	Intercept	-2.19	[-2.95,-1.44]	<.001	-2.21	[-2.88,-1.54]	<.001
	Climate	0.18	[0.06,0.30]	.003	0.18	[0.07,0.28]	.001

	worry						
	Individual responsibility	0.32	[-0.01,0.65]	.060			
	Identity	0.00	[-0.15,0.14]	.959	0.01	[-0.13,0.15]	.871
	Moral obligation	0.34	[0.19,0.50]	<.001	0.38	[0.23,0.53]	<.001
	Self-efficacy	0.05	[-0.08,0.17]	.461	0.03	[-0.09,0.16]	.571
	Perceived control	-0.14	[-0.24,-0.04]	.005	-0.12	[-0.22,-0.03]	.011
	Urban	-0.17	[-0.47,0.13]	.265	-0.21	[-0.50,0.09]	.173
Action (2)	Intercept	-4.68	[-5.53,-3.84]	<.001	-4.82	[-5.57,-4.06]	<.001
	Climate worry	0.01	[-0.10,0.12]	.846	-0.01	[-0.12,0.09]	.821
	Individual responsibility	-0.01	[-0.33,0.32]	.967			
	Identity	0.20	[0.07,0.34]	.003	0.22	[0.09,0.35]	.871
	Moral obligation	0.13	[-0.01,0.28]	.073	0.16	[0.02,0.30]	.028
	Self-efficacy	0.17	[0.05,0.29]	.006	0.17	[0.05,0.29]	.004
	Perceived control	0.04	[-0.06,0.13]	.426	0.04	[-0.05,0.13]	.359
	Urban	0.48	[0.21,0.75]	<.001	0.50	[0.23,0.76]	<.001
Ordinal effects							
Env groups responsible		0.49	[0.17,0.81]	.003	0.38	[0.15,0.62]	.001
Attitudes		0.18	[0.05,0.31]	.005	0.19	[0.08,0.29]	<.001
Male		0.06	[-0.18,0.30]	.629	0.06	[-0.17,0.30]	.588
Age		0.00	[-0.01,0.01]	.639	0.00	[-0.01,0.01]	.861
Degree		0.23	[-0.01,0.46]	.060	0.22	[-0.01,0.46]	.057
Government responsible		0.02	[-0.33,0.36]	.931			
Business responsible		-0.15	[-0.48,0.17]	.353			
EU responsible		0.01	[-0.29,0.31]	.943			
Local responsible		-0.2	[-0.54,0.15]	.259			

Individual effectiveness	0.00	[-0.11,0.11]	.974
Injunctive norms	0.02	[-0.07,0.16]	.637
Social norms (close)	0.02	[-0.09,0.13]	.711
Dynamic norms	0.05	[-0.07,0.16]	.446
Collective effectiveness	0.01	[-0.10,0.13]	.974
Trade-off	-0.01	[-0.11,0.10]	.865
Fairness	0.06	[-0.07,0.20]	.338
Coherent	-0.02	[-0.15,0.11]	.763
Trust science	-0.02	[-0.13,0.09]	.686
Trust NGO	-0.07	[-0.17,0.04]	.224
Trust media	0.03	[-0.07,0.13]	.519
Trust leaders	0.07	[-0.04,0.18]	.198
Trust business	-0.11	[-0.21,0.00]	.053
AIC	2266.6		2245.7
Log Likelihood	-1094.3		-1102.9
McFadden Pseudo R^2	0.16		0.15
Observations	1200		1200

Note: [a] In the first panel (1), the model predicts crossing the threshold for the intention stage, in the second panel (2) it predicts crossing the threshold for the action stage. Unstandardised coefficients are displayed.

Table S7. Generalised order logistic regression models on stage of change for transport, controlling for intervention

		Model 1: Full model			Model 2: Reduced		
Threshold effects[a]		Log Odds	95% *CI*	*p*	Log Odds	95% *CI*	*p*
Intention (1)	Intercept	-0.93	[-1.38, -0.48]	<.001	-0.98	[-1.32, -0.64]	<.001
	Climate worry	**0.30**	**[0.11, 0.50]**	**.003**	**0.30**	**[0.12, 0.48]**	**.001**
	Individual responsible	0.31	[-0.02, 0.64]	.064			
	Identity	-0.01	[-0.24, 0.22]	.948	0.02	[-0.20, 0.24]	.876

	Moral obligation	**0.59**	**[0.32, 0.85]**	**<.001**	**0.64**	**[0.39, 0.90]**	**<.001**
	Self-efficacy	0.08	[-0.12, 0.27]	.450	0.06	[-0.14, 0.25]	.562
	Perceived control	**-0.25**	**[-0.42, 0.07]**	**.006**	**-0.21**	**[-0.38, -0.05]**	**.011**
	Urban	-0.17	[-0.48, 0.13]	.262	-0.21	[-0.50, 0.09]	.172
Action (2)	Intercept	1.00	[0.55, 1.46]	<.001	1.19	[0.85, 1.52]	<.001
	Climate worry	-0.02	[-0.21, 0.17]	.853	-0.02	[-0.20, 0.16]	.825
	Individual responsible	-0.01	[-0.34, 0.32]	.950			
	Identity	**0.33**	**[0.11, 0.54]**	**.003**	**0.36**	**[0.15, 0.57]**	**.001**
	Moral obligation	0.23	[-0.02, 0.47]	.071	**0.27**	**[0.03, 0.51]**	**.027**
	Self-efficacy	**0.27**	**[0.08, 0.46]**	**.005**	**0.27**	**[0.09, 0.46]**	**.004**
	Perceived control	0.07	[-0.10, 0.23]	.417	0.07	[-0.08, 0.23]	.355
	Urban	**0.48**	**[0.21, 0.75]**	**.001**	**0.49**	**[0.23, 0.76]**	**<.001**
Ordinal effects							
Intervention		-0.05	[-0.3, 0.19]	.673	-0.03	[-0.27, 0.21]	.799
Env groups responsible		**0.49**	**[0.17, 0.82]**	**.003**	**0.38**	**[0.15, 0.62]**	**.001**
Attitudes		**0.29**	**[0.09, 0.50]**	**.006**	**0.30**	**[0.13, 0.47]**	**.001**
Male		0.06	[-0.18, 0.30]	.626	0.06	[-0.17, 0.30]	.585
Age		-0.03	[-0.15, 0.09]	.637	-0.01	[-0.13, 0.11]	.862
Degree		0.22	[-0.01, 0.46]	.062	0.22	[-0.01, 0.46]	.058
Government responsible		0.01	[-0.33, 0.36]	.932			
Business responsible		-0.16	[-0.48, 0.17]	.340			
EU responsible		0.01	[-0.29, 0.31]	.934			
Local responsible		-0.2	[-0.54, 0.15]	.265			
Individual		0	[-0.2, 0.20]	.980			

effectiveness			
Injunctive norms	0.03	[-0.11, 0.17]	.643
Social norms (close)	0.03	[-0.14, 0.20]	.720
Dynamic norms	0.07	[-0.1, 0.24]	.436
Collective effectiveness	0.02	[-0.16, 0.21]	.795
Trade-off	-0.02	[-0.2, 0.17]	.868
Fairness	0.11	[-0.11, 0.33]	.331
Coherent	-0.04	[-0.26, 0.19]	.747
Trust science	-0.03	[-0.2, 0.13]	.685
Trust NGO	-0.11	[-0.29, 0.06]	.212
Trust media	0.05	[-0.11, 0.22]	.526
Trust leaders	0.12	[-0.06, 0.30]	.191
Trust business	-0.17	[-0.33,0.00]	.053
AIC	2268.4		2247.7
Log Likelihood	-1094.2		-1102.8
McFadden Pseudo R^2	0.16		0.16
Observations	1200		1200

Note: [a] In the first panel (1), the model predicts crossing the threshold for the intention stage, in the second panel (2) it predicts crossing the threshold for the action stage. Standardised coefficients are displayed.

Table S8. Generalised ordered logistic regression models for transport stage of change, excluding non-drivers.

		Model 1: Full			Model 2: Reduced		
Threshold effects[a]		Log Odds	95% *CI*	*p*	Log Odds	95% *CI*	*p*
Intention (1)	Intercept	-1.09	[-1.53,-0.65]	<.001	-1.09	[-1.41,-0.78]	<.001
	Climate worry	0.37	[0.17, 0.58]	<.001	0.36	[0.17, 0.55]	<.001
	Individual responsibility	0.27	[-0.07, 0.62]	.121			
	Identity	-0.04	[-0.28,0.20]	.734	0.00	[-0.23,0.23]	.995

	Moral obligation	0.64	[0.36, 0.91]	<.001	0.70	[0.44, 0.97]	<.001
	Self-Efficacy	0.09	[-0.11, 0.30]	.370	0.08	[-0.12, 0.28]	.435
	Perceived control	-0.24	[-0.42,-0.06]	.008	-0.21	[-0.38, -0.03]	.019
	Urban	-0.15	[-0.47, 0.16]	.343	-0.16	[-0.47, 0.14]	.296
Action (2)	Intercept	0.94	[0.50,1.37]	<.001	1.15	[0.85,1.45]	<.001
	Climate worry	0.04	[-0.16, 0.23]	.716	0.00	[-0.18,0.19]	.975
	Individual responsibility	-0.04	[-0.38, 0.29]	.802			
	Identity	0.30	[0.09, 0.52]	.006	0.34	[0.13, 0.55]	.002
	Moral obligation	0.23	[-0.03, 0.48]	.079	0.28	[0.04, 0.52]	.025
	Self-Efficacy	0.29	[0.10, 0.49]	.003	0.30	[0.11, 0.49]	.002
	Perceived control	0.06	[-0.10, 0.23]	.458	0.07	[-0.08, 0.23]	.362
	Urban	0.49	[0.31, 0.76]	.001	0.51	[0.24, 0.78]	<.001
Ordinal effects							
Env groups responsible		0.52	[0.19,0.85]	.002	0.39	[0.15,0.63]	.002
Attitudes		0.27	[0.06,0.48]	.013	0.30	[0.12,0.48]	.001
Male		0.11	[-0.13,0.36]	.368	0.11	[-0.13,0.35]	.377
Age		-0.06	[-0.19,0.07]	.352	-0.04	[-0.16,0.09]	.557
Degree		0.14	[-0.10,0.38]	.265	0.12	[-0.12,0.36]	.324
Government responsible		-0.04	[-0.4,0.31]	.809			
Business responsible		-0.15	[-0.48,0.19]	.395			
EU responsible		-0.06	[-0.37,0.25]	.705			
Local responsible		-0.14	[-0.49,0.22]	.453			
Individual effectiveness		0.00	[-0.20,0.21]	.980			
Injunctive norms		0.05	[-0.09,0.19]	.475			
Social norms (close)		0.03	[-0.15,0.21]	.758			

Dynamic norms	0.09	[-0.09,0.26]	.341
Collective effectiveness	0.03	[-0.16,0.23]	.735
Trade-off	-0.01	[-0.20,0.18]	.907
Fairness	0.14	[-0.09,0.37]	.244
Coherent	-0.01	[-0.24,0.22]	.924
Trust science	-0.03	[-0.21,0.14]	.693
Trust NGO	-0.12	[-0.30,0.06]	.200
Trust media	0.10	[-0.08,0.27]	.270
Trust leaders	0.06	[-0.13,0.24]	.549
Trust business	-0.18	[-0.35,0.00]	.046
AIC	2125.5		2105.7
Log Likelihood	-1023.7		-1032.8
McFadden Pseudo R^2	0.17		0.17
Observations	1143		1143

Note: [a] In the first panel (1), the model predicts crossing the threshold for the intention stage, in the second panel (2) it predicts crossing the threshold for the action stage. Standardised coefficients are displayed.

Table S9. Ordered Logistic Regression Model on Stage of Change for Diet

	Diet SOC			
	Log Odds	95% *CI*	*p*	Prop odds assumption *p*
Climate worry	0.33	[0.16, 0.51]	<.001	.343
Attitudes	0.08	[-0.14, 0.29]	.474	.219
Identity	0.23	[0.02, 0.43]	.029	<.001
Moral obligation	0.51	[0.28, 0.75]	<.001	.683
Self-efficacy	0.11	[-0.07, 0.28]	.223	.962
Perceived control	-0.07	[-0.22, 0.09]	.386	.066
Individual effectiveness	-0.09	[-0.29, 0.11]	.366	.704
Social norms (close)	-0.06	[-0.24, 0.12]	.521	.503
Fairness	0.08	[-0.15, 0.31]	.491	.210
Trade-off	0.12	[-0.06, 0.30]	.194	.435

Coherence	0.06	[-0.17, 0.29]	.593	.345
Injunctive norms	0.02	[-0.13, 0.16]	.825	.719
Dynamic norms	0.13	[-0.05, 0.29]	.158	.879
Collective effectiveness	0.06	[-0.13, 0.25]	.524	.016
Trust science	-0.22	[-0.39, -0.05]	.014	.712
Trust leaders	0.16	[-0.02, 0.34]	.088	.390
Trust NGO	0.02	[-0.16, 0.19]	.822	.999
Trust media	0.09	[-0.08, 0.25]	.318	.900
Trust business	-0.19	[-0.36, -0.02]	.028	.176
Government responsible	0.11	[-0.25, 0.46]	.557	.102
EU responsible	0.04	[-0.27, 0.35]	.788	.457
Local auth. responsible	0.19	[-0.15, 0.55]	.268	.992
Business responsible	-0.34	[-0.68, 0.00]	.051	.010
Env groups responsible	0.31	[-0.02, 0.63]	.064	.422
Individuals responsible	-0.18	[-0.49, 0.12]	.239	.414
Male	-0.42	[-0.66, -0.18]	<.001	.889
Age	-0.30	[-0.43, -0.17]	<.001	.974
Urban	-0.05	[-0.19, -0.29]	<.001	.023
Degree	0.17	[-0.07, 0.41]	.164	.514

Table S10. Generalised ordered logistic regression models for diet stage of change, adjusted p-values.

		Model 1: Full				Model 2: Reduced			
Threshold effects[a]		Log Odds	95% *CI*	*p*	p_b	Log Odds	95% *CI*	*p*	p_b
Intention (1)	Intercept	-0.33	[-0.73,0.73]	.109		-0.33	[-0.65,-0.01]	.042	
	Business resp.	**-0.43**	[-0.79,-0.07]	**.019**	.703	-0.13	[-0.42,0.16]	.379	
	Identity	0.05	[-0.16,0.27]	.629		0.04	[-0.16,0.24]	.705	

	Collective effectiveness	**0.22**	[0.02,0.43]	**.035**	1	**0.33**	[0.16,0.24]	**< .001**	**< .001**
	Age	**-0.38**	[-0.52,-0.23]	**< .001**	**< .001**	**-0.35**	[-0.49,-0.21]	**< .001**	**< .001**
	Degree	0.09	[-0.18,0.35]	.524		0.08	[-0.18,0.34]	.529	
Action (2)	Intercept	1.58	[1.13,2.03]	< .001	< .001	1.56	[1.19,1.94]	< .001	< .001
	Business resp.	-0.12	[-0.52,0.27]	.543		0.19	[-0.14,0.52]	.263	
	Identity	**0.54**	[0.29,0.78]	**< .001**	**< .001**	**0.52**	[0.29,0.75]	**< .001**	**< .001**
	Collective effectiveness	-0.14	[-0.36,0.08]	.199		-0.05	[-0.23,0.14]	.626	
	Age	**-0.17**	[-0.33,0.02]	.030	1	-0.13	[-0.28,0.01]	.076	
	Degree	**0.32**	[0.02,0.61]	**.034**	1	**0.33**	[0.04,0.61]	**.026**	.494
Ordinal effects									
Climate worry		**0.35**	[0.17,0.53]	**< .001**	**< .001**	**0.42**	[0.25,0.59]	**< .001**	**< .001**
Moral obligation		**0.52**	[0.28,0.76]	**< .001**	**< .001**	**0.63**	[0.41,0.84]	**< .001**	**< .001**
Trust science		**-0.24**	[-0.41,-0.06]	**.008**	.296	-0.12	[-0.27,0.02]	.094	
Trust business		**-0.18**	[-0.35,-0.01]	**.039**	1	-0.04	[-0.16,0.08]	.491	
Male		**-0.42**	[-0.66,-0.18]	**< .001**	**.037**	**-0.40**	[-0.63,-0.16]	**< .001**	**.019**
Urban		0.07	[-0.17,0.31]	.571		0.11	[-0.13,0.35]	.363	
Government responsible		0.13	[-0.23,0.48]	.477					
EU responsible		0.03	[-0.28,0.34]	.868					

Local responsible	0.19	[-0.16,0.54]	.293
Env group responsible	0.29	[-0.03,0.63]	.074
Individuals responsible	-0.18	[-0.49,0.13]	.248
Self-efficacy	0.09	[-0.08,0.27]	.292
Perceived control	-0.07	[-0.22,0.09]	.394
Attitudes	0.08	[-0.14,0.29]	.479
Individual effectiveness	-0.09	[-0.30,0.11]	.349
Injunctive norms	0.02	[-0.13,0.16]	.819
Social norms (close)	-0.06	[-0.24,0.12]	.502
Dynamic norms	0.13	[-0.05,0.30]	.147
Trade-off	0.12	[-0.07,0.29]	.214
Fairness	0.06	[-0.17,0.29]	.617
Coherent	0.06	[-0.17,0.29]	.618
Trust NGO	0.03	[-0.15,.20]	.780
Trust media	0.08	[-0.09,0.25]	.337
Trust leaders	0.15	[-0.03,0.33]	.106
AIC		2217.8	2207.5
Log Likelihood		-1071.9	-1084.7

McFadden Pseudo R^2	0.16	0.15
Observations	1200	1200

Note: [a] In the first panel (1), the model predicts crossing the threshold for the intention stage, in the second panel (2) it predicts crossing the threshold for the action stage. Standardised coefficients are displayed. p_b show Bonferroni-corrected p-values.

Table S11. Generalised ordered logistic regression models for diet stage of change, unstandardised.

		Model 1: Full			Model 2: Reduced		
Threshold effects[a]		Log Odds	95% *CI*	*p*	Log Odds	95% *CI*	*p*
Intention (1)	Intercept	-2.06	[-2.85, -1.27]	.109	-1.99	[-2.69,-1.29]	.042
	Business responsibility	-0.43	[-0.79,-0.07]	.019	-0.13	[-0.42,0.16]	.379
	Identity	0.03	[-0.10,0.17]	.629	0.02	[-0.10,0.15]	.705
	Collective effectiveness	0.13*	[0.01,0.25]	.035	0.20	[0.10,0.30]	< .001
	Age	-0.02	[-0.03,-0.02]	< .001	-0.02	[-0.01,-0.03]	< .001
	Degree	0.09	[-0.18,0.35]	.524	0.08	[-0.18,0.34]	.529
Action (2)	Intercept	-4.96	[-5.90,-4.02]	< .001	-4.86	[-5.73,-3.99]	< .001
	Business responsibility	-0.12	[-0.52,0.27]	.543	0.19	[-0.14,0.52]	.263
	Identity	0.34	[0.19,0.49]	< .001	0.33	[0.18,0.37]	< .001
	Collective effectiveness	-0.09	[-0.22,0.04]	.199	-0.03	[-0.14,0.08]	.626
	Age	-0.01	[-0.00,-0.02]	.030	-0.01	[-0.02,0.00]	.076
	Degree	0.32	[0.02,0.61]	.034	0.33	[0.04,0.61]	.026
Ordinal effects							
Climate worry		0.21	[0.10,0.32]	< .001	0.25	[0.15,0.35]	< .001
Moral obligation		0.31	[0.17,0.45]	< .001	0.37	[0.24,0.50]	< .001
Trust science		-0.15	[-0.27,-0.04]	.008	-0.08	[-0.18,0.01]	.094
Trust business		-0.12	[-0.22,-0.01]	.039	-0.03	[-0.10.0.05]	.491

Male	-0.42	[-0.66,-0.18]	< .001	-0.40	[-0.63,-0.16]	< .001
Urban	0.07	[-0.17,0.31]	.571	0.11	[-0.13,0.35]	.363
Government responsible	0.13	[-0.23,0.48]	.477			
EU responsible	0.03	[-0.28,0.34]	.868			
Local responsible	0.19	[-0.16,0.54]	.293			
Env group responsible	0.3	[-0.03,0.63]	.074			
Individuals responsible	-0.18	[-0.49,0.13]	.248			
Self-efficacy	0.06	[-0.05,0.17]	.292			
Perceived control	-0.04	[-0.13,0.05]	.394			
Attitudes	0.05	[-0.09,0.18]	.479			
Individual effectiveness	-0.05	[-0.17,0.06]	.349			
Injunctive norms	0.01	[-0.08,0.10]	.819			
Social norms (close)	-0.04	[-0.15,0.07]	.502			
Dynamic norms	0.09	[-0.03,0.20]	.147			
Trade-off	0.07	[-0.04,0.17]	.214			
Fairness	0.03	[-0.10,0.17]	.617			
Coherent	0.03	[-0.10,0.17]	.618			
Trust NGO	0.02	[-0.09,0.12]	.780			
Trust media	0.05	[-0.05,0.15]	.337			
Trust leaders	0.09	[-0.02,0.20]	.106			
AIC		2217.8			2207.5	
Log Likelihood		-1071.9			-1084.7	
McFadden Pseudo R^2		0.16			0.15	
Observations		1200			1200	

Note: [a] In the first panel (1), the model predicts crossing the threshold for the intention stage, in the second panel (2) it predicts crossing the threshold for the action stage. Unstandardised coefficients are displayed.

Table S12. Generalised order logistic regression models on stage of change for diet, controlling for intervention.

		Model 1: Full model			Model 2: Reduced		
Threshold effects[a]		Log Odds	95% *CI*	*p*	Log Odds	95% *CI*	*p*
Intention (1)	Intercept	-0.42	[-0.87, 0.02]	.060	-0.4	[-0.76, -0.03]	.032
	Business responsible	**-0.45**	**[-0.81, -0.08]**	**.016**	-0.14	[-0.42, 0.15]	.357
	Identity	0.05	[-0.17, 0.26]	.669	0.04	[-0.17, 0.24]	.730
	Collective effectiveness	**0.22**	**[0.02, 0.43]**	**.034**	**0.33**	**[0.17, 0.50]**	**<.001**
	Age	**-0.38**	**[-0.52, -0.23]**	**<.001**	**-0.35**	**[-0.49, -0.21]**	**<.001**
	Degree	0.09	[-0.18, 0.35]	.533	0.08	[-0.18, 0.34]	.533
Action (2)	Intercept	1.49	[1.00, 1.97]	<.001	1.5	[-0.34, 0.15]	<.001
	Business responsible	-0.14	[-0.53, 0.26]	.504	0.18	[-0.15, 0.51]	.278
	Identity	**0.53**	**[0.29, 0.77]**	**<.001**	**0.52**	**[0.29, 0.75]**	**<.001**
	Collective effectiveness	-0.14	[-0.36, 0.08]	.199	-0.05	[-0.23, 0.14]	.619
	Age	**-0.17**	**[-0.33, -0.02]**	**.030**	-0.13	[-0.28, 0.01]	.076
	Degree	**0.31**	**[0.02, 0.60]**	**.037**	**0.32**	**[0.04, 0.61]**	**.027**
Ordinal effects							
Intervention		-0.13	[-0.38, 0.12]	.304	-0.09	[-0.34, 0.15]	.459
Climate worry		**0.35**	**[0.17, 0.53]**	**<.001**	**0.42**	**[0.25, 0.59]**	**<.001**
Moral obligation		**0.53**	**[0.29, 0.77]**	**<.001**	**0.63**	**[0.41, 0.85]**	**<.001**
Trust science		-0.24	[-0.41, -0.06]	.008	-0.13	[-0.27, 0.02]	.086
Trust business		-0.18	[-0.35, -0.01]	.038	-0.04	[-0.16, 0.08]	.499
Male		**-0.42**	**[-0.66, -0.18]**	**.001**	**-0.39**	**[-0.63, -0.16]**	**.001**
Urban		0.07	[-0.18, 0.31]	.582	0.11	[-0.13, 0.35]	.364
Government responsible		0.13	[-0.23, 0.48]	.478			
EU responsible		0.03	[-0.28, 0.34]	.852			

Local responsible	0.2	[-0.15, 0.55]	.269
Env group responsible	0.3	[-0.02, 0.63]	.070
Individuals responsible	-0.19	[-0.50, 0.12]	.221
Self-efficacy	0.1	[-0.08, 0.27]	.268
Perceived control	-0.06	[-0.22, 0.09]	.413
Attitudes	0.08	[-0.14, 0.29]	.495
Individual effectiveness	-0.10	[-0.30, 0.11]	.342
Injunctive norms	0.02	[-0.13, 0.16]	.830
Social norms (close)	-0.06	[-0.24, 0.12]	.495
Dynamic norms	0.13	[-0.04, 0.31]	.141
Trade-off	0.12	[-0.07, 0.30]	.209
Fairness	0.06	[-0.17, 0.30]	.595
Coherent	0.05	[-0.18, 0.28]	.655
Trust NGO	0.02	[-0.16, 0.20]	.846
Trust media	0.08	[-0.09, 0.25]	.341
Trust leaders	0.15	[-0.03, 0.33]	.096
AIC	2218.7		2208.9
Log Likelihood	-1071.4		-1084.5
McFadden Pseudo R^2	0.16		0.15
Observations	1200		1200

Note: [a] In the first panel (1), the model predicts crossing the threshold for the intention stage, in the second panel (2) it predicts crossing the threshold for the action stage. Standardised coefficients are displayed

Table S13. Generalised order logistic regression models on stage of change for diet, excluding those not eating beef, other meat, or cheese.

	Model 1: Full model			Model 2: Reduced		
Threshold effects[a]	Log Odds	95% *CI*	*p*	Log Odds	95% *CI*	*p*

Intention (1)	Intercept	-0.39	[-0.80,0.02]	.061	-0.34	[-0.66,-0.02]	.039
	Business responsibility	-0.42	[-0.78,-0.05]	.025	-0.14	[-0.43,0.16]	.362
	Identity	0.06	[-0.16,0.27]	.612	0.05	[-0.16,0.25]	.648
	Collective effectiveness	0.22	[0.01,0.43]	.036	0.32	[0.15,0.49]	<.001
	Age	-0.39	[-0.54,-0.25]	<.001	-0.37	[-0.50,-0.23]	<.001
	Degree	0.09	[-0.18,0.36]	.510	0.09	[-0.17,0.35]	.510
Action (2)	Intercept	1.54	[1.09,2.00]	<.001	1.58	[1.20,1.96]	<.001
	Business responsibility	-0.12	[-0.52,0.28]	.567	0.17	[-0.16,0.51]	.306
	Identity	0.55	[0.30,0.79]	<.001	0.54	[0.30,0.77]	<.001
	Collective effectiveness	-0.14	[-0.35,0.08]	.224	-0.05	[0.15,0.49]	.599
	Age	-0.17	[-0.33,-0.02]	.032	-0.14	[-0.29,0.01]	.071
	Degree	0.33	[0.03,0.62]	.030	0.34	[0.05,0.63]	.022
Ordinal effects							
Climate worry		0.36	[0.18,0.54]	<.001	0.42	[0.25,0.59]	<.001
Moral obligation		0.53	[0.29,0.77]	<.001	0.63	[0.41,0.85]	<.001
Trust science		-0.23	[-0.41,-0.06]	.001	-0.13	[-0.27,0.02]	.094
Trust business		-0.17	[-0.34,0.00]	.051	-0.03	[-0.15,0.09]	.631
Male		-0.44	[-0.68,-0.19]	<.001	-0.41	[-0.65,-0.17]	<.001
Urban		0.09	[-0.16,0.34]	.472	0.13	[-0.10,0.37]	.270
Government responsible		0.07	[-0.29,0.43]	.693			
EU responsible		0.01	[-0.30,0.33]	.927			
Local responsible		0.19	[-0.17,0.55]	.295			
Env group responsible		0.31	[-0.02,0.64]	.068			
Individuals responsible		-0.2	[-0.51,0.11]	.197			

Self-efficacy	0.11	[-0.06,0.29]	.207
Perceived control	-0.07	[-0.23,0.08]	.366
Attitudes	0.08	[-0.14,0.30]	.479
Individual effectiveness	-0.11	[-0.31,0.10]	.310
Injunctive norms	0.01	[-0.14,0.15]	.903
Social norms (close)	-0.04	[-0.22,0.14]	.648
Dynamic norms	0.11	[-0.06,0.29]	.202
Trade-off	0.10	[-0.08,0.28]	.288
Fairness	0.06	[-0.17,0.30]	.594
Coherent	0.06	[-0.18,0.29]	.641
Trust NGO	0.03	[-0.15,0.21]	.749
Trust media	0.08	[-0.09,0.25]	.376
Trust leaders	0.16	[-0.03,0.34]	.093
AIC	2184.7		2173.1
Log Likelihood	-1055.4		-1067.6
McFadden Pseudo R^2	0.16		0.15
Observations	1184		1184

Note: [a] In the first panel (1), the models predict crossing the threshold for the intention stage, in the second panel (2) they predict crossing the threshold for the action stage. Standardised coefficients are displayed.

Table S14. Unrestricted generalised ordered logistic regression models on transport and diet stage of change

	Model 1. Transport			Model 2. Diet		
	Est.	95% CI	p	Est.	95% CI	p
1.Intercept	-0.86	[-1.31, -0.41]	<.001	-0.26	[-0.69, 0.16]	.220
2.Intercept	0.98	[0.54, 1.42]	<.001	1.38	[0.89, 1.87]	<.001
1.Climate worry	**0.31**	**[0.11, 0.52]**	**.003**	***0.38***	***[0.18, 0.57]***	***<.001***
2.Climate worry	0.02	[-0.17, 0.22]	.802	***0.28***	***[0.05, 0.51]***	***.016***
1.Attitudes	***0.38***	***[0.13, 0.63]***	***.003***	0.11	[-0.13, 0.35]	.372

	Model 1. Transport			Model 2. Diet		
	Est.	95% CI	p	Est.	95% CI	p
2.Attitudes	***0.21***	***[-0.03, 0.45]***	***.093***	0.00	[-0.29, 0.28]	.977
1.Identity	-0.02	[-0.26, 0.22]	.895	0.05	[-0.18, 0.27]	.682
2.Identity	**0.34**	**[0.13, 0.56]**	**.002**	**0.59**	**[0.31, 0.86]**	**<.001**
1.Morality	**0.55**	**[0.27, 0.83]**	**<.001**	***0.51***	***[0.25, 0.77]***	***<.001***
2.Morality	**0.26**	**[0.01, 0.52]**	**.045**	***0.54***	***[0.22, 0.86]***	***<.001***
1.Efficacy	0.03	[-0.18, 0.23]	.805	0.11	[-0.08, 0.31]	.246
2.Efficacy	**0.29**	**[0.10, 0.48]**	**.003**	0.07	[-0.16, 0.31]	.540
1.Control	**-0.21**	**[-0.39, -0.04]**	**.018**	-0.12	[-0.30, 0.05]	.170
2.Control	0.04	[-0.12, 0.21]	.626	0.04	[-0.16, 0.25]	.668
1.Individual effectiveness	-0.10	[-0.36, 0.15]	.415	-0.09	[-0.32, 0.14]	.435
2.Individual effectiveness	0.08	[-0.15, 0.30]	.506	-0.12	[-0.38, 0.14]	.368
1.Social norms (close)	0.06	[-0.16, 0.28]	.605	-0.07	[-0.27, 0.14]	.524
2.Social norms (close)	0.03	[-0.17, 0.22]	.775	-0.08	[-0.30, 0.13]	.452
1.Fairness	0.07	[-0.22, 0.35]	.633	0.14	[-0.12, 0.40]	.284
2.Fairness	0.14	[-0.12, 0.39]	.293	-0.04	[-0.34, 0.26]	.801
1.Trade-off	0.02	[-0.21, 0.25]	.887	0.13	[-0.07, 0.34]	.209
2.Trade-off	-0.05	[-0.25, 0.15]	.625	0.08	[-0.14, 0.30]	.473
1.Coherence	0.00	[-0.29, 0.28]	.976	0.04	[-0.22, 0.29]	.784
2.Coherence	-0.05	[-0.30, 0.21]	.723	0.07	[-0.22, 0.37]	.628
1.Injunctive norms	0.08	[-0.09, 0.26]	.340	0.02	[-0.14, 0.19]	.772
2.Injunctive norms	0.00	[-0.15, 0.16]	.989	0.01	[-0.17, 0.19]	.954
1.Dynamic norms	0.03	[-0.19, 0.26]	.763	0.08	[-0.11, 0.28]	.398

	Model 1. Transport			Model 2. Diet		
	Est.	95% CI	p	Est.	95% CI	p
2.Dynamic norms	0.07	[-0.12, 0.27]	.468	0.18	[-0.04, 0.40]	.108
1.Collective effectiveness	0.08	[-0.17, 0.32]	.541	**0.20**	**[-0.01, 0.42]**	**.068**
2.Collective effectiveness	-0.01	[-0.22, 0.21]	.947	-0.10	[-0.34, 0.14]	.402
1.Trust science	-0.03	[-0.24, 0.17]	.747	***-0.26***	***[-0.46, -0.07]***	***.008***
2.Trust science	-0.05	[-0.24, 0.15]	.628	***-0.20***	***[-0.42, 0.03]***	***.085***
1.Trust leaders	0.19	[-0.03, 0.41]	.094	0.14	[-0.06, 0.35]	.166
2.Trust leaders	0.07	[-0.13, 0.26]	.492	0.15	[-0.07, 0.37]	.187
1.Trust NGO	-0.16	[-0.37, 0.06]	.146	0.04	[-0.15, 0.24]	.658
2.Trust NGO	-0.07	[-0.26, 0.13]	.495	-0.02	[-0.24, 0.20]	.883
1.Trust media	0.12	[-0.08, 0.33]	.233	0.07	[-0.12, 0.26]	.477
2.Trust media	0.00	[-0.18, 0.18]	.995	0.10	[-0.12, 0.31]	.374
1.Trust businesses	-0.26	[-0.47, -0.05]	.016	***-0.16***	***[-0.36, 0.04]***	***.109***
2.Trust businesses	-0.10	[-0.28, 0.08]	.279	***-0.21***	***[-0.41, 0.00]***	***.048***
1.Government responsible	0.15	[-0.25, 0.55]	.475	0.26	[-0.13, 0.64]	.195
2.Government responsible	-0.10	[-0.49, 0.28]	.598	-0.12	[-0.56, 0.32]	.598
1.EU responsible	0.22	[-0.14, 0.58]	.229	0.00	[-0.34, 0.35]	.997
2.EU responsible	-0.15	[-0.49, 0.19]	.377	0.10	[-0.29, 0.49]	.617
1.Business responsible	-0.26	[-0.65, 0.13]	.195	**-0.54**	**[-0.91, -0.16]**	**.005**
2.Business responsible	-0.09	[-0.47, 0.28]	.621	0.03	[-0.40, 0.46]	.892
1.Env. groups responsible	***0.42***	***[0.00, 0.83]***	***.049***	0.36	[-0.01, 0.73]	.058

	Model 1. Transport			Model 2. Diet		
	Est.	95% CI	p	Est.	95% CI	p
2.Env. groups responsible	***0.53***	***[0.17, 0.89]***	***.004***	0.22	[-0.18, 0.61]	.283
1.Local auth. responsible	-0.32	[-0.74, 0.11]	.142	0.19	[-0.19, 0.58]	.329
2.Local auth. responsible	-0.07	[-0.46, 0.32]	.726	0.20	[-0.24, 0.65]	.364
1.Individuals responsible	0.30	[-0.04, 0.65]	.087	-0.13	[-0.47, 0.21]	.444
2.Individuals responsible	-0.02	[-0.36, 0.31]	.898	-0.28	[-0.67, 0.11]	.152
1.Male	0.00	[-0.30, 0.30]	.984	***-0.41***	***[-0.68, -0.14]***	***.003***
2.Male	0.11	[-0.16, 0.38]	.416	***-0.42***	***[-0.72, -0.12]***	***.006***
1.Age	-0.16	[-0.32, 0.00]	.055	**-0.38**	**[-0.53, -0.23]**	**<.001**
2.Age	0.06	[-0.08, 0.20]	.427	**-0.15**	**[-0.31, 0.01]**	**.071**
1.Urban	-0.19	[-0.50, 0.12]	.223	0.06	[-0.21, 0.34]	.643
2.Urban	**0.49**	**[0.22, 0.77]**	**<.001**	0.06	[-0.24, 0.36]	.706
1.Degree	0.30	[0.01, 0.60]	.046	0.07	[-0.20, 0.34]	.629
2.Degree	0.18	[-0.08, 0.45]	.180	**0.34**	**[0.04, 0.64]**	**.026**
Observations		1200			1200	
AIC		2284.4			2248.8	
BIC		2589.8			2554.2	
RMSE		1.84			1.63	

Note: Estimates in bold indicate significant nominal effects in the partial proportional odds models. Estimates in bold and italic indicate significant ordinal effects in the partial proportional odds models.