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Citation for published version (APA):

Intentions to purchase a sustainable mobile phone by network analysis in four European countries

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ABSTRACT

The environmental impact of the smartphone industry is large and growing. Smartphone production requires precious metals, and its manufacturing, energy consumption during use, and disposal also harm the environment. These impacts are exacerbated by the low repairability and short replacement cycles of around two years. We investigate the factors relating to the intention to purchase an easily repairable modular smartphone (the Fairphone 4), in order to better understand what influences consumers to choose this sustainable alternative. We used an attitude network approach in a pre-registered online study (total $N = 2202$) in four countries: the Netherlands, Germany, France, and the United Kingdom. Across countries, psychological factors were more closely related to intentions to buy a sustainable smartphone than product and brand characteristics. In particular, joy and excitement, overall attitude, and green product interest related positively to purchase intentions, while the status of the product and feelings of uncertainty about the product correlated negatively with intentions. We discuss network analysis as a tool for information gathering and hypothesis generation, and suggest how the results could inform marketing and communication strategies.

1. Introduction

In the last 50 years, the global consumption of electronic devices has increased sixfold (Belkhir and Elmeligi, 2018). Between 2010 and 2020, the greenhouse gas emissions associated with smartphones increased by 730 % from 17 to 125 Mt-CO_2-e (Belkhir and Elmeligi, 2018) and 146 Mt-CO2-e in 2022 (Lee et al., 2021), equivalent to the CO_2 emissions of the Netherlands in 2020 (World Population Review, 2023). The number of smartphones is rising particularly rapidly, caused both by increased market proliferation and short replacement cycles (around two years), subsidized by the two-year contracts of many telecoms (Belkhir and Elmeligi, 2018; Cordella et al., 2021). The environmental impact of smartphones varies during their lifecycle, from mining materials including precious metals, to manufacturing, energy consumption during use, and waste disposal, with around 83 % of the emissions stemming from the manufacture, shipping, and first-year usage (Lee et al., 2021). Less than 16 % of discarded smartphones are recycled each year, creating e-waste, which can emit dangerous contaminants potentially

damaging to both the environment and human health (Envirotech, 2019), and depleting scarce materials (Nasiri and Shokouhyar, 2021). The electronics industry also has issues with inadequate working conditions, compensation, insufficient health and safety routines, and labor law violations (TCO certified, 2014).

Buying a new smartphone has a high environmental impact, especially because it is relatively infrequent compared to everyday pro-environmental behaviors such as recycling or reusing shopping bags. 'Pro-environmental behavior' describes a heterogeneous group of behaviors, including bringing a shopping bag, not eating meat, and installing solar panels. Psychological research often assumes that these behaviors are linked by a unitary psychological construct (see discussion in Lange and Dewitte, 2019; Nielsen et al., 2021), which may be an overgeneralization (Brick et al., 2022). Different types of behavior are influenced by different psychological and contextual factors (Ertz et al., 2016) and antecedents of everyday behaviors do not necessarily generalize to costlier and less frequent behaviors (Nielsen et al., 2021).

The aim of this paper is to determine the factors that are most

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strongly related to the intention to buy a more sustainable, easy-to-repair smartphone: the Fairphone 4. Research on predictors of sustainable technology is limited, especially with regard to smartphones or other electronics. There are studies examining pre-owned smartphones (e.g., Liu and Tsaur, 2020; Mugge et al., 2017; Nasiri and Shokouhyar, 2021) but none to our knowledge that examined consumer attitudes and purchase intentions of new, modular smartphones. Given the large environmental footprint of smartphones and their continued proliferation, it is critical to understand what might encourage consumers to switch to more sustainable alternatives with similar functionality.

The novelty and contribution of this research is threefold. First, our conceptual approach is unusually broad. Unlike the majority of psychological research on green consumer behavior, or even on pre-owned smartphones, we used an exploratory approach not limited to one specific theory, but explored the relationships of a multitude of (non-)psychological factors with consumers' purchase intention (Chambon et al., 2021; Zwicker et al., 2020a). Research on attitudes is often deductively based on theoretical models (e.g., see Table 1), in which a limited set of variables directionally predict an intention or behavior. We argue that purchasing behavior is complex and determined by the interplay of many factors, over and above what can be described by a single theory. Given the specificity of the subject and the fact that buying a smartphone is a relatively infrequent and high-impact behavior, it is also unclear whether psychological factors common to low-impact behaviors (like recycling or reusing a plastic bag) are as relevant. We therefore draw on a host of factors the literature identified as relevant with regard to green (consumer) behavior and use an exploratory, inductive approach to determine which factors are most strongly related to the intention to buy a sustainable smartphone.

The second novelty is the attitude network approach (Dalege et al., 2016). Social scientists only recently started to apply attitude networks to consumers' thoughts and behaviors (e.g., Zwicker et al., 2020a). Network analysis allows the visualization of the direct relationships between different psychological factors and purchase intentions, as well as illustrating the indirect relationships between the examined factors that make up a person's attitude. This was done across the four different countries that made up Fairphone's biggest market share to examine cross-country similarities and differences (the Netherlands, Germany, France, and the United Kingdom; Lempers, 2023).

The third novel aspect is the focus on the Fairphone 4. Most of the previous research on more sustainable smartphones has studied pre-owned phones (e.g., Liu and Tsaur, 2020; Mugge et al., 2017; Nasiri and Shokouhyar, 2021). For example, consumers appear to be willing to purchase sustainable smartphones (Liu and Tsaur, 2020), but positive attitudes towards refurbished smartphones differ between different consumer groups (Mugge et al., 2017). Additionally, when it comes to refurbished smartphones, product characteristics such as functionality (e.g., guaranteed software updates), appearance, and battery health, are important features related to purchase intentions (Mugge et al., 2017; Nasiri and Shokouhyar, 2021). To our knowledge, this is the first research examining perceptions of a modular smartphone. More

sustainable smartphones, especially in the form of pre-owned (e.g., refurbished) or easily-repairable (e.g., the Fairphone), have recently increased in popularity (Lee et al., 2021). This is evidenced by the growing market for second-hand and refurbished phones (for overview see The Considerate Consumer, 2022) and the emergence of modular, easy-to-repair phone providers (Fairphone, 2022; Shift, 2022; Teracube, 2022). While pre-owned phones account for about half of global market share (Persistence Market Research, 2023) and the psychological and situational factors related to the purchase of a pre-owned smartphone are comparatively well understood, modular smartphones hold a very small market share and consumer perception of them is understudied. Given the large environmental footprint of smartphones and their continued proliferation, it is critical to understand what might encourage consumers to switch to different types of more sustainable smartphones.

Overall, this exploratory research provides the first insights into which factors are most relevant to the purchase intention of a sustainable smartphone. These results can be used in future confirmatory research and to inform organizational and marketing strategies.

2. Literature review

2.1. Less progress than anticipated

Consumers play a key role in the mitigation of global warming. First, the cumulative effect of individual consumption and disposal is devastating (Trudel, 2018). Second, consumers can influence the market and aid the sustainable transition through their preferences and consumption patterns (De Marchi et al., 2020). Demand influences the types of products that are produced (Gaffey et al., 2021). Many consumers appear willing to contribute to a more sustainable society, as the majority sometimes considers the environment when shopping (Groening et al., 2018; Testa et al., 2021). Some companies are responding to this demand by marketing new products and services as environmentally friendly. However, despite endorsing environmental values and the increasing amount of green products on retail shelves, consumers are not buying green products and services as often as expected (Gleim et al., 2013; Park and Lin, 2020; Testa et al., 2021; Young et al., 2010). Despite the importance of determining whether consumers will choose a green product, the decision process is not well understood (ElHaffar et al., 2020; Park and Lin, 2020; Trudel, 2018). While purchase behavior is often influenced by a great variety of factors, previous research often focused on a single or a few groups of factors, rather than providing a comprehensive picture (Testa et al., 2021).

2.2. Using attitudes to understand consumer behavior

Companies often focus on consumers' preferences when designing marketing strategies. Specifically, companies use consumer profiles to categorize and target specific consumer groups and increase sales. This segmentation divides the market into types of customers that behave in a

Table 1
Selection of psychological theories predicting intentions and behavior.

Theory	Psychological factors related to intentions or behavior	Reference
Theory of Planned Behavior	Attitudes, subjective norms, perceived behavioral control	Ajzen (1991)
Value Belief Norm Theory	Values, problem awareness, outcome efficacy, personal norms	Stern (2000)
Norm Activation Model	Perceived behavioral control, responsibility, norms, attitude, emotions (pride and guilt)	Onwezen et al. (2013)
Value Identity Personal Norm Model	Values, environmental self-identity, personal norm	van der Werff and Steg (2016)
Comprehensive Action Determination Model	Normative processes, habitual processes, situational influences	Klöckner and Blöbaum (2010)
Social Identity Model of Collective Action	Injustice, identity, efficacy	van Zomeren et al. (2008)
Social Identity Model of Pro-Environmental Action	Ingroup identification, collective efficacy beliefs, ingroup norms and goals, social identity, emotions and motivations, appraisal	Fritsche et al. (2018)

similar way or have similar needs (e.g., based on purchase behavior, usage, demographics, or geography), and who might respond similarly to marketing (Amine and Smith, 2009; Jadczaková, 2013). For example, companies might categorize certain consumers into 'light green' (early adopters of sustainable products) or 'dark green' (pioneers of sustainability). However, consumer profiles are a simplification that aggregates how consumers differ between and within segments. This approach has been criticized for stigmatizing the relevant groups and creates uncertainty about whether the groups are socially constructed rather than discovered (Brick et al., 2022; Kácha et al., 2022).

While a segmentation approach is often used in marketing, we suggest that attitudes can provide a more nuanced view for trying to understand and change the consumer behavior of smartphone purchase. An attitude is a relatively enduring evaluation of an object, person, or event. This evaluation can include beliefs (cognition), feelings (affect), as well as intentions and behaviors (Bhattacherjee and Sanford, 2009). Attitudes and perceived difficulty are the main predictors of pro-environmental behavior (Kaiser et al., 2021; Taube et al., 2018). Positive attitudes towards sustainable products are the starting point to stimulating sustainable consumption (Kaiser et al., 2020; Park and Lin, 2020; Zwicker et al., 2023), with attitudes towards a product having the highest impact on purchase intentions of that product (Rausch and Kopplin, 2021; Zhuang et al., 2021).

2.3. A new kind of smartphone

As a reaction to the aforementioned severe issues in the smartphone lifecycle, several companies started producing more sustainable smartphones (e.g., Fairphone, 2022; Shift, 2022; Teracube, 2022). These companies aim to lower the environmental and social impact of the electronics industry by creating products with a longer lifespan, reduced e-waste, fairer materials, and improved working conditions. Modular and/or easy-to-repair smartphones with long warranties ensure longevity. The market share of these more sustainable phones is still very small. As of February 2023, Fairphone has sold about 400,000 and SHIFT around 70,000 devices, but their sales are expected to increase (Schweiger, 2022). More established companies are also pledging to become more sustainable. For example, Apple committed to make its supply chain and products 100 % carbon neutral by 2030 (Apple, 2020).

In this research, we focused on the electronics manufacturer Fairphone. In particular, we examined which (psychological) factors were related to the purchase intentions of their newest product, the Fairphone 4. The present research was conducted in the four countries with Fairphone's largest market share: Germany, France, the Netherlands, and the United Kingdom.

2.4. Factors affecting purchase intention

Purchase intentions are frequently used to make strategic decisions concerning both new and existing products, forecast future demand, test which geographic markets and consumer segments to target, pre-test advertising and promotions, and to proxy purchase behavior (Morwitz et al., 2007). Since actual behavior is difficult to measure in part because it is infrequent, we used purchase intentions as a proxy. However, there can be a substantial gap between intentions and behaviors (Sheeran and Webb, 2016).

Numerous theories detail the psychological factors that relate to pro-environmental intentions and behaviors (Table 1). In the majority of these theories, a limited set of variables directionally predict an intention or behavior. We argue that purchasing behavior is highly complex and determined by the interplay of a great variety of factors, over and above what can be described by one single theory. The psychological factors most frequently studied in relation to pro-environmental intention or behavior include: attitudes, norms, motivations, values, perceived behavioral control/efficacy, affect/emotions, perceived responsibility, pro-environmental identities, habits, and situational factors

(also see Gifford et al., 2011). Other factors also appear important such as status (Berger, 2017; Vesely et al., 2020), trust (Bray et al., 2010; Gleim et al., 2013; Joshi and Rahman, 2015; Rausch and Kopplin, 2021), and product characteristics (e.g., price, features; Joshi and Rahman, 2015; Testa et al., 2021).

In the present research, we included emotions, attitude, trust, status, pro-environmental identity, social norms, preferences for sustainable and ethical products, (egoistic) values, prior knowledge, and some factors related to the brand and product such as technical features of the phone. This broad range of variables provides good coverage of the key factors expected to be related to the purchase intentions of a more sustainable smartphone.

2.5. Attitude network approach

In this study, we used an attitude network approach (Dalege et al., 2016) to visualize consumer attitudes and investigate factors that might relate to purchase intention. Attitude networks represent psychometric networks in which different variables, or evaluative reactions (called *nodes*) are conditionally related to each other (via so-called *edges*; Borsboom et al., 2021). Each object in an attitude network could represent beliefs, feelings, or behaviors towards the attitude object.

Consider a person's attitude towards cycling and imagine that a person thinks cars are bad for the environment and really enjoys cycling. These two evaluative reactions (an attitude and an emotion respectively) relate strongly to that person deciding to cycle to work (a behavior). These three nodes constitute a simple network (Fig. 1).

The individual nodes differ in how strongly they are connected. A connecting edge means that two nodes are conditionally dependent taking into account all other nodes in the network. Edge strength can be estimated with partial correlations. Evaluative reactions that are similar to one another tend to cluster together (Dalege et al., 2016). Similar evaluative reactions are more strongly related to each other than dissimilar ones (Dalege et al., 2017a). For example, enjoying cycling may
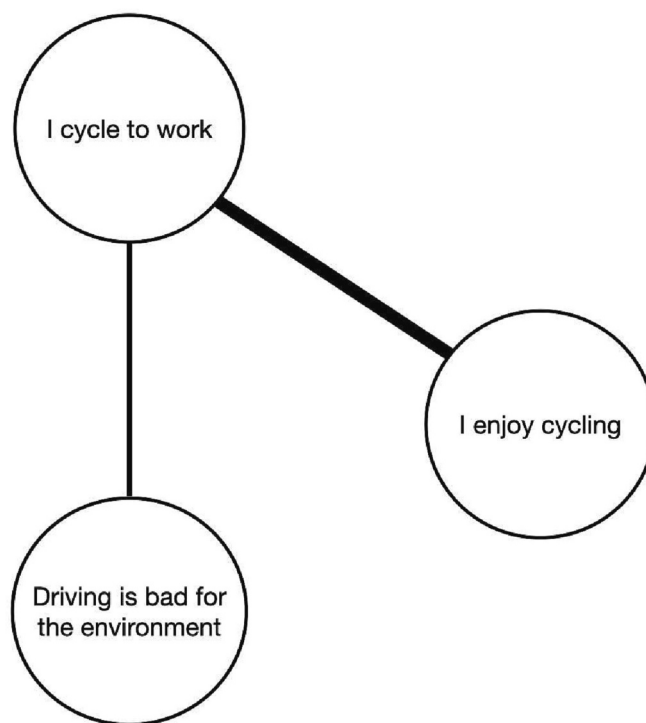

Fig. 1. Hypothetical attitude network towards cycling to work.
Note. Each node represents evaluative reactions and the width of the connecting lines (edges) represents their conditional independence (e.g., the strength of the partial correlation).

be more strongly connected to cycling to work than to knowing that driving is bad for the environment (Fig. 1). Attitude networks are a useful descriptive starting point for characterizing context and populations and establishing relationships between concepts (see Scheel et al., 2021 on the importance of descriptive research). Importantly, cross-sectional attitude networks do not provide strong evidence about causation.

The added value of a network analysis over other approaches, e.g., over a correlation matrix or regression analysis, is that networks provide better visualizations, and are easier to interpret (cf. Jones et al., 2018) and use to build theories. Attitude networks also visualize the indirect relationships between variables and provide information on the structural importance of the different nodes (centrality), which may help infer which evaluative reactions are most likely to influence decision making (Dalege et al., 2017b). Mathematical proofs show that network models are equivalent to latent variable modes or factor analysis (Epskamp et al., 2018). While factor analysis reduces a large number of variables into fewer numbers of factors by extracting maximum common variables from all items, network models visualize the pattern of interconnectedness. It is also possible to compare different networks across countries or demographics.

Network models have been applied to other sustainability attitudes. For example, Zwicker et al. (2020a) visualized perceptions towards plastics to determine which evaluative reactions related most strongly to people's willingness to pay for a hypothetical bio-based plastic bottle. They determined which nodes to include with a qualitative method: asking participants to note down thoughts that came to mind about different plastic types. This type of introspective research has merits but it only examines factors that participants are aware of and consider important. The current research took a more theoretical approach to selecting nodes based on factors previously linked to pro-environmental behavior. We further extend the previous research by focusing on an existing consumer product (a Fairphone smartphone) using existing marketing material. When participants in an online study see the same marketing materials used by the company itself, the responses are more likely to correspond to consumers' purchasing outside of the study (i.e., greater ecological validity).

As this study was exploratory and descriptive, there were no directional hypotheses.

3. Method

The survey was conducted online through Prolific.co in the United Kingdom, Germany, France, and the Netherlands in their respective languages. The items were developed in English and then translations were done by native speakers with academic backgrounds and edited by a second native speaker. While the network analyses were the main focus of this research, we also conducted a regression analysis with additional variables not included in the networks. The pre-registration, data, materials, and analysis scripts are available on the Open Science Framework (https://osf.io/tjrg3/).

3.1. Participants

Epskamp (2016) suggested that a sample size of 250 is sufficient for moderately sized networks (around 25 nodes) based on continuous data. We expected to create networks around that size but decided to recruit double the participants because the size of the network could vary depending on how many nodes were included (see the pre-registration). We pre-registered recruiting 550 per country to allow for possible exclusions. In total, we recruited 2223 participants. We excluded outliers with very high annual net income ($> €1$ m, $n = 4$) and participants who finished <70 % of the questionnaire ($n = 17$) (these exclusions were not pre-registered). The final sample contained 2202 participants with about 550 each from the United Kingdom, Germany, France, and the Netherlands (Table 2).

Table 2
Demographics.

	Netherlands $n = 547$	Germany $n = 543$	France $n = 563$	United Kingdom $n = 549$
Gender	49.8 % male	49.0 % male	49.8 % male	49.9 % male
	47.6 % female	49.9 % female	47.5 % female	49.4 % female
	2.6 % other	1.1 % other	2.7 % other	0.7 % other
		Mean (*SD*)		
Age	28.0 (9.1)	29.7 (9.8)	29.0 (9.69)	42.4 (14.3)
Education in years	15.6 (4.3)	14.1 (3.3)	15.2 (3.7)	16.0 (3.4)
Rurality[a]	2.20 (1.0)	2.13 (1.2)	1.98 (1.1)	2.64 (1.0)
Political orientation[b]	4.17 (2.0)	4.14 (1.9)	4.37 (2.1)	4.87 (2.1)
Net income/year k€	38.4 (69.6)	30.0 (34.0)	27.8 (27.5)	38.9 (39.0)

[a] 1 = A big city, 2 = The suburbs or outskirts of a big city, 3 = A town or a small city, 4 = A country village, 5 = A farm or home in the countryside.
[b] 1 = very left-wing/progressive, 11 = very right-wing/conservative.

3.2. Procedure

Participants who tried to complete the survey on a mobile phone were automatically screened out. This was done to ensure that everyone was able to view the Fairphone marketing materials and image (which contained small text and numbers) with the same ease, and to reduce the likelihood of participants completing the survey in potentially distracting surroundings. The remaining participants received information about the study and agreed to the consent form. They indicated their prior knowledge about Fairphone before reading an informational text about Fairphone that was accompanied by a graphic. Participants then responded to questions assessing their emotions and overall attitude about the Fairphone 4, and indicated how much trust they had in the Fairphone organization and the phone. Afterwards, participants indicated their intentions to buy a Fairphone. This was followed by questions about the importance of 11 product and brand characteristics and status when purchasing a new phone. Participants then reported their interest in green products, indicated how much they identified as an environmentalist, their values, and responded to questions about social norms. After filling in the demographic questions and receiving the option to learn more about Fairphone, they were debriefed and paid.

3.3. Measures

Unless otherwise indicated, all items were measured on 7-point Likert scales. The Cronbach alphas for all scales are in Table 3.

3.3.1. Prior knowledge about Fairphone
As Fairphone is a relatively young and unknown company, we gauged how much knowledge participants had about Fairphone and their objectives. We asked participants: "Which of these companies strive(s) to use fair, recycled, and responsibly mined materials in their phones?" and "Which of these companies has modular, easy-to-repair phones?" In both cases we provided them with five response options: *Apple, Fairphone, Nokia, OnePlus,* and *Samsung* and told the participants to "Select all that apply". We also inquired how familiar participants were with the Fairphone brand from 1 (*very unfamiliar*) to 7 (*very familiar*).

3.3.2. Information about Fairphone
In order to make sure that all participants were relatively familiar with Fairphone and the Fairphone 4, participants read about 100 words about the Fairphone company, their mission, and the Fairphone 4. The text was accompanied by a screenshot taken from the Fairphone

Table 3

Cronbach alphas and composite scale means by country.

	Netherlands		Germany		France		United Kingdom	
	α	*M* (*SD*)	α	*M* (*SD*)	α	*M* (*SD*)	α	*M* (*SD*)
Overall attitude	0.82	5.2 (0.8)	0.87	5.6 (0.8)	0.82	5.5 (0.8)	0.89	5.5 (0.8)
Trust	0.81	5.7 (0.8)	0.86	5.7 (0.9)	0.81	5.6 (0.9)	0.87	5.8 (0.9)
Purchase intention	0.92	3.6 (1.6)	0.92	3.9 (1.5)	0.88	3.6 (1.5)	0.92	4.0 (1.5)
Status	0.88	2.8 (1.4)	0.93	2.4 (1.4)	0.89	2.7 (1.4)	0.91	2.5 (1.4)
Green product interest	0.92	4.1 (1.1)	0.90	4.5 (1.1)	0.91	4.6 (1.1)	0.93	4.4 (1.2)
Environmental identity	0.92	3.0 (1.4)	0.91	4.1 (1.4)	0.90	4.0 (1.4)	0.95	3.9 (1.5)
Egoistic values	0.77	4.0 (1.1)	0.78	4.0 (1.2)	0.80	3.9 (1.2)	0.79	3.6 (1.2)
Norms	0.94	3.8 (1.3)	0.94	4.2 (1.3)	0.93	4.4 (1.3)	0.82	4.8 (1.2)
Political orientation	0.91	4.2 (2.0)	0.92	4.1 (1.9)	0.92	4.4 (2.1)	0.94	4.9 (2.1)

website, displaying the Fairphone 4, its price (adjusted per country), and the color and memory options.

3.3.3. Purchase intention

The main outcome variable was purchase intention measured by agreement from 1 (*completely disagree*) to *7* (*completely agree*) with three statements: "I am considering buying a Fairphone", "I am willing to switch to Fairphone", and "The next time I am buying a new phone, I will buy a Fairphone". The responses to these three statements were combined into a 'purchase intention' mean composite score.

As a measure of actual behavior, we also included a link at the end of the survey that participants could voluntarily follow to learn more about the Fairphone 4 and the brand and its aims. However, due to a technical error, the number of participants who clicked the link was not recorded.

3.3.4. Emotions about the Fairphone

Participants indicated how much of the following emotions they felt when thinking about buying or using a Fairphone from 1 (*completely disagree*) to 7 (*completely agree*): worry, joy, guilt, sadness, anger, uncertainty, excitement, pride, awe, hope, and annoyance. This measure was adapted from Zwicker et al. (2020a), who assessed the first seven emotions. We added three positive emotions that have been linked to pro-environmental intentions and behavior, pride (Bissing-Olson et al., 2016; Onwezen et al., 2013; Schneider et al., 2017; Shipley and van Riper, 2022), awe (Skurka et al., 2022; Zelenski and Desrochers, 2021; Zhao et al., 2018), and hope (Ojala, 2012; van Zomeren et al., 2019). We also added annoyance, as people might feel annoyed or frustrated by the current increased focus on sustainability of products and policies.

3.3.5. Overall attitude

As Fairphone is relatively new and this research was mainly exploratory, we assessed general attitudes towards the Fairphone 4. This was done using semantic differentials (Heise, 1970). Participants saw seven pairs of polar adjectives (e.g., bad-good, unreliable-reliable) (see Fig. 3) and rated them according to the statement "I think the Fairphone smartphone is…" on a 7-point scale.

3.3.6. Trust

Participants reported their trust in Fairphone with four items ranging from 1 (*completely disagree*) to 7 (*completely agree*). The first three were adapted from van Prooijen (2019). We made adjustments to simplify the wording and relate the items to the Fairphone organization. Each item measures one of the factors known to influence perceived trustworthiness: ability, integrity, and benevolence (Mayer et al., 1995). For example, this item assessed integrity: "I think the Fairphone organization is guided by sound morals." We also included one item that assessed trust in the mobile phone (rather than the Fairphone organization): "I consider the Fairphone smartphone to be a reliable product."

3.3.7. Product and brand characteristics

We assessed the importance of 11 product and brand characteristics when purchasing a new phone: price, appearance, technical

specifications, quality of the phone, size, camera, sustainability of the phone, treatment of the workforce, the brand's reputation, customer service, and sustainability of the company. These were based on previous literature and Fairphone's market research (see van den Heuvel, 2020). Participants responded to the following question for each of the characteristics on a scale from 1 (*not very important*) to 7 (*very important*): "How important is …. to you when you purchase a new phone?" These items were analyzed separately.

3.3.8. Status

We used the Status Consumption Scale (Eastman et al., 1999; used in Goldsmith and Clark, 2012) to assess how much the status of a product mattered to the participants. Participants indicated how much they agreed from 1 (*completely disagree*) to 7 (*completely agree*) with the scale's five items (e.g., "I would pay more for a product if it had status.").

3.3.9. Green product interest

The Ethically Minded Consumer Behavior Scale (Sudbury-Riley and Kohlbacher, 2016) was used to measure green product interest. This 10-item scale assessed how important it was to participants that products they buy are sustainable and ethical. Participants indicated how true statements were such as "I will not buy a product if I know that the company that sells it is socially irresponsible" from 1 (*never true*) to 7 (*always true*).

3.3.10. Environmentalist identity

We assessed how much participants identified with being an environmentalist (Brick and Lai, 2018; Brick et al., 2017). This 4-item Likert-type measure included items such as "I see myself as an environmentalist" rated from 1 (*completely disagree*) to 7 (*completely agree*).

3.3.11. Egoistic values

We used the Egoistic subscale of the Value Orientation Scale (De Groot and Steg, 2007) to determine how important from 1 (*not very important*) to *7* (*very important*) participants valued these principles: social power, wealth, authority, being influential, and being ambitious. Only this subscale was chosen, as the other values (altruistic and biospheric) overlap with other measures in this study and were omitted for time constraints.

3.3.12. Pro-environmental norms

Norms were assessed with two sets of three items adapted from Bissing-Olson et al. (2016). Participants indicated (dis)agreement with three statements about the environmental actions of people close to them (e.g., "Most people who are important to me act in environmentally-friendly ways.") on a scale from 1 (*completely disagree*) to 7 (*completely agree*). Participants then responded to the same items about the expectations of close others about the participant's behavior (e.g., "Most people who are important to me expect me to act in environmentally-friendly ways.").

3.3.13. Demographics

Participants reported their age, gender, education (completed years of education), and household income. We also asked participants to indicate whether they lived in a city or the countryside (rurality). Political orientation was assessed with four items on a 11-point Likert scale. Participants placed themselves on a political left-right and progressive-conservative continuum, as well as two more left-right continua for economic and then social issues (measure adapted from Zwicker et al., 2020b).

4. Results

All analyses were pre-registered and identical across countries except where explicitly noted. The data, scripts, and additional information are on the Open Science Framework (https://osf.io/tjrg3/). Alpha was set at 0.05 and all analyses were conducted in R 4.2.2 (R Core Team, 2022).

4.1. Prior knowledge

As expected, participants were unfamiliar with the Fairphone brand, $M_{overall} = 2.44$ (Fig. 2 for country medians and SDs). A Kruskal-Wallis test (not pre-registered but used because of the skew of the outcome variable) revealed significant differences in familiarity with the Fairphone across countries, $H(3) = 205$, $p < .001$, $\eta^2 = 0.09$, 95 % CI [0.07, 0.12]. A post-hoc pairwise comparison using Wilcoxon rank sum test with corrections for multiple testing showed significant differences between all countries ($ps < .036$). Of the four countries, Germans were most familiar with Fairphone followed by the Dutch and the French, with the British least familiar (Fig. 2).

4.2. Attitude towards Fairphone

Overall, participants were positive about the Fairphone ($M = 5.45$, $SD = 0.81$). Fig. 3 visualizes participants' mean attitudes across countries and shows that most responses are on the positive side of the

semantic adjective pairings. The overall pattern was similar across countries, but one-way ANOVA results (not pre-registered) found a significant main effect of attitude by country, $F(3, 2209) = 23.76$, $p \leq .001$, $\eta^2 = 0.03$. Post-hoc comparisons revealed that the Dutch were less positive about Fairphone ($M = 5.21$, $SD = 0.75$) than the French ($M = 5.48$, $SD = 0.75$, $d = -0.36$ [$-0.47, -0.24$]), British ($M = 5.55$, $SD = 0.83$, $d = -0.43$ [$-0.54, -0.30$]), and Germans ($M = 5.56$, $SD = 0.83$, $d = -0.45$ [$-0.57, -0.33$]). These differences were mainly driven by the Dutch perceiving the Fairphone as less trustworthy and less reliable than the other countries.

4.3. Network analysis

The main network analysis was based on the Causal Attitude Network model (Dalege et al., 2016; Dalege et al., 2017a). To estimate the network for continuous variables, the Gaussian Graphical Model was applied (Epskamp et al., 2018). In this model, two variables or nodes are connected via an edge if they are conditionally dependent given all other variables in the network. We estimated such dependencies via partial correlation coefficients between the variables. We constructed a weighted, undirected network for each country, estimating a Gaussian Graphical Model based on the partial correlation matrix using regularization (EBICglasso) as the model selection procedure in *bootnet* (Epskamp et al., 2018).

4.3.1. Interpretation

In order to find densely connected subgraphs in each network, we employed the Walktrap algorithm (Pons and Latapy, 2005). Nodes that are similar and more strongly connected to one another are colored the same and form a cluster. Positive relationships are represented by blue edges and negative relationships by red edges. The thicker the line, the stronger the relationship. Importantly, these are partial correlations and do not provide strong causal evidence, as we focused on an undirected network and cross-sectional data. Below, we focused on variables relating to purchase intention. An overview of all four networks is
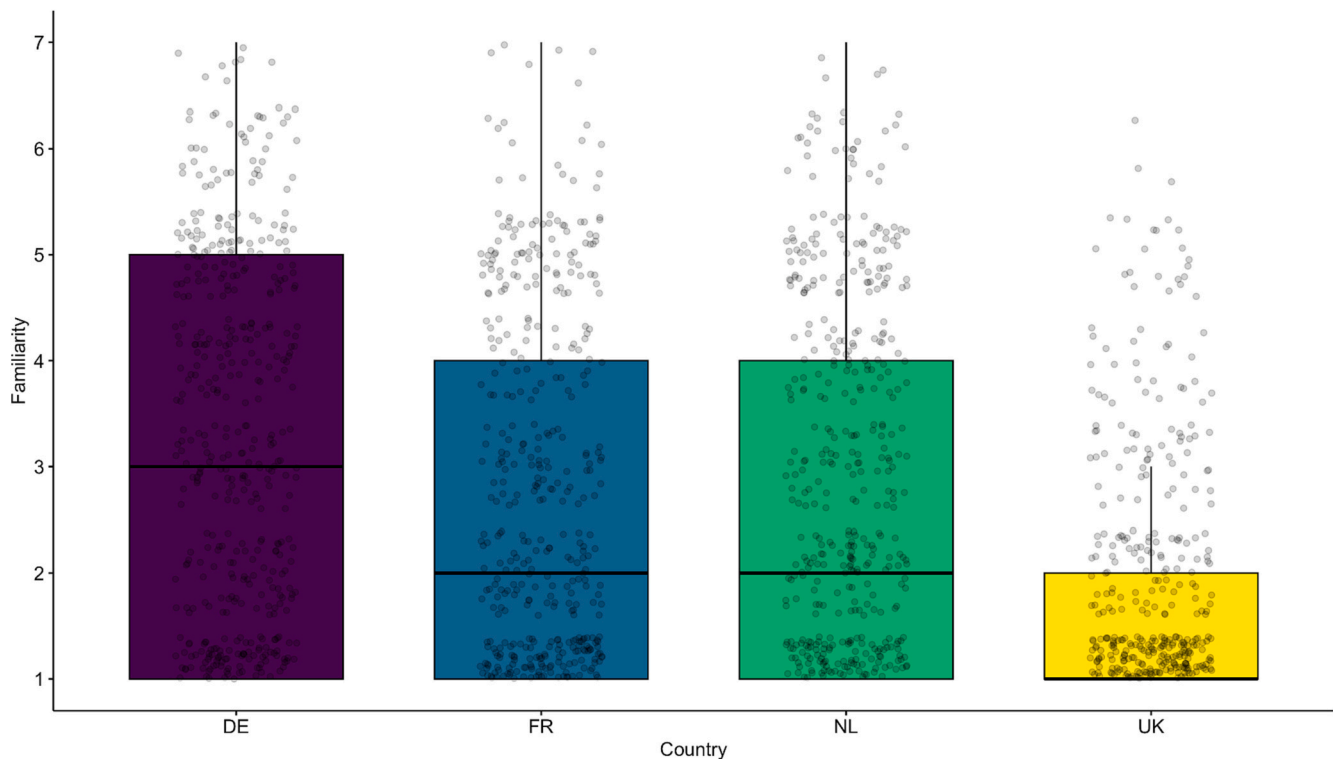
Fig. 2. Boxplots of familiarity with Fairphone by country.
Note. The horizontal line represents the median and the colored boxes the interquartile range.
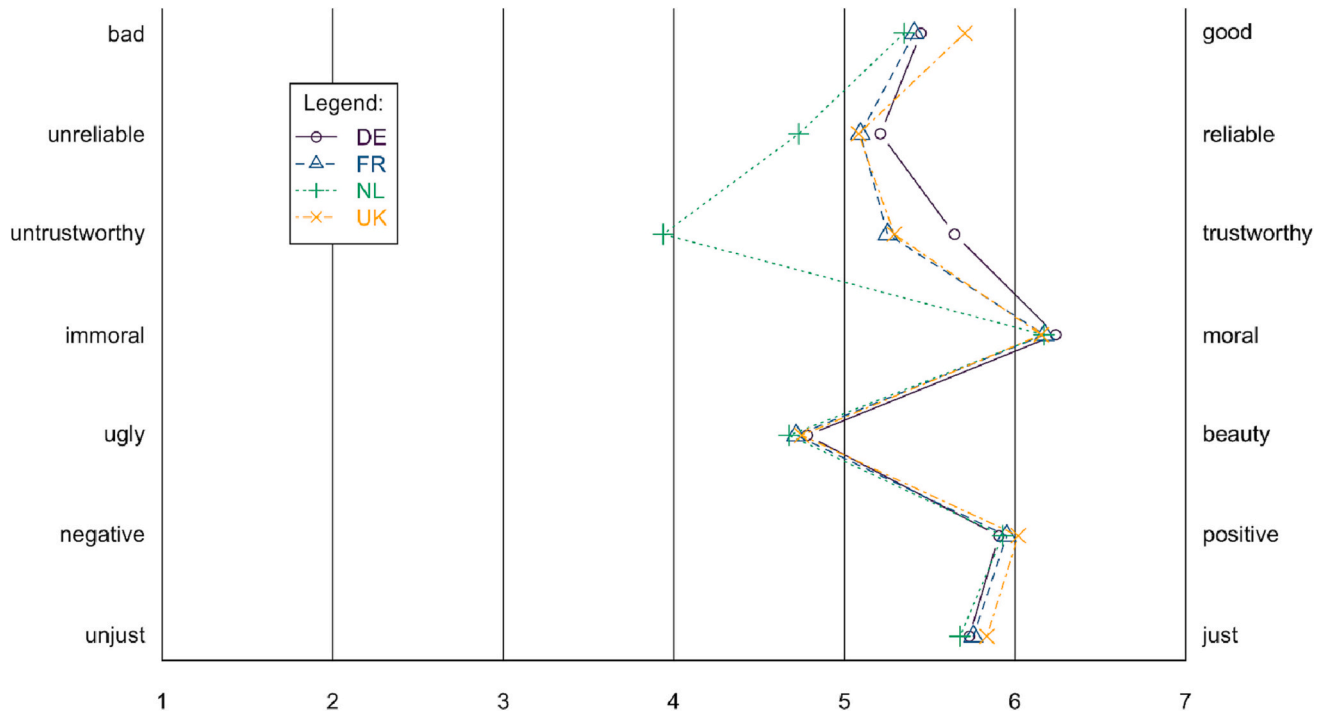
Fig. 3. Attitude pairs and their results per country.
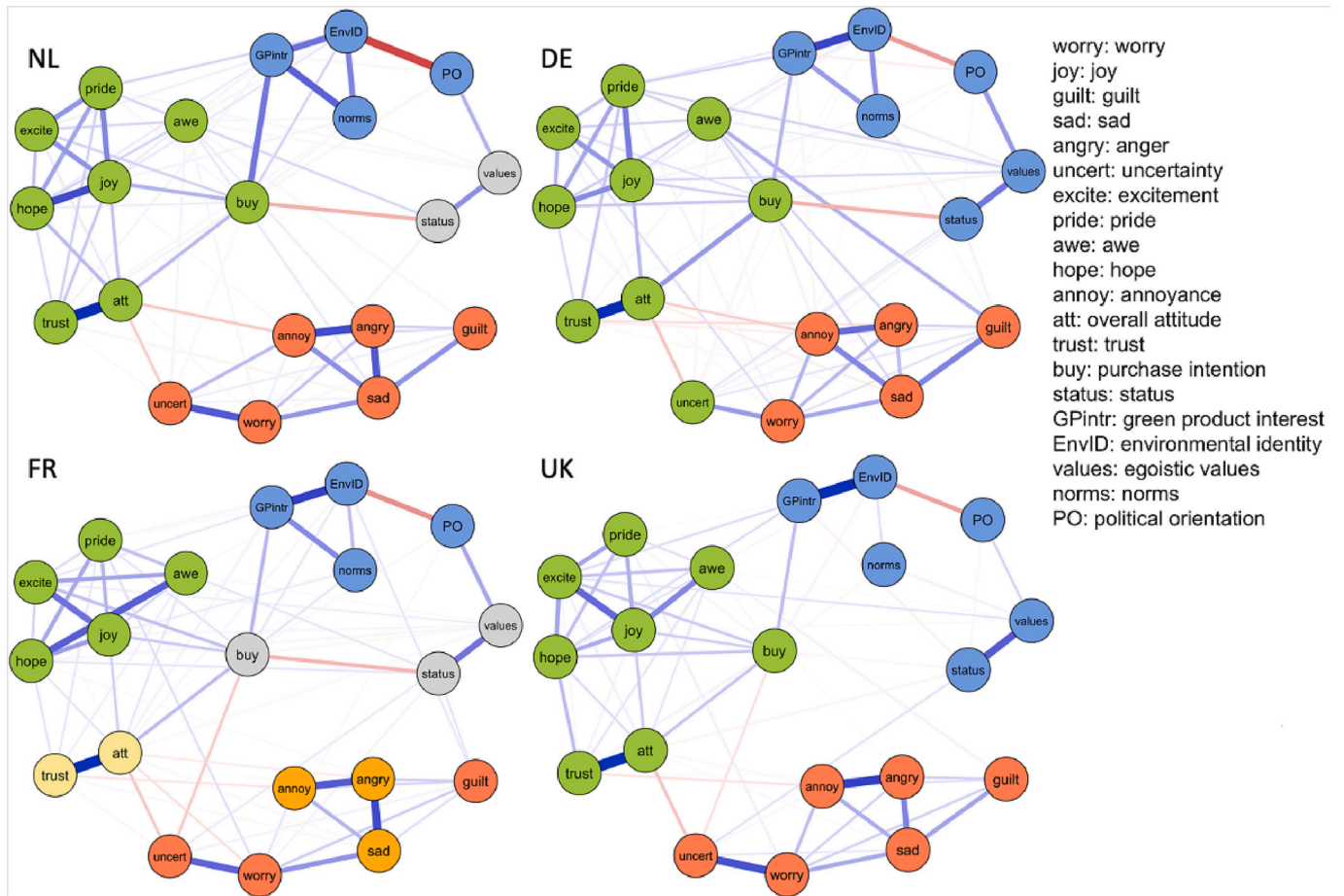
Fig. 4. Networks of attitudes and purchase intentions across four countries.
Note. Node placement is based on the average placement across all networks. Blue edges are positive and red edges are negative partial correlations.

provided in Fig. 4. Node placement is based on the average node placement of all four networks. In general, the clusters were similar across countries but the grouping and number varied slightly. One of the limitations of cluster detection algorithms is that they allocate each node to only one cluster, precluding nodes from being shared between multiple clusters (Lange and Zickfeld, 2021). We believe purchase intentions to be one such shared node. Testing whether purchase intentions is part of more than one community is complex and falls outside the scope of this paper. Therefore, we do not place much importance in our interpretation on which cluster it belongs to.

4.3.2. The Dutch attitude network

Fig. 4 (top left) visualizes the Dutch attitude network. There were four distinct clusters: positive emotions and overall attitude (green), negative emotions (red), personal identity (blue), and egoistic values and status (gray). Green product interest appeared particularly important for purchase intentions ($r_{partial} = 0.25$): the more interested a person was in 'green' products, the more they intended to buy a Fairphone. The more a person cared about status, the less likely they wanted to buy a Fairphone ($r_{partial} = -0.14$).

Positive edges connected intentions with the positive emotions joy ($r_{partial} = 0.13$) and excitement ($r_{partial} = 0.08$), and positive overall attitude ($r_{partial} = 0.12$). Negative emotions were mostly unrelated to purchase intention. The more participants identified with being an environmentalist, the more they intended to buy a Fairphone ($r_{partial} = 0.07$).

4.3.3. The German attitude network

The German network (Fig. 4, top right) had a similar structure but only three clusters: positive emotions (green; this time including uncertainty), negative emotions (red), and identity (blue). Again, people

with higher purchase intentions reported more positive emotions of joy ($r_{partial} = 0.09$), excitement ($r_{partial} = 0.06$), and hope ($r_{partial} = 0.12$) and positive attitudes towards Fairphone (overall attitude, $r_{partial} = 0.22$). Negative emotions seemed less relevant to purchase intentions. Only two negative emotions (uncertainty, $r_{partial} = -0.03$, and annoyance, $r_{partial} = -0.04$) were weakly and negatively linked to purchase intention. Like the Dutch network, people for whom status was more important reported lower purchase intentions ($r_{partial} = -0.17$) and individuals with more green product interest indicated more purchase intentions ($r_{partial} = 0.15$).

4.3.4. The French attitude network

The French network had more clusters than the other networks (Fig. 4, bottom left). In addition to positive emotions (green) and negative emotions (this time split up into two clusters red and orange), another cluster contained purchase intentions, status, and egoistic values (gray; similar to the Dutch network), and a final cluster of overall attitude and trust (green).

As in the other networks, people with higher positive emotions of joy ($r_{partial} = 0.11$), excitement ($r_{partial} = 0.13$), and pride ($r_{partial} = 0.06$) and positive attitudes towards Fairphone ($r_{partial} = 0.14$) reported more purchase intentions. Other than a negative relationship between uncertainty and purchase intentions ($r_{partial} = -0.11$), negative emotions did not seem to be related to purchase intentions. There were positive relationships between intentions with green product interest ($r_{partial} = 0.16$) and environmental identity ($r_{partial} = 0.05$), and a negative relationship with status ($r_{partial} = -0.16$).

4.3.5. The United Kingdom attitude network

The United Kingdom network (Fig. 4, bottom right) had three clusters: positive emotions and overall attitude (green), negative emotions
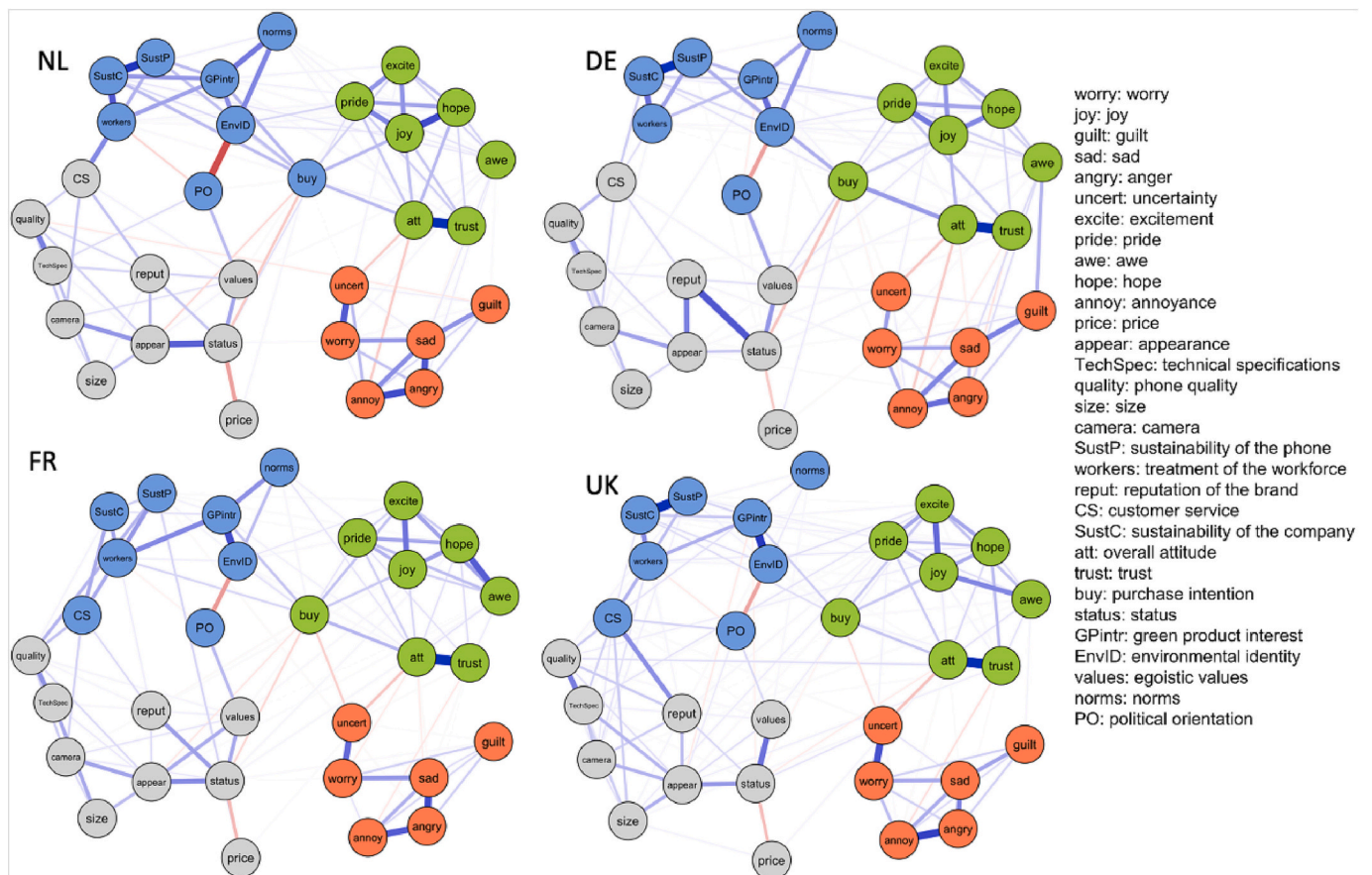

Fig. 5. Overview of networks for the German (DE), French (FR), Dutch (NL) and UK data including the phone and brand characteristics.

(red), and identity (blue). There were positive relationships between purchase intentions and joy ($r_{partial} = 0.10$), excitement ($r_{partial} = 0.11$), and hope ($r_{partial} = 0.11$). Purchase intentions correlated positively to overall attitudes ($r_{partial} = 0.12$), green product interest ($r_{partial} = 0.14$), and negatively to uncertainty ($r_{partial} = -0.07$).

4.3.6. Network analyses including product and brand characteristics

We also ran a network analysis including all the product and brand characteristics (Fig. 5). The four countries appeared very similar and showed four clusters: positive emotions and overall attitude (green), negative emotions (red), identity (blue), and device characteristics, (status, and values; gray). The inclusion of the product and brand characteristics variables did not change the inferences we drew from the original networks discussed above. Purchase intentions related mostly to the psychological factors. In particular, intentions correlated positively to overall attitude, positive emotions, and green product interest, and negatively to status and in some cases uncertainty. The sustainability of the phone was positively related to purchase intentions in Germany and the Netherlands (DE: $r_{partial} = 0.16$; NL: $r_{partial} = 0.11$), and so was the sustainability of the company in the Netherlands and the UK (NL: $r_{partial} = 0.12$; UK: $r_{partial} = 0.06$). Apart from these brand characteristics, none of the product or brand characteristics related to purchase intentions. This lack of relationships suggests that psychological factors are relatively more important for intentions to purchase a Fairphone.

4.4. Network summary

The four countries were broadly similar in network structure and purchase intentions correlated with similar factors across countries. Purchase intentions were most closely linked to positive emotions (specifically joy and excitement), overall attitudes, and green product interest. Purchase intentions were also negatively related to the importance of product status. Unrelated to purchase intentions, we also found trust to be positively and strongly related to overall attitudes across all countries. The countries also differed in the strength of relationships between nodes.

4.5. Network comparison

We compared the networks in Fig. 4 in an exploratory analysis to outline overarching similarities and differences using the Network Comparison Test (van Borkulo et al., 2022). See the online Supplement for more information (Table S1). All four networks had similar connectivity, meaning that they did not significantly differ in how well various parts of a network connected to one another. Most networks showed some edge variation, suggesting at least one of the edges was different between the networks. This overall similarity in structure with some edge variation corresponds with the visual inspection of the networks.

We also tested for network centrality of all four networks (Fig. S1) to determine the structural importance of the individual nodes. We focused on the strength measure of centrality, which represents the direct influence of a given node on the network and is calculated by summing the absolute values of all edge weights a given node has. Across all four countries, overall attitude was one of the nodes with the greatest strength, as was joy, which corresponds with the visual representation discussed above. Depending on the country, other positive emotions, such as pride, excitement, and hope also had comparatively high strength, as did environmental identity.

While we compared data from four different countries, we cannot assume that participants from all countries interpreted the measures in a conceptually similar manner. The results of a measurement invariance analysis (see online Supplement) suggested that the countries are not directly comparable, which was expected because these tests are very stringent. In particular, the factor loadings of the three items making up the purchase intentions variable differed across countries, especially for the French sample. We tested other scales most commonly related to purchase intentions (status, overall attitude, green product interest), and none reached strict measurement invariance (see OSF link in Section 3 for procedure and code). As measurement invariance is almost never met in practice and many researchers argue for more relaxed criteria (e. g., Van De Schoot et al., 2015), we argue that comparing the four countries in this paper is viable.

4.6. Regression

We also conducted a regression analysis to investigate the unique variance explained by psychological factors, product and brand characteristics, and demographic variables (Table 4). The pre-registration did not include the product and brand characteristics, but we included them to extend the network analyses and also investigate the unique variance explained by non-psychological factors. The regression removes shared variance between predictors and reveals the unique contribution of each predictor.

The regression (Table 4) indicated that two positive emotions (joy and excitement) and overall attitudes were positively related to purchase intentions in most countries and overall. Uncertainty was negatively related to purchasing intentions across most countries. No other factors consistently explained unique variance. Most overall variance was explained by overall attitude ($\beta = 0.15$), followed by excitement ($\beta = 0.14$), joy ($\beta = 0.13$), and uncertainty ($\beta = -0.10$). Green product interest appeared to be of importance in the Netherlands ($\beta = 0.18$) and the UK ($\beta = 0.16$), but did not reach statistical significance in Germany and France.

There were differences across countries concerning the importance of different product and brand characteristics, but no product and brand characteristic was significant across more than two countries. Nevertheless, the sustainability of the phone showed comparatively large ($\beta > 0.10$) effect sizes in Germany ($\beta = 0.20$) and the Netherlands ($\beta = 0.11$), as did the sustainability of the company in the Netherlands ($\beta = 0.16$) and the UK ($\beta = 0.14$).

Overall, this pattern of results is consistent with the network analysis in demonstrating the importance of psychological factors and particularly emotions for purchase intention. The examined variables explained about half of the variance in purchase intentions. That is typical for the field (Ballard, 2019; Frost, 2018), and suggests that this study included most of the important psychological and demographic variables.

5. Discussion

Understanding the psychology behind sustainable behaviors is critical in determining whether consumers will choose a green product. Despite the importance of consumer decisions, intentions to buy environmentally friendly products are not well understood (Park and Lin, 2020; Trudel, 2018) and are often influenced by many factors. In this research, we employed the attitude network approach to determine which (psychological) factors were related to the purchase of a commercially available smartphone (the Fairphone 4), a proxy for a meaningful and high-impact real-world behavior. We used this descriptive approach because the antecedents of low-impact behaviors do not necessarily generalize to costlier and less frequent high-impact behaviors (Nielsen et al., 2021).

The goal of this study was not to validate or falsify any specific theory. As opposed to a confirmatory test of a specific model, for example testing whether a certain pathway has a certain effect size, this work was descriptive and exploratory. We integrated common aspects of multiple theories to explore which of the predictors frequently linked to pro-environmental intention and behavior are related to the intention to buy this sustainable smartphone, which provides the foundation for future model development (Scheel et al., 2021). Nevertheless, this research does illustrate which theories might be more or less relevant in this specific context. For example, we consistently find emotions, and

Table 4
Regression betas on purchase intentions (95 % CIs).

	Overall	DE	FR	NL	UK
Predictors			*beta* (95% CI)		
Worried	0.01 (-0.03 – 0.05)	0.07 (-0.01 – 0.15)	0.01 (-0.07 – 0.09)	0.02 (-0.05 – 0.10)	-0.07 (-0.16 – 0.02)
Joy	**0.13 (0.09 – 0.18)**	**0.13 (0.04 – 0.23)**	**0.14 (0.05 – 0.23)**	**0.11 (0.01 – 0.21)**	**0.14 (0.03 – 0.25)**
Guilty	**0.05 (0.01 – 0.08)**	0.04 (-0.03 – 0.12)	0.07 (-0.00 – 0.14)	0.06 (-0.01 – 0.13)	0.01 (-0.07 – 0.08)
Sad	-0.01 (-0.05 – 0.04)	-0.02 (-0.11 – 0.06)	-0.08 (-0.17 – 0.01)	-0.02 (-0.10 – 0.07)	0.07 (-0.02 – 0.16)
Angry	0.03 (-0.01 – 0.08)	0.02 (-0.06 – 0.11)	0.05 (-0.04 – 0.14)	0.03 (-0.05 – 0.12)	-0.03 (-0.12 – 0.07)
Uncertain	**-0.10 (-0.14 – -0.06)**	-0.03 (-0.10 – 0.05)	**-0.11 (-0.18 – -0.03)**	**-0.10 (-0.17 – -0.03)**	**-0.09 (-0.17 – -0.00)**
Excited	**0.14 (0.09 – 0.18)**	0.07 (-0.01 – 0.15)	**0.14 (0.05 – 0.23)**	**0.14 (0.06 – 0.22)**	**0.14 (0.03 – 0.25)**
Proud	0.04 (-0.01 – 0.08)	-0.01 (-0.10 – 0.08)	0.08 (-0.01 – 0.17)	0.06 (-0.02 – 0.15)	0.06 (-0.04 – 0.15)
In awe	-0.02 (-0.06 – 0.01)	0.00 (-0.07 – 0.08)	-0.01 (-0.11 – 0.08)	0.01 (-0.06 – 0.08)	0.00 (-0.09 – 0.09)
Hopeful	**0.08 (0.04 – 0.13)**	**0.10 (0.01 – 0.19)**	0.05 (-0.05 – 0.14)	0.01 (-0.08 – 0.10)	**0.14 (0.04 – 0.24)**
Annoyed	-0.04 (-0.08 – 0.00)	**-0.12 (-0.21 – -0.03)**	-0.00 (-0.08 – 0.08)	-0.02 (-0.10 – 0.07)	-0.02 (-0.11 – 0.08)
Price	**0.07 (0.04 – 0.11)**	**0.10 (0.04 – 0.17)**	0.01 (-0.06 – 0.08)	**0.07 (0.00 – 0.13)**	0.04 (-0.03 – 0.11)
Appearance	**-0.05 (-0.09 – -0.01)**	-0.06 (-0.13 – 0.02)	**-0.11 (-0.19 – -0.03)**	**-0.08 (-0.15 – -0.00)**	0.02 (-0.07 – 0.10)
Technical specifications	-0.03 (-0.06 – 0.01)	-0.06 (-0.13 – 0.01)	0.01 (-0.07 – 0.08)	-0.05 (-0.12 – 0.02)	-0.02 (-0.10 – 0.06)
Quality-phone	**-0.04 (-0.08 – -0.00)**	-0.03 (-0.10 – 0.04)	**-0.11 (-0.19 – -0.04)**	-0.03 (-0.09 – 0.04)	0.00 (-0.08 – 0.08)
Size	-0.02 (-0.06 – 0.01)	**-0.07 (-0.13 – -0.00)**	0.03 (-0.04 – 0.10)	0.03 (-0.03 – 0.10)	-0.06 (-0.14 – 0.01)
Camera	-0.01 (-0.05 – 0.02)	0.02 (-0.05 – 0.09)	-0.05 (-0.12 – 0.03)	-0.02 (-0.09 – 0.05)	0.07 (-0.00 – 0.14)
Sustainability -phone	0.04 (-0.00 – 0.09)	**0.20 (0.08 – 0.32)**	0.06 (-0.02 – 0.13)	**0.11 (0.02 – 0.20)**	0.00 (-0.12 – 0.12)
Treatment of the workforce	**0.07 (0.03 – 0.12)**	0.04 (-0.05 – 0.14)	**0.14 (0.05 – 0.22)**	0.01 (-0.09 – 0.10)	-0.07 (-0.17 – 0.03)
The brand's reputation	**-0.08 (-0.12 – -0.05)**	-0.04 (-0.12 – 0.04)	-0.07 (-0.14 – 0.00)	**-0.08 (-0.15 – -0.01)**	**-0.08 (-0.16 – -0.01)**
Customer service	0.02 (-0.02 – 0.06)	0.03 (-0.04 – 0.10)	0.06 (-0.02 – 0.13)	-0.03 (-0.10 – 0.04)	-0.02 (-0.10 – 0.07)

Sustainability-company	**0.07** (0.03 – 0.12)	0.07 (-0.05 – 0.20)	-0.02 (-0.10 – 0.05)	**0.16** (0.06 – 0.26)	**0.14** (0.01 – 0.26)
Trust	**0.05** (0.01 – 0.10)	0.05 (-0.05 – 0.15)	0.04 (-0.06 – 0.14)	0.03 (-0.06 – 0.12)	0.05 (-0.06 – 0.17)
Status	**-0.07** (-0.11 – -0.03)	-0.04 (-0.12 – 0.04)	**-0.12** (-0.20 – -0.03)	**-0.10** (-0.17 – -0.02)	-0.06 (-0.15 – 0.02)
Values	**-0.04** (-0.08 – -0.00)	**-0.08** (-0.16 – -0.00)	-0.03 (-0.10 – 0.05)	-0.01 (-0.08 – 0.06)	-0.02 (-0.10 – 0.06)
Attitude	**0.15** (0.10 – 0.20)	**0.24** (0.13 – 0.35)	**0.16** (0.05 – 0.27)	**0.12** (0.02 – 0.22)	0.09 (-0.02 – 0.21)
Green product interest	**0.11** (0.07 – 0.16)	0.05 (-0.05 – 0.14)	0.09 (-0.01 – 0.19)	**0.18** (0.09 – 0.28)	**0.16** (0.06 – 0.26)
Environmental identity	0.01 (-0.03 – 0.05)	-0.06 (-0.15 – 0.03)	-0.00 (-0.09 – 0.09)	0.09 (0.00 – 0.18)	-0.01 (-0.10 – 0.09)
Norms	0.02 (-0.02 – 0.05)	0.00 (-0.07 – 0.08)	0.05 (-0.02 – 0.12)	**-0.12** (-0.20 – -0.04)	0.07 (0.00 – 0.13)
Political orientation	-0.01 (-0.04 – 0.03)	0.03 (-0.04 – 0.11)	-0.06 (-0.13 – 0.02)	-0.00 (-0.08 – 0.08)	-0.00 (-0.08 – 0.07)
Age	**0.05** (0.02 – 0.09)	**0.09** (0.02 – 0.16)	0.05 (-0.03 – 0.12)	0.03 (-0.04 – 0.10)	-0.05 (-0.13 – 0.03)
Education	0.03 (-0.00 – 0.06)	0.02 (-0.05 – 0.08)	0.02 (-0.04 – 0.09)	0.05 (-0.01 – 0.11)	0.01 (-0.06 – 0.08)
Income	-0.00 (-0.03 – 0.03)	-0.03 (-0.09 – 0.03)	0.03 (-0.04 – 0.10)	0.01 (-0.06 – 0.07)	-0.07 (-0.14 – 0.00)
Rurality	0.02 (-0.01 – 0.05)	-0.02 (-0.08 – 0.05)	0.03 (-0.04 – 0.09)	0.02 (-0.04 – 0.08)	0.02 (-0.05 – 0.09)
Familiar	0.03 (-0.01 – 0.06)	0.04 (-0.03 – 0.10)	0.00 (-0.06 – 0.07)	0.06 (-0.00 – 0.13)	0.01 (-0.06 – 0.08)
Observations	2175	534	559	535	547
R^2	.47	.54	.49	.54	.47
R^2 adjusted	.46	.51	.46	.51	.44

Note. **Bold** estimates are $p < .05$. Predictors are shown in bold if significant in at least three countries. Colors are added to improve readability and reflect effect sizes.

positive emotions in particular, to be related to the intention to purchase a Fairphone. Few of the frequently used theories include emotions. The Theory of Planned Behavior (TPB), for instance, one of the most used and influential theories in predicting intentions and behavior, does not include emotions and might therefore not be entirely sufficient when aiming to understand the psychological underpinnings of purchase intentions of modular smartphones. Indeed, there are calls for extensions of the TPB to include emotions (e.g., Berki-Kiss and Menrad, 2022; La Barbera et al., 2022; Londono et al., 2017). Nevertheless, we would still argue that, even an extended TPB (or any of the other commonly used models) would not have given as broad of an insight into which factors are directly and indirectly linked to the purchase intention of a Fairphone, as the approach taken in this paper.

5.1. Summary of results

Consumer willingness to purchase the Fairphone seems driven more

by how the product is perceived than by its technical characteristics. The network structure and connectivity across the four countries was similar, mainly including three clusters: positive emotions and overall attitudes, negative emotions, identity, and a cluster of product characteristics when included. Purchase intentions were most closely linked to positive emotions (excitement and joy), overall attitudes, and green product interest. Purchase intentions were also negatively related to the importance individuals placed on the status of a product when buying a new phone and feelings of uncertainty about the product. Including product and brand characteristics in the network (Fig. 5) and regression analyses illustrated the importance of psychological factors (especially emotions) for purchase intentions compared to product and brand characteristics and demographics. For example, in our results, price appeared as less of a barrier for this sustainable alternative than previously assumed (Sheoran and Kumar, 2020). Across these samples, price was only very weakly related to purchase intentions in Germany and the Netherlands (see Fig. 5 and Table 4), with psychological factors being

comparatively more important. It remains untested whether these patterns would hold for actual purchasing behavior.

5.1.1. Attitude

Purchase intentions were consistently and strongly linked to overall attitudes ($rs_{partial}$ = 0.12–0.22). Participants who were more positive towards the Fairphone also reported greater intentions to purchase one. This is in accordance with a large literature suggesting that attitude is one of the main drivers of behavior (Kaiser et al., 2021; Taube et al., 2018), and sustainable consumption in particular (Kaiser et al., 2020; Park and Lin, 2020; Zhuang et al., 2021; Zwicker et al., 2023). This is also consistent with consumer demand being important for a sustainable transition; when consumers do not feel positively towards a sustainable alternative, they are likely less willing to adopt it. Therefore, we recommend that companies producing sustainable alternatives create and maintain a positive attitude towards both the brand and their products.

We also found a strong relationship between trust and overall attitude: participants who reported higher trust in the Fairphone smartphone and the brand were more positive towards the phone ($r_{partial}$ = 0.46 - $r_{partial}$ = 0.57). This might partially be caused by one of the seven items specifically mentioning trustworthiness. However, customer trust appeared tightly connected to people's attitudes, which were in turn related to intentions to purchase. The Dutch sample found the Fairphone much less trustworthy than participants from other countries. We are unsure why this was the case. Fairphone is a Dutch company and we were not able to find any obvious controversy surrounding it.

5.1.2. Emotions

Across all countries, joy and excitement positively related to purchase intention. There were less consistent positive relationships with pride and hope. There were consistent negative relationships between how uncertain participants felt about the product and their intentions to buy a Fairphone. No other negative emotion showed a consistent relationship with purchase intention. This suggests that evoking positive emotions and reducing uncertainty about the product might be a way to effectively market sustainable smartphones.

The psychological literature suggests that pro-environmental behavior is more consistently linked to negative emotions (especially guilt) than positive emotions (of which pride has received particular attention) (Adams et al., 2020; Hurst and Sintov, 2022; Rees et al., 2015; Zwicker et al., 2020a). However, there is precedent for positive emotions playing an important role. Recent reviews illustrate that both (anticipated) negative and positive emotions relate to and predict a wide range of climate change related judgements and behaviors (Brosch, 2021; Shipley and van Riper, 2022). Other research showed that anticipated positive emotions are more effective than negative emotions in predicting pro-environmental behavior (Bissing-Olson et al., 2016; Schneider et al., 2017).

However, caution needs to be taken not to overgeneralize the relationship between purchase intentions and positive emotions. Positive emotions do not universally increase prosocial behavior, but rather encourage different types of prosocial behavior through different mechanisms (Brosch, 2021; Zelenski and Desrochers, 2021), depending on the type of person or cause benefited (Brick et al., 2021; Cavanaugh et al., 2015). It is therefore important for marketers and policymakers to be aware of the type of emotion used in their appeals to consumers and in which context they occur (Cavanaugh et al., 2015). Even though negative emotions other than uncertainty were mostly unrelated to purchase intention, negative emotions might still drive other relevant behaviors. For example, negative emotions towards an unsustainable brand could translate into actions against it by propagating negative word of mouth, avoidance, or vengeance (Khatoon and Rehman, 2021).

This type of exploratory research is intended to aid in theory development and the design of more confirmatory studies. Specific recommendations for marketing strategies or management practice fall mostly outside the scope of this evidence. The apparent importance of psychological factors over product characteristics for purchase intention is encouraging for companies that put sustainable alternatives on the market. It might provide an additional inroad for marketing strategies, because psychological factors might be more malleable than other features. Connecting the sustainable choice to positive emotions (and not just coupling the prevalent unsustainable option to negative emotions) might be particularly effective in attracting potential customers.

5.1.3. Green product interest and status

Both green product interest and status were related to purchase intentions in the network analyses across all four countries. Consumers who care about the environment, social justice and human rights, animal welfare and local community, and who consciously reduce purchasing certain products (i.e., who are high in green product interest; Sudbury-Riley and Kohlbacher, 2016) also indicated a greater willingness to purchase a Fairphone. This makes sense, as Fairphone's stated values closely align with the values of ethical consumption. Predictably, green product interest was closely and strongly related to environmental identity across countries (Figs. 4 and 5). This suggests that a continued emphasis on the social and environmental benefits of the modular smartphone in marketing campaigns might be an effective way to encourage ethically and sustainably minded consumers to choose for this modular smartphone and similar products.

Sustainable products can act as status symbols by indicating wealth or prosocial traits (Berger, 2017; Sheoran and Kumar, 2020). Our results indicate that this is not currently working for the Fairphone, as customers more concerned with social status were less intent on purchasing a Fairphone. This might be related to people's unfamiliarity with Fairphone, as buying a product from a relatively unknown brand might make it less likely to increase status. The Fairphone's appearance might also not be noticeably different enough from similar, non-sustainable products. Recent research suggests that consumers prefer sustainable products that look visually distinct from their conventional counterparts (Zwicker et al., 2023). Companies might consider making the modular phone appearance more distinct from conventional smartphones, as products that are visually recognizable as the sustainable choice might serve a stronger signaling function, for example indicating prosocial traits (Berger, 2019; Braun Kohlová and Urban, 2020).

5.1.4. Lack of knowledge

Participants were not very familiar with Fairphone but were overall positive towards its smartphone. This aligns with research on other sustainable technologies such as bio-based plastic products, which consistently finds positive attitudes despite a lack of knowledge about the material and its properties (Zwicker et al., 2021; Zwicker et al., 2023; Zwicker et al., 2020a). Lack of awareness about ethical or sustainable alternatives is one of the main barriers to sustainable consumption (Sheoran and Kumar, 2020). Adding green products to the shelves is not enough (Gleim et al., 2013). Lacking relevant information can prevent consumers from selecting products that follow their ethical or environmental principles (Bray et al., 2010).

Future research could examine how much the provision of information contributes to purchase intentions and behavior and how that compares to the role of psychological factors such as attitudes and emotions. This was not possible in the current study, as participants received information about the Fairphone brand and smartphone before indicating their purchase intention. We would recommend that comparatively new companies such as Fairphone invest in widespread information campaigns to create awareness of both the existence and the sustainable qualities of their product and company. Information-based promotion also builds trust, which in turn can generate greater interest in green products (Gleim et al., 2013).

5.2. Limitations

This study used purchase intentions as a proxy for a high-impact environmental behavior. We did measure whether participants followed a link to the official Fairphone site to learn more about the new smartphone and the brand itself. This could have provided a more accurate measure of interest and possibly a better indication of purchase intention. However, due to a technical error, how many participants clicked the link was not recorded. Because intentions do not necessarily translate into actual purchasing behavior even when consumers hold positive attitudes towards sustainable products (Bray et al., 2010; Groening et al., 2018; Morwitz et al., 2007; Rausch and Kopplin, 2021), the predictors of actual purchase behavior might differ (Nielsen et al., 2022; Nielsen et al., 2021). Only measuring intentions can therefore lead to biased conclusions, potentially exaggerated by participants wanting to appear socially desirable. The strength of the relationship between purchase intentions and actual behavior varies with product type and measurement design. For example, the predictive accuracy of purchase intentions is lower for new products, for non-durable goods, and for more temporally distant purchase occasions (Morwitz et al., 2007).

It is difficult to measure actual purchasing behavior for relatively infrequent and expensive purchases like buying a smartphone. Intentions can therefore provide some insight and be a useful proxy. Including a broader range of measures that tap into different kinds of behavior, and including online measures of actual behavior (e.g., a donation or the Work for Environmental Protection Task; Lange and Dewitte, 2021) might give a better indication of whether participants' intentions are likely to translate into behavior. A future retrospective study asking people that bought a Fairphone about their reasons and attitudes might also shed more light onto successful attitude-behavior translation.

Another limitation of this research is its correlational nature and therefore the lack of causal conclusions. We deliberately chose an exploratory design (Scheel et al., 2021). Our aim was to determine which (psychological) factors relate to the intentions to purchase a Fairphone and to see whether these differed between the four countries. To test the predictive power of the different psychological factors, one could conduct an experimental study or use a temporal network approach like Chambon et al. (2022). This kind of temporal network approach can determine whether one node predicts other nodes in the next measurement, while controlling for all other nodes. Another approach to establishing causality was taken by Zwicker et al. (2020a), who first conducted a survey to establish the empirical network and in a subsequent study experimentally manipulated the evaluative reaction most strongly related to the node of interest, in order to test whether the manipulation would lead to an increase in behavior. For example, one could manipulate positive emotions (joy and excitement in particular) to test whether that leads to greater purchase intentions or actual purchase of a Fairphone.

Another limitation is the potential low generalizability of the results to non-European and/or non-Western countries and other types of smartphones. In this study, we investigated a specific modular smartphone (the Fairphone 4). A Fairphone (and other modular smartphones, e.g., Teracube and SHIFT phones) may have different characteristics and conditions expected from a typical smartphone (e.g., it might be perceived as a more innovative or less functional model), and therefore represent a unique consumer type, potentially leading to a low generalisability of the results.

The lack of importance of product characteristics for purchase intention contradicts what has been found with regards to pre-owned smartphones, for which product characteristics, such as functionality (e.g., guaranteed software updates), appearance, and battery health, are important features (Mugge et al., 2017; Nasiri and Shokouhyar, 2021). Whether this difference is due to the measurement of intentions or is caused by modular and pre-owned smartphones being influenced by different factors requires future research. Additionally, people for whom sustainability is of great importance might not be interested in buying a new phone (even if it is sustainable) and rather choose second-hand models. Future research could investigate whether modular phones are appealing to this consumer type, or whether modular phones are more appealing to consumers who place a high value on buying an unused product. Another avenue for future research is the comparison of conventional and modular smartphones using an attitude network or similar descriptive approach. This would allow an investigation of the differences in attitudes and potentially different factors relating to the purchase intentions of different phone types.

6. Conclusion

We used an attitude network approach across four countries to determine which factors relate to the intention to purchase a sustainable smartphone. Understanding which factors play a role in consumer decision-making to switch to more sustainable products is vital in the fight against climate change. Psychological factors appeared more important for purchase intentions than product and brand characteristics. Future research could employ similar descriptive approaches to examine whether these results generalize to other (novel) sustainable products and technologies, and non-European and non-Western populations. Subsequent research can also investigate whether marketing and communication strategies aimed at the psychological variables identified here, such as positive emotions, are effective in changing purchase behaviors.

CRediT authorship contribution statement

Maria V. Zwicker: Conceptualization, Pre-registration, Data curation, Software, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Visualization, Writing - original draft, Writing - review & editing. **Frenk van Harreveld:** Conceptualization, Pre-registration, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing - review & editing. **Janis H. Zickfeld:** Resources, Software, Formal analysis, Visualization, Writing - review & editing. **Cameron Brick:** Conceptualization, Pre-registration, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing - review & editing.

Declaration of competing interest

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

Appendix A. Supplementary material

Supplementary material to this article can be found online at https://doi.org/10.1016/j.spc.2023.07.008.

References

Adams, I., Hurst, K., Sintov, N.D., 2020. Experienced guilt, but not pride, mediates the effect of feedback on pro-environmental behavior. J. Environ. Psychol. 71 https://doi.org/10.1016/j.jenvp.2020.101476.

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50, 179–211.

Amine, L.S., Smith, A.J., 2009. Challenges to modern consumer segmentation in a changing world: the need for a second step. Multinatl. Bus. Rev. 17 (3), 71–100. https://doi.org/10.1108/1525383X200900018.

Apple, 2020. Apple commits to be 100 percent carbon neutral for its supply chain and products by 2030. In: Apple Newsroom. Retrieved November 17, 2022 from. https://www.apple.com/newsroom/2020/07/apple-commits-to-be-100-percent-carbon-neutral-for-its-supply-chain-and-products-by-2030/.

Ballard, C., 2019. An Ode to R-Squared or, The Statistician's Crusade: A Duty-dance With Determination. Towards Data Science. Retrieved Jan 25 from. https://towardsdatascience.com/an-ode-to-r-squared-804d8d0ed22c#:~:text=Generally%2C%20an%20R%2DSquared%20above,squared%20values%20lower%20than%200.5.

Belkhir, L., Elmeligi, A., 2018. Assessing ICT global emissions footprint: trends to 2040 & recommendations. J. Clean. Prod. 177, 448–463. https://doi.org/10.1016/j.jclepro.2017.12.239.

Berger, J., 2017. Are luxury brand labels and "green" labels costly signals of social status? An extended replication. PLoS One 12 (2). https://doi.org/10.1371/journal.pone.0170216.

Berger, J., 2019. Signaling can increase consumers' willingness to pay for green products. Theoretical model and experimental evidence. J. Consum. Behav. 18 (3), 233–246. https://doi.org/10.1002/cb.1760.

Berki-Kiss, D., Menrad, K., 2022. The role emotions play in consumer intentions to make pro-social purchases in Germany – An augmented theory of planned behavior model. Sustain. Prod. Consum. 29, 79–89. https://doi.org/10.1016/j.spc.2021.09.026.

Bhattacherjee, A., Sanford, C., 2009. The intention–behaviour gap in technology usage: the moderating role of attitude strength. Behav. Inform. Technol. 28 (4), 389–401. https://doi.org/10.1080/01449290802121230.

Bissing-Olson, M.J., Fielding, K.S., Iyer, A., 2016. Experiences of pride, not guilt, predict pro-environmental behavior when pro-environmental descriptive norms are more positive. J. Environ. Psychol. 45, 145–153. https://doi.org/10.1016/j.jenvp.2016.01.001.

Borsboom, D., Deserno, M.K., Rhemtulla, M., Epskamp, S., Fried, E.I., McNally, R.J., Robinaugh, D.J., Perugini, M., Dalege, J., Costantini, G., Isvoranu, A.-M., Wysocki, A.C., van Borkulo, C.D., van Bork, R., Waldorp, L.J., 2021. Network analysis of multivariate data in psychological science. Nat. Rev. Methods Primers 1 (1), 58. https://doi.org/10.1038/s43586-021-00055-w.

Braun Kohlová, M., Urban, J., 2020. Buy green, gain prestige and social status. J. Environ. Psychol. 69, 101416 https://doi.org/10.1016/j.jenvp.2020.101416.

Bray, J., Johns, N., Kilburn, D., 2010. An exploratory study into the factors impeding ethical consumption. J. Bus. Ethics 98 (4), 597–608. https://doi.org/10.1007/s10551-010-0640-9.

Brick, C., Lai, C.K., 2018. Explicit (but not implicit) environmentalist identity predicts pro-environmental behavior and policy preferences. J. Environ. Psychol. 58, 8–17. https://doi.org/10.1016/j.jenvp.2018.07.003.

Brick, C., Sherman, D.K., Kim, H.S., 2017. "Green to be seen" and "brown to keep down": visibility moderates the effect of identity on pro-environmental behavior. J. Environ. Psychol. 51, 226–238. https://doi.org/10.1016/j.jenvp.2017.04.004.

Brick, C., Bosshard, A., Whitmarsh, L., 2021. Motivation and climate change: a review. Curr. Opin. Psychol. 42, 82–88. https://doi.org/10.1016/j.copsyc.2021.04.001.

Brick, C., Hood, B., Ekroll, V., de-Wit, L., 2022. Illusory essences: a bias holding back theorizing in psychological science. Perspect. Psychol. Sci. 17 (2), 491–506. https://doi.org/10.1177/1745691621991838.

Brosch, T., 2021. Affect and emotions as drivers of climate change perception and action: a review. Curr. Opin. Behav. Sci. 42, 15–21. https://doi.org/10.1016/j.cobeha.2021.02.001.

Cavanaugh, L.A., Bettman, J.R., Luce, M.F., 2015. Feeling love and doing more for distant others: specific positive emotions differentially affect prosocial consumption. J. Mark. Res. 52 (5), 657–673. https://doi.org/10.1509/jmr.10.0219.

Chambon, M., Dalege, J., Elberse, J.E., van Harreveld, F., 2021. A psychological network approach to attitudes and preventive behaviors during pandemics: a COVID-19 study in the United Kingdom and the Netherlands. Soc. Psychol. Personal. Sci. https://doi.org/10.1177/19485506211002420.

Chambon, M., Dalege, J., Borsboom, D., Waldorp, L.J., van der Maas, H.L.J., van Harreveld, F., 2022. How compliance with behavioural measures during the initial phase of a pandemic develops over time: a longitudinal COVID-19 study. Br. J. Soc. Psychol. https://doi.org/10.1111/bjso.12572.

Cordella, M., Alfieri, F., Sanfelix, J., 2021. Reducing the carbon footprint of ICT products through material efficiency strategies: a life cycle analysis of smartphones. J. Ind. Ecol. 25 (2), 448–464. https://doi.org/10.1111/jiec.13119.

Dalege, J., Borsboom, D., van Harreveld, F., van den Berg, H., Conner, M., van der Maas, H.L., 2016. Toward a formalized account of attitudes: the Causal Attitude Network (CAN) model. Psychol. Rev. 123 (1), 2–22. https://doi.org/10.1037/a0039802.

Dalege, J., Borsboom, D., van Harreveld, F., van der Maas, H.L., 2017a. Network analysis on attitudes: a brief tutorial. Soc. Psychol. Personal. Sci. 8 (5), 528–537. https://doi.org/10.1177/1948550617709827.

Dalege, J., Borsboom, D., van Harreveld, F., Waldorp, L.J., van der Maas, H.L.J., 2017b. Network structure explains the impact of attitudes on voting decisions. Sci. Rep. 7 (1) https://doi.org/10.1038/s41598-017-05048-y.

De Groot, J.I.M., Steg, L., 2007. Value orientations and environmental beliefs in five countries:validity of an instrument to measure egoistic, altruistic and biospheric value orientations. J. Cross-Cult. Psychol. 38 (3), 318–332. https://doi.org/10.1177/0022022107300278.

De Marchi, E., Pigliafreddo, S., Banterle, A., Parolini, M., Cavaliere, A., 2020. Plastic packaging goes sustainable: an analysis of consumer preferences for plastic water bottles. Environ. Sci. Pol. 114, 305–311. https://doi.org/10.1016/j.envsci.2020.08.014.

Eastman, J.K., Goldsmith, R.E., Flynn, L.R., 1999. Status consumption in consumer behavior: scale development and validation. J. Mark. Theory Pract. 7 (3), 41–52. http://www.jstor.org/stable/40469967.

ElHaffar, G., Durif, F., Dubé, L., 2020. Towards closing the attitude-intention-behavior gap in green consumption: a narrative review of the literature and an overview of future research directions. J. Clean. Prod. 275 https://doi.org/10.1016/j.jclepro.2020.122556.

Envirotech, 2019. How Do Smartphones Affect the Environment? Retrieved 19 July 2022, from. https://www.envirotech-online.com/news/environmental-laboratory/7/breaking-news/how-do-smartphones-affect-the-environment/48339.

Epskamp, S., 2016. Regularized Gaussian Psychological Networks: Brief Report on Estimating Regularized Gaussian Networks From Continuous and Ordinal Data.

Epskamp, S., Waldorp, L.J., Mõttus, R., Borsboom, D., 2018. The Gaussian graphical model in cross-sectional and time-series data. Multivar. Behav. Res. 53 (4), 453–480. https://doi.org/10.1080/00273171.2018.1454823.

Ertz, M., Karakas, F., Sarigöllü, E., 2016. Exploring pro-environmental behaviors of consumers: an analysis of contextual factors, attitude, and behaviors. J. Bus. Res. 69 (10), 3971–3980. https://doi.org/10.1016/j.jbusres.2016.06.010.

Fairphone, 2022. The phone that cares for people and planet. Fairphone. Retrieved November 17, 2022 from. https://www.fairphone.com.

Fritsche, I., Barth, M., Jugert, P., Masson, T., Reese, G., 2018. A social identity model of pro-environmental action (SIMPEA). Psychol. Rev. 125 (2), 245–269. https://doi.org/10.1037/rev0000090.

Frost, J., 2018. How High Does R-squared Need to Be? Statistics By Jim. Retrieved Jan 25 from. https://statisticsbyjim.com/regression/how-high-r-squared/.

Gaffey, J., McMahon, H., Marsh, E., Vehmas, K., Kymäläinen, T., Vos, J., 2021. Understanding consumer perspectives of bio-based products—a comparative case study from Ireland and the Netherlands. Sustainability 13 (11). https://doi.org/10.3390/su13116062.

Gifford, R., Kormos, C., McIntyre, A., 2011. Behavioral dimensions of climate change: drivers, responses, barriers, and interventions. WIREs Clim. Change 2 (6), 801–827. https://doi.org/10.1002/wcc.143.

Gleim, M.R., Smith, J.S., Andrews, D., Cronin, J.J., 2013. Against the green: a multi-method examination of the barriers to green consumption. J. Retail. 89 (1), 44–61. https://doi.org/10.1016/j.jretai.2012.10.001.

Goldsmith, R.E., Clark, R.A., 2012. Materialism, status consumption, and consumer independence. J. Soc. Psychol. 152 (1), 43–60. https://doi.org/10.1080/00224545.2011.555434.

Groening, C., Sarkis, J., Zhu, Q., 2018. Green marketing consumer-level theory review: a compendium of applied theories and further research directions. J. Clean. Prod. 172, 1848–1866. https://doi.org/10.1016/j.jclepro.2017.12.002.

Heise, D.R., 1970. The semantic differential and attitude research. In: Attitude measurement, 4, pp. 235–253. https://kb-research.ca/archives/ACT/recovered/SemanticDifferential.pdf.

Hurst, K.F., Sintov, N.D., 2022. Guilt consistently motivates pro-environmental outcomes while pride depends on context. J. Environ. Psychol. 80 https://doi.org/10.1016/j.jenvp.2022.101776.

Jadczaková, V., 2013. Review of segmentation process in consumer markets. Acta Univ. Agric. Silvic. Mendel. Brun. 61 (4), 1215–1224. https://doi.org/10.11118/actaun201361041215.

Jones, P.J., Mair, P., McNally, R.J., 2018. Visualizing psychological networks: a tutorial in R [review]. Front. Psychol. 9 https://doi.org/10.3389/fpsyg.2018.01742.

Joshi, Y., Rahman, Z., 2015. Factors affecting green purchase behaviour and future research directions. Int. Strateg. Manag. Rev. 3 (1–2), 128–143. https://doi.org/10.1016/j.ism.2015.04.001.

Kácha, O., Vintr, J., Brick, C., 2022. Four Europes: climate change beliefs and attitudes predict behavior and policy preferences using a latent class analysis on 23 countries. J. Environ. Psychol. 81 https://doi.org/10.1016/j.jenvp.2022.101815.

Kaiser, F.G., Henn, L., Marschke, B., 2020. Financial rewards for long-term environmental protection. J. Environ. Psychol. https://doi.org/10.1016/j.jenvp.2020.101411.

Kaiser, F.G., Kibbe, A., Hentschke, L., 2021. Offsetting behavioral costs with personal attitudes: a slightly more complex view of the attitude-behavior relation. Personal. Individ. Differ. 183, 111158 https://doi.org/10.1016/j.paid.2021.111158.

Khatoon, S., Rehman, V., 2021. Negative emotions in consumer brand relationship: a review and future research agenda. Int. J. Consum. Stud. 45 (4), 719–749. https://doi.org/10.1111/ijcs.12665.

Klöckner, C.A., Blöbaum, A., 2010. A comprehensive action determination model: toward a broader understanding of ecological behaviour using the example of travel mode choice. J. Environ. Psychol. 30 (4), 574–586. https://doi.org/10.1016/j.jenvp.2010.03.001.

La Barbera, F., Amato, M., Riverso, R., Verneau, F., 2022. Social emotions and good provider norms in tackling household food waste: an extension of the theory of planned behavior. Sustainability 14 (15), 9681. https://www.mdpi.com/2071-1050/14/15/9681.

Lange, F., Dewitte, S., 2019. Measuring pro-environmental behavior: review and recommendations. J. Environ. Psychol. https://doi.org/10.1016/j.jenvp.2019.04.009.

Lange, F., Dewitte, S., 2021. The work for environmental protection task: a consequential web-based procedure for studying pro-environmental behavior. Behav. Res. Methods. https://doi.org/10.3758/s13428-021-01617-2.

Lange, J., Zickfeld, J.H., 2021. Emotions as overlapping causal networks of emotion components: implications and methodological approaches. Emot. Rev. 13, 157–167. https://doi.org/10.1177/1754073920988787.

Lee, P., Calugar-Pop, C., Bucaille, A., Raviprakash, S., 2021. Making smartphones sustainable: live long and greener. Retrieved 27 May 2023, from. https://www2.deloitte.com/xe/en/insights/industry/technology/technology-media-and-telecom-predictions/2022/environmental-impact-smartphones.html.

Lempers, M., 2023. Fairphone Impact Report 2022. https://www.fairphone.com/wp-content/uploads/2023/05/Fairphone-Impact-Report-2022.pdf.

Liu, H.T., Tsaur, R.-C., 2020. The theory of reasoned action applied to green smartphones: moderating effect of government subsidies. Sustainability 12 (15), 5979. https://www.mdpi.com/2071-1050/12/15/5979.

Londono, J.C., Davies, K., Elms, J., 2017. Extending the Theory of Planned Behavior to examine the role of anticipated negative emotions on channel intention: the case of an embarrassing product. J. Retail. Consum. Serv. 36, 8–20. https://doi.org/10.1016/j.jretconser.2016.12.002.

Mayer, R.C., Davis, J.H., Schoorman, F.D., 1995. An integrative model of organizational trust. Acad. Manag. Rev. 20 (3), 709–734. https://doi.org/10.2307/258792.

Morwitz, V.G., Steckel, J.H., Gupta, A., 2007. When do purchase intentions predict sales? Int. J. Forecast. 23 (3), 347–364. https://doi.org/10.1016/j.ijforecast.2007.05.015.

Mugge, R., Jockin, B., Bocken, N., 2017. How to sell refurbished smartphones? An investigation of different customer groups and appropriate incentives. J. Clean. Prod. 147, 284–296. https://doi.org/10.1016/j.jclepro.2017.01.111.

Nasiri, M.S., Shokouhyar, S., 2021. Actual consumers' response to purchase refurbished smartphones: exploring perceived value from product reviews in online retailing. J. Retail. Consum. Serv. 62, 102652 https://doi.org/10.1016/j.jretconser.2021.102652.

Nielsen, K.S., Cologna, V., Lange, F., Brick, C., Stern, P.C., 2021. The case for impact-focused environmental psychology. J. Environ. Psychol. 74, 101559 https://doi.org/10.1016/j.jenvp.2021.101559.

Nielsen, K.S., Brick, C., Hofmann, W., Joanes, T., Lange, F., Gwozdz, W., 2022. The motivation–impact gap in pro-environmental clothing consumption. Nat. Sustain. 5 (8), 665–668. https://doi.org/10.1038/s41893-022-00888-7.

Ojala, M., 2012. Hope and climate change: the importance of hope for environmental engagement among young people. Environ. Educ. Res. 18 (5), 625–642. https://doi.org/10.1080/13504622.2011.637157.

Onwezen, M.C., Antonides, G., Bartels, J., 2013. The Norm Activation Model: an exploration of the functions of anticipated pride and guilt in pro-environmental behaviour. J. Econ. Psychol. 39, 141–153. https://doi.org/10.1016/j.joep.2013.07.005.

Park, H.J., Lin, L.M., 2020. Exploring attitude–behavior gap in sustainable consumption: comparison of recycled and upcycled fashion products. J. Bus. Res. 117, 623–628. https://doi.org/10.1016/j.jbusres.2018.08.025.

Persistence Market Research, 2023. Refurbished and Used Mobile Phones. Retrieved 27 May 2023, from. https://www.persistencemarketresearch.com/market-research/refurbished-and-used-mobile-phones-market.asp.

Pons, P., Latapy, M., 2005. Computing communities in large networks using random walks. In: Computer and Information Sciences - ISCIS 2005, Berlin, Heidelberg.

R Core Team, 2022. R: a language and environment for statistical computing. In: (Version 4.2.2) R Foundation for Statistical Computing. https://www.R-project.org/.

Rausch, T.M., Kopplin, C.S., 2021. Bridge the gap: consumers' purchase intention and behavior regarding sustainable clothing. J. Clean. Prod. 278 https://doi.org/10.1016/j.jclepro.2020.123882.

Rees, J.H., Klug, S., Bamberg, S., 2015. Guilty conscience: motivating pro-environmental behavior by inducing negative moral emotions. Clim. Chang. 130 (3), 439–452. https://doi.org/10.1007/s10584-014-1278-x.

Scheel, A.M., Tiokhin, L., Isager, P.M., Lakens, D., 2021. Why hypothesis testers should spend less time testing hypotheses. Perspect. Psychol. Sci. 16 (4), 744–755. https://doi.org/10.1177/1745691620966795.

Schneider, C.R., Zaval, L., Weber, E.U., Markowitz, E.M., 2017. The influence of anticipated pride and guilt on pro-environmental decision making. PLoS One 12 (11), e0188781. https://doi.org/10.1371/journal.pone.0188781.

Schweiger, F., 2022, 22 February. The mobile phones you can take apart and repair yourself. In: BBC News. https://www.bbc.com/news/business-60374806.

Sheeran, P., Webb, T.L., 2016. The intention–behavior gap. Soc. Personal. Psychol. Compass 10 (9), 503–518. https://doi.org/10.1111/spc3.12265.

Sheoran, M., Kumar, D., 2020. Benchmarking the barriers of sustainable consumer behaviour. Soc. Responsib. J. 18 (1), 19–42. https://doi.org/10.1108/srj-05-2020-0203.

Shift, 2022. SHIFT6mq - Shiftphones -. Shift. Retrieved November 17, 2022 from. https://www.shiftphones.com/shift6mq/.

Shipley, N.J., van Riper, C.J., 2022. Pride and guilt predict pro-environmental behavior: a meta-analysis of correlational and experimental evidence. J. Environ. Psychol. 79 https://doi.org/10.1016/j.jenvp.2021.101753.

Skurka, C., Eng, N., Oliver, M.B., 2022. On the Effects and Boundaries of Awe and Humor Appeals for Pro-environmental Engagement (Vol. 16) [Awe, Humor, Emotional

Appeals, Climate Change, Air Pollution]. https://ijoc.org/index.php/ijoc/article/view/19513/3786.

Stern, P.C., 2000. New environmental theories: toward a coherent theory of environmentally significant behavior. J. Soc. Issues 56 (3), 407–424. https://doi.org/10.1111/0022-4537.00175.

Sudbury-Riley, L., Kohlbacher, F., 2016. Ethically minded consumer behavior: scale review, development, and validation. J. Bus. Res. 69 (8), 2697–2710. https://doi.org/10.1016/j.jbusres.2015.11.005.

Taube, O., Kibbe, A., Vetter, M., Adler, M., Kaiser, F.G., 2018. Applying the Campbell Paradigm to sustainable travel behavior: compensatory effects of environmental attitude and the transportation environment. Transport. Res. F: Traffic Psychol. Behav. 56, 392–407. https://doi.org/10.1016/j.trf.2018.05.006.

TCO certified, 2014. The State of Socially Responsible Manufacturing in the IT Industry. TCO certified. Retrieved 19 July 2022 from. https://tcocertified.com/news/the-state-of-socially-responsible-manufacturing-in-the-it-industry/.

Teracube, 2022. The Sustainable Smartphone With a 4 Year Warranty. Teracube. Retrieved November 17, 2022 from. https://myteracube.com.

Testa, F., Pretner, G., Iovino, R., Bianchi, G., Tessitore, S., Iraldo, F., 2021. Drivers to green consumption: a systematic review. Environ. Dev. Sustain. 23 (4), 4826–4880. https://doi.org/10.1007/s10668-020-00844-5.

The Considerate Consumer, 2022. The Sustainable Smartphone. Retrieved 27 May 2023, from. https://www.considerate-consumer.com/smartphone#.

Trudel, R., 2018. Sustainable consumer behavior. Consum. Psychol. Rev. https://doi.org/10.1002/arcp.1045.

van Borkulo, C.D., van Bork, R., Boschloo, L., Kossakowski, J.J., Tio, P., Schoevers, R.A., Borsboom, D., Waldorp, L.J., 2022. Comparing network structures on three aspects: a permutation test. Psychol. Methods. https://doi.org/10.1037/met0000476.

Van De Schoot, R., Schmidt, P., De Beuckelaer, A., Lek, K., Zondervan-Zwijnenburg, M., 2015. Editorial: measurement invariance [editorial]. Front. Psychol. 6 https://doi.org/10.3389/fpsyg.2015.01064.

van den Heuvel, J., 2020. Barriers and Triggers in the Process of Purchasing a Fairphone. Delft University of Technology. https://repository.tudelft.nl/islandora/object/uuid%3Ad2fd0260-75a5-4d1a-a922-dd49ec827204.

van der Werff, E., Steg, L., 2016. The psychology of participation and interest in smart energy systems: comparing the value-belief-norm theory and the value-identity-personal norm model. Energy Res. Soc. Sci. 22, 107–114. https://doi.org/10.1016/j.erss.2016.08.022.

van Prooijen, A.-M., 2019. Public trust in energy suppliers' communicated motives for investing in wind power. J. Environ. Psychol. 61, 115–124. https://doi.org/10.1016/j.jenvp.2019.01.004.

van Zomeren, M., Postmes, T., Spears, R., 2008. Toward an integrative social identity model of collective action: a quantitative research synthesis of three socio-psychological perspectives. Psychol. Bull. 134 (4), 504–535. https://doi.org/10.1037/0033-2909.134.4.504.

van Zomeren, M., Pauls, I.L., Cohen-Chen, S., 2019. Is hope good for motivating collective action in the context of climate change? Differentiating hope's emotion- and problem-focused coping functions. Glob. Environ. Chang. 58 https://doi.org/10.1016/j.gloenvcha.2019.04.003.

Vesely, S., Klöckner, C.A., Brick, C., 2020. Pro-environmental behavior as a signal of cooperativeness: evidence from a social dilemma experiment. J. Environ. Psychol. 67, 101362 https://doi.org/10.1016/j.jenvp.2019.101362.

World Population Review, 2023. Carbon Footprint by Country 2023. Retrieved 27 May 2023 from. https://worldpopulationreview.com/country-rankings/carbon-footprint-by-country.

Young, W., Hwang, K., McDonald, S., Oates, C.J., 2010. Sustainable consumption: green consumer behaviour when purchasing products. Sustain. Dev. https://doi.org/10.1002/sd.394 n/a-n/a.

Zelenski, J.M., Desrochers, J.E., 2021. Can positive and self-transcendent emotions promote pro-environmental behavior? Curr. Opin. Psychol. 42, 31–35. https://doi.org/10.1016/j.copsyc.2021.02.009.

Zhao, H., Zhang, H., Xu, Y., Lu, J., He, W., 2018. Relation between awe and environmentalism: the role of social dominance orientation [original research]. Front. Psychol. 9 https://doi.org/10.3389/fpsyg.2018.02367.

Zhuang, W., Luo, X., Riaz, M.U., 2021. On the factors influencing green purchase intention: a meta-analysis approach [original research]. Front. Psychol. 12 https://doi.org/10.3389/fpsyg.2021.644020.

Zwicker, M.V., Nohlen, H.U., Dalege, J., Gruter, G.-J.M., van Harreveld, F., 2020a. Applying an attitude network approach to consumer behaviour towards plastic. J. Environ. Psychol. 69, 101433 https://doi.org/10.1016/j.jenvp.2020.101433.

Zwicker, M.V., van Prooijen, J.W., Krouwel, A.P., 2020b. Persistent beliefs: political extremism predicts ideological stability over time. Group Process. Intergr. Relat. 23 (8), 1137–1149. https://doi.org/10.1177/1368430220917753.

Zwicker, M.V., Brick, C., Gruter, G.-J.M., van Harreveld, F., 2021. (Not) doing the right things for the wrong reasons: an investigation of consumer attitudes, perceptions, and willingness to pay for bio-based plastics. Sustainability 13 (12), 6819. https://www.mdpi.com/2071-1050/13/12/6819.

Zwicker, M.V., Brick, C., Gruter, G.-J.M., van Harreveld, F., 2023. Consumer attitudes and willingness to pay for novel bio-based products using hypothetical bottle choice. Sustain. Prod. Consum. 35, 173–183.