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Addressing climate change: Determinants of consumers' willingness to act and to support policy measures

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ABSTRACT

Consumers influence climate change through their consumption patterns and their support or dismissal of climate mitigation policy measures. Both climate-friendly actions and policy support comprise a broad range of options, which vary in manifold ways and, therefore, might be influenced by different factors. The aims of the study were, therefore, two-fold: first, we intended to find a meaningful way to classify different ways of addressing climate change. Second, we aimed to examine which determinants influence people's willingness to engage in these behaviors. We conducted a large-scale mail survey in Switzerland in which respondents rated, among other items, their willingness to act or support a range of possible actions and mitigations measures. A principal component analysis indicated that a distinction in terms of a behavior's directness as well as a differentiation according to perceived costs seem to be appropriate to classify climate-friendly actions. Multiple regression analyses showed that perceived costs and perceived climate benefit turned out to be the strongest predictors for willingness to act or to support climate policy measures. The strong influence of perceived climate benefit might reflect a strategy of reducing cognitive dissonance. As high-cost behaviors are more difficult to adopt, consumers may reduce dissonance by dismissing high-cost behaviors as not effective in terms of climate mitigation. Political affiliation proved to be another strong determinant of willingness to act or support. Participants on the right wing were less willing to show indirect climate-friendly behaviors, change their mobility behaviors, and to support any type of climate mitigation policy measures. Climate-friendly low-cost behaviors, however, were not influenced by political affiliation.

1. Introduction

When dealing with environmental issues, such as climate change, consumers play an important role. Not only do they have a substantial influence through their consumption patterns, but as citizens and voters, they also support or dismiss policies that implement environmental measures. In this study, we therefore examined consumers' willingness to take climate-friendly actions. We aimed to classify different ways of addressing climate change and examined which factors influence climate-friendly actions.

Past studies indicate that the majority of people in industrialized countries are aware of climate change and consider it a serious problem (Leiserowitz, 2007b; Lorenzoni & Pidgeon, 2006; Poortinga, Pidgeon, & Lorenzoni, 2006). Similar results have been found in Switzerland. Specifically, 82% of the Swiss public rated greenhouse effect and global warming as highly dangerous (Diekmann & Meyer, 2008). However, positive attitudes toward the environment or environmental concerns are not necessarily consistent with the according behavioral patterns. Meta-analyses of a large body of research found only moderate relationships between environmental attitudes and pro-environmental behavior (Bamberg & Möser, 2007; Hines, Hungerford, & Tomera, 1986/87). This might be due to an undifferentiated view on environmental behavior, as different pro-environmental activities and their determinants have often been examined together, regardless of their different characteristics.

In this study, our aims were therefore two-fold: First, we intended to find a meaningful categorization of climate-friendly actions. Second, we aimed to examine which determinants influence these different types of climate-friendly actions. The various options of addressing climate change thereby ranged from individual behavior to political measures. The two aims of our study are presented in more detail in the following.

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1.1. Classifying climate-friendly action

Finding and examining patterns of behaviors might prove worthwhile (Swim et al., 2009), as this would allow, for instance, to examine whether there is a positive spillover (Crompton & Thørgersen, 2009). In other words, it would be possible to investigate whether a person's change of one behavior increases his or her motivation to adopt a second and more ambitious behavior; or if people who engage in pro-environmental behavior (perhaps an easy and effortless step) use this as a justification for not adopting other (more difficult) behaviors (see Crompton & Thørgersen, 2009). As many environmental campaigns encourage people to adopt small behavioral changes, it seems crucial to examine the effect of these messages on people's propensity to show a wider set of pro-environmental behaviors.

In several studies, Kaiser and colleagues measured general ecological behavior as a unidimensional construct, by taking the difficulties of several pro-environmental behaviors into consideration (Kaiser & Biel, 2000; Kaiser & Wilson, 2000; Kaiser, Wölfing, & Fuhrer, 1999). Yet, ecological behavior can also be seen as a "disparate and multi-faceted phenomenon" (Diekmann & Preisendörfer, 1998, p. 86), which differs not only in terms of difficulty but also regarding the consumption domain and other characteristics. Therefore, a more precise discrimination of behaviors might result in higher correlations with predictors, because various kinds of activities might be influenced by different determinants. This assumption is substantiated by Balderjahn (1988), who found that different behavioral patterns have their own cluster of predictors. Therefore, we would like to examine whether pro-environmental behavior is multidimensional and defined by more characteristics than just its difficulty.

In the literature, two alternative ways to differentiate pro-environmental actions have been suggested: (a) according to the actions' directness, indicating whether an action has a direct impact on greenhouse gas emissions (Kollmuss & Agyeman, 2002), or (b) costs, differentiating between actions associated with high or low level of personal or behavioral costs or efforts (Diekmann & Preisendörfer, 2003). The two suggested ways of distinguishing pro-environmental behaviors are presented in the following sections.

1.1.1. Direct and indirect behaviors

One can distinguish between two different manners that consumers can contribute to climate change mitigation: (a) as citizens and voters, they can support government initiatives to mitigate climate change, and (b) as consumers and actors, they can decide to alter their own lifestyle in order to reduce greenhouse gas emissions (see Bord, Fisher, & O'Connor, 1998). The first option is an indirect form of pro-environmental action: although it is of substantial importance, it has no direct impact on the environment. The second option has a direct, but smaller impact on the environment (see Kollmuss & Agyeman, 2002). Since both actions differ substantially (e.g., in terms of regularity and effort) it is conceivable that they might be influenced by different factors. Thus, Kollmuss and Agyeman (2002) suggested that environmental knowledge and attitude might have a more powerful influence on people's indirect actions than on their direct pro-environmental behaviors. Accordingly, people with high levels of environmental concern might not necessarily be willing to change their lifestyle, but they might be more willing to accept political changes that encourage pro-environmental behaviors (e.g., higher fuel taxes).

Past research indicates that direct and indirect actions are, in fact, influenced by different factors. For instance, environmental concern seems to be a good predictor of intentions to act pro-environmentally (e.g., willingness to sign a petition or to pay more for cleaner energy), whereas personal norms seem to be a more influential determinant for pro-environmental behavior, such as recycling or ecological product choice (Minton & Rose, 1997). Another study found that determinants of voluntary actions (e.g., driving less or installing insulation) and voting intentions (e.g., regarding gasoline taxes) differed, indicating that these two forms of addressing climate change are influenced by different factors (O'Connor, Bord, & Fisher, 1999). For example, women were more likely to take voluntary actions, whereas men were more willing to support policies to reduce greenhouse gas emissions.

Yet, the authors also found considerable variability within both voluntary actions and voting intentions. Although people were willing to install more insulation or to replace older appliances, they seemed more reluctant to drive less and use public transportation more often. Similarly, consumers were in favor of raising car fuel efficiency standards but clearly rejected an increase in gasoline taxes. These results indicate that among both voluntary action and voting intentions, consumers' acceptance seems to vary across the different options. Thus, a further differentiation within these two groups might be necessary.

1.1.2. High- and low-cost behaviors

Another approach to classify climate-relevant behavior is offered by the low-cost hypothesis, which postulates that behavioral costs moderate the effects of attitudes on behavior (Diekmann & Preisendörfer, 2003). Cost in this context is not merely defined in an economical sense, but also includes other factors, such as the requirement of additional time, discomfort, or effort (Diekmann & Preisendörfer, 1998; Kollmuss & Agyeman, 2002).

Typically, recycling is considered a low-cost domain while mobility belongs to the high-cost domain (Diekmann & Preisendörfer, 2003). In line with this assumption, consumers generally seem to be most willing to recycle waste, followed by shopping ecologically and saving electricity, while being more resistant to changing traveling behavior (Diekmann & Preisendörfer, 2003; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; Whitmarsh, 2009). Furthermore, technical measures seem to be more accepted than behavioral measures, and shifts in consumption tend to be least acceptable (Poortinga, Steg, Vlek, & Wiersma, 2003).

Generally, environmental concern is assumed to influence ecological behavior primarily when it is connected to low-costs and little inconvenience. Lower costs ease the transformation of attitudes into the corresponding behavior (Diekmann & Preisendörfer, 2003). However, for behaviors that are associated with higher costs or inconveniences, environmental concern alone is not sufficient to overcome the barriers. This assumption is substantiated by studies finding that environmentally concerned people generally tend to show low-cost behaviors such as recycling but do not necessarily engage in activities that are more costly or inconvenient, such as reducing driving or flying (Diekmann & Preisendörfer, 1998, 2003; Kollmuss & Agyeman, 2002). Past research also found that the main effects of costs on environmental behavior were far stronger than those of environmental concern (Diekmann & Preisendörfer, 2003).

Similarly, Stern (1992) concluded that psychological factors, such as attitudes and personal norms, have a stronger influence on actions that are relatively inexpensive and easy to perform. For more expensive or difficult behaviors, however, financial aspects and education might mediate the link between attitude and behavior. In fact, a recent study found that knowledge and norms had a stronger influence on high-cost recycling (metal, plastic, and organic waste) than on low-cost recycling (glass, paper, and batteries) (Andersson & von Borgstede, 2010).

Accordingly, theories focusing on moral obligations to act pro-environmentally (e.g., the norm-activation model or the value–belief–norm theory) seem to be successful in explaining low-cost environmental behavior and consumers' willingness to change their behavior (see Steg & Vlek, 2009). However, for situations with higher behavioral costs or constraints (e.g., reducing car use) the theory of planned behavior appears to be more powerful in explaining environmental behaviors.

Of course, the two suggested ways of categorizing climate-friendly actions, namely in terms of costs and directness, are not mutually exclusive. As a matter of fact, it is also conceivable that there are both low- and high-cost direct behaviors (e.g., energy conservation vs. changing traveling behavior) as well as low- and high-cost indirect behaviors (e.g., support for incentives and technological solutions vs. support for taxes or higher bills). A past study, for instance, not only distinguished between voting intentions and voluntary actions but also separated the latter into three types: buying green (e.g., buying more efficient appliances), suffering discomfort (e.g., lowering the thermostat) and driving less (O'Connor, Bord, Yarnal, & Wiefek, 2002). These categories of voluntary actions could also indicate different cost levels. Accordingly, people's willingness of taking these actions decreased when they became more difficult or costly (e.g., installing solar panels), or if they threatened people's lifestyle (e.g., driving less).

However, to the best of our knowledge, no previous study has attempted to systematically classify climate-friendly actions by taking a broad variety of behaviors and policy measures into account. Therefore, the first aim of this study was to find a meaningful grouping of consumers' willingness to address climate change. We examined various climate-related behaviors, ranging from recycling to mobility behavior. In addition, we included different policy measures, some involving taxes and others encompassing subsidies. We expected to find a mixed categorization, namely that direct behaviors could be divided into high-cost direct behaviors (such as mobility) and low-cost ones (e.g., recycling). Similarly, we believed that policy measures would be separated into high-cost measures (involving higher personal costs, such as taxes) and low-cost policies (involving costs that are born by the society, such as subsidies).

1.2. Determinants of consumers' willingness to address climate change

Finding determinants influencing consumers' willingness to address climate change could prove particularly useful for developing information strategies and campaigns motivating consumers to act climate-friendly. Therefore, we aimed to identify the specific factors that influence these resulting types of climate-friendly behaviors. We examined the influence of respondents' concern about climate change, feeling of powerlessness, and level of skepticism. Furthermore, we studied the influence of perceived climate benefits and costs on consumers' inclination to address climate change. These variables will be described in more detail in the following.

1.2.1. Concern about climate change

People's perception of climate change influences their level of concern, which ultimately affects their motivation to act (Swim et al., 2009). In line with this assumption, past research indicates that concern about climate change increases consumers' willingness to change their behaviors (e.g., Semenza et al., 2008).

A review of major studies on public views of climate change demonstrated widespread awareness of and concern about climate change (Lorenzoni & Pidgeon, 2006). However, compared with other problems (e.g., personal or social issues), it was considered less important. Similarly, a very recent American study found that about half of the respondents indicated they were somewhat or very worried about climate change (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011a). Yet about 40% reported that climate change was not a very important issue to them personally. As lack of concern about climate change might impede consumers addressing the issue, we included this determinant as a predictor in our analyses.

1.2.2. Feeling of powerlessness

If people feel they cannot change a situation, they will very likely retreat into apathy and resignation and thus will be less likely to address environmental issues (Kollmuss & Agyeman, 2002; Moser, 2007; Moser & Dilling, 2004). One concept for measuring this feeling of powerlessness is the locus of control, which describes the degree to which individuals believe they can influence outcomes through their actions (McCarty & Shrum, 2001). Individuals with an internal locus of control believe that their actions can bring about change (Kollmuss & Agyeman, 2002). In contrast, persons with an external locus of control feel that their actions are insignificant; these persons attribute outcomes to powerful others rather than their own actions.

Meta-analyses of past studies demonstrated that internal locus of control or similar constructs (e.g., self-efficacy or perceived behavioral control) are positively correlated with pro-environmental behavior (Bamberg & Möser, 2007; Hines et al., 1986/87). However, as climate change is a global problem, many individuals might feel they cannot do anything about it (Swim et al., 2009). A recent study demonstrated that almost half of American adults to some extent believed that the actions of a single individual would not make any difference in climate change (Leiserowitz et al., 2011a; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011b). Such beliefs might ultimately discourage people from acting; therefore, it seemed important to include the concept feeling of powerlessness as a predictor in our study.

1.2.3. Skepticism

Most people's experience of climate change is indirect and mediated by news coverage and film documentaries (Swim et al., 2009). Almost every new story about climate change brings more bad news, which might overwhelm the public (Moser, 2007). Therefore, people might develop defense mechanisms that result in skepticism, such as denying the existence of the threat, believing that the problem will not happen here or to oneself, or emphasizing the uncertainty. In fact, anthropogenic climate change is a widely discussed issue and not universally accepted as a reality (e.g., Reynolds, Bostrom, Read, & Morgan, 2010). In the past two years, about 20% of Americans indicated that they believed climate change was not happening; a similar fraction was unsure (Leiserowitz et al., 2011a).

Lorenzoni et al. (2007) named uncertainty and skepticism as important barriers to engaging with climate change. Some people, for instance, feel unsure or skeptical about the causes of climate change, its seriousness, and the necessity and effectiveness of actions. Some also perceive a large scientific controversy about this issue. Similarly, Leiserowitz (2007a) identified a group of "naysayers" among the U.S. public that had associations indicating skepticism or cynicism about the reality of climate change. This community believed that climate change is natural, and that there is hype about this subject. Furthermore, they doubted the science, denied the problem, and believed in conspiracy theories. Naysayers had a substantially lower climate risk perception than the rest of U.S. society.

Such mindsets can have an effect on the perception and interpretation of information about climate change and therefore might

be an important barrier to addressing climate change (Lorenzoni et al., 2007). Therefore, we believed including a measurement of skepticism in our study was important.

1.2.4. Perceived costs and climate benefit

Psychological research has generally focused on people's characteristics but has often neglected how people perceive a certain action in terms of costs and benefits. As we put a strong focus on the characteristics of the climate-related actions, we also examined how consumers' perceptions of these actions influence their willingness to act. Past studies have demonstrated that pro-environmental behaviors are influenced by people's knowledge about the monetary costs of these behaviors, perceptions of their difficulty, and knowledge about which actions have the largest impact (Stern, 1992). We therefore believe perceived costs and benefits to be important determinants for a close examination of climate-friendly actions, and assume that they can largely contribute to the explanation of willingness to act and the acceptability of policy measures.

In a study testing the low-cost hypothesis, Diekmann and Preisendörfer (2003) relied on indirect cost measures by using the frequency of a behavior as an indicator of its average cost intensity. However, they suggested that future research might use subjective measures of costs and proposed including financial expenditures, additional time, discomfort, or other subjectively defined inhibitions of behavior (Diekmann & Preisendörfer, 1998). Therefore, we included perceived costs as a predictor and, in contrast to Diekmann and Preisendörfer (2003), considered consumers' perception of behavioral costs, defining behavioral costs in a broad sense according to their suggestions. Lastly, we also took into account to what extent people believed a certain action to be beneficial for the climate, because knowing which actions have the largest impact might motivate people to show the respective behaviors (Stern, 1992).

In sum, we studied whether the *respondents'* characteristics (sociodemographics, concern about climate change, skepticism, and feelings of control) or perceptions of the *behaviors'* characteristics (perceived climate benefit and costs) were more successful in explaining consumers' willingness to act and to support policy measures.

2. Method

2.1. Participants

We sent questionnaires to randomly selected households in the German-speaking part of Switzerland. To ensure a random sample, we asked the household member who was 18 years or older and whose birthday was next to participate. We sent two reminders to non-responders, the second one containing another copy of the questionnaire. A total of 916 persons returned completed questionnaires, which resulted in a response rate of 39%.

Our final sample consisted of 60% men ($n = 546$) and 38% women ($n = 354$), and 2% ($n = 16$) did not disclose their gender. Our respondents' mean age ($M = 55$, $SD = 16$) was somewhat higher than in the adult Swiss population ($M = 49$ years) (BFS, 2009). The self-reported education level ranged from primary school (5%, $n = 41$), lower secondary school (8%, $n = 75$), upper secondary vocational school or business school (41%, $n = 374$), and upper secondary school (17%, $n = 157$) to college or university (27%, $n = 251$). Two percent ($n = 18$) did not indicate their highest level of education. Compared with Swiss census data (BFS, 2009), men were overrepresented and the sample had a slightly higher education level than the general Swiss population.

2.2. Questionnaire

The questionnaire consisted of 16 pages, covering a broad range of constructs, which were each measured by a variety of items. Unless stated otherwise, the items were presented as statements and participants rated each item on a 6-point Likert scale, indicating to what extent they agreed, from 1 ("strongly disagree") to 6 ("fully agree").

We included both the willingness to exhibit climate-friendly behavior and the willingness to accept climate mitigation policy measures as dependent measures. As independent variables, we examined perceived climate benefit, perceived costs, attitudes, and demographics. These measures are introduced in the following.[1]

2.2.1. Willingness to act and to support policy measures

We presented an extensive list of possible activities and policy measures. We developed 15 behavioral items and included various behaviors that were measured in past studies, such as buying a fuel-efficient car, using less heat during the winter, or donating money to an organization working to reduce global warming (e.g., Bord et al., 1998; Bord, O'Connor, & Fisher, 2000; Diekmann & Preisendörfer, 2003; Leiserowitz, 2007b; Leiserowitz et al., 2011b). We also included behaviors recommended by environmental organizations (e.g., World Wildlife Fund [WWF]), for instance, reducing meat consumption or avoiding flights for holidays. We thereby chose items that were appropriate for the Swiss situation. For instance, as only a third of the Swiss population own the home they live in (BFS, 2009), we did not include insulation in houses. Similarly, we chose to include only one item about energy savings, as in Switzerland electricity is mostly produced by hydroelectric or nuclear power.

Overall, we aimed to cover a wide range of behaviors from different domains (e.g., habitation, mobility) with different characteristics (such as effort, repetition, costs). We also included behaviors with high relevance for climate change (e.g., flying, heating), behaviors that are considered generally environmentally friendly (e.g., recycling) or even regarded as not very relevant for climate change (avoiding spray cans with CFC) (see Table 1). Participants could rate their willingness to show these behaviors on a 7-point Likert scale ranging from 1 ("not willing at all") over 6 ("very willing") with the additional response option "already showing this behavior" (7).

For the policy measures, we included items measured in previous research, such as a tax on gasoline or requirements for automobile fuel efficiency (e.g., Bord et al., 2000; Diekmann & Meyer, 2008; Leiserowitz, 2006; Leiserowitz et al., 2011b), which were adapted to the Swiss situation. We also added policy measures that are currently being discussed in Switzerland, such as an increase in the CO_2 tax on heating oil. For these nine items (see Table 2), participants indicated how acceptable they found the presented policies on a 6-point Likert scale from 1 ("not acceptable at all") to 6 ("very acceptable").

2.2.2. Perceived climate benefit

To measure perceived climate benefit, we presented the same list of climate-friendly behaviors (shown in Table 1) and asked participants how significant they believed the climate benefit to be if they were to engage in the respective behavior. Similarly, we also presented the above mentioned policy measures (see Table 2) and asked the participants how significant they estimated the climate benefit of these policies to be. Participants indicated their perceived climate benefit on a 6-point Likert scale, ranging from 1 ("no

[1] The list of all items is available from the first author upon request.

Table 1
Items measuring the willingness to act, including means, standard deviations, and factor loadings.

	M	*SD*	Low-cost behaviors	Indirect behavior	Mobility
1. Airing the rooms briefly but efficiently during the cold seasons (Inrush airing)	6.75	.76	**.71**	.01	.02
2. Recycling paper	6.73	.82	**.71**	.09	.02
3. Using warm water sparingly (e.g., taking a shower instead of a bath)	6.43	1.16	**.71**	.01	.10
4. Avoiding spray cans containing CFC	6.34	1.08	**.63**	.25	−.06
5. Consuming seasonal food whenever possible	6.22	1.21	**.65**	.05	.26
6. Saving electricity (e.g., by using energy-efficient light bulbs or by completely switching off appliances)	6.15	1.29	**.63**	.16	.14
7. Preferring fuel-efficient vehicles when buying a car	5.98	1.19	**.46**	**.32**	.11
8. Setting your thermostat to 20 degrees Celsius or lower during the cold season	5.59	1.57	**.40**	.22	.22
9. Reducing meat consumption (max. 3 times a week)	5.36	1.79	**.37**	.18	**.42**
10. Electing politicians committed to climate protection	5.10	1.75	.22	**.76**	.17
11. Offsetting CO_2 emissions (e.g., from flights) financially	4.28	1.78	.14	**.70**	.20
12. Donating money to climate protection projects	3.84	2.01	.08	**.83**	.12
13. Avoiding flights for holidays	5.13	1.88	.20	−.05	**.65**
14. Avoiding car use for commuting to work	4.90	2.32	−.02	.24	**.72**
15. Avoid car use for regular purchases	4.66	2.10	.02	**.32**	**.72**

Note. Willingness to act was rated on a 7-point Likert scale ranging from 1 (not willing at all) to 7 (already showing this behavior). The factor loadings >.3 are set in bold.

benefit") to 6 ("very large benefit"). We built the subscales for perceived climate benefit according to the resulting categorization of respondents' willingness to act and to support policy measures, which will be explained in Section 2.1. Thus, the subscales of perceived climate benefit included the same items as the subscales of willingness to act and to support policy measures. With Cronbach αs > .75, all scales showed satisfactory reliabilities.

Table 2
Items measuring the acceptability of climate policy measures, including means, standard deviations, and factor loadings.

	M	*SD*	Supportive measures	CO_2 restrictions
1. Subsidies for building and renovating according to the MINERGIE[a] standard (with low energy demand)	5.32	1.03	**.82**	.21
2. Subsidies for electricity generation from renewable energy (such as solar or wind energy)	5.23	1.16	**.80**	.26
3. Subsidies for research projects in the field of climate-friendly technology	5.19	1.10	**.70**	.29
4. Extension of public transportation	5.07	1.18	**.44**	**.47**
5. Subsidies for alternative heating systems (such as wood firing or heat pumps)	5.01	1.23	**.80**	.11
6. Binding CO_2 emission limits for new cars	5.19	1.25	**.44**	**.60**
7. Bonus malus system for car taxes	4.68	1.60	.28	**.74**
8. Increase of CO_2 tax on heating oil (from now 9 Rp/Lt to 18 Rp/Lt)	3.79	1.74	.16	**.87**
9. CO_2 tax on gasoline and diesel (15 Rp/Lt)	3.78	1.79	.13	**.91**

Note. Acceptability of policy measures was rated on a 6-point Likert scale ranging from 1 (not acceptable at all) to 6 (very acceptable). The factor loadings >.3 are set in bold.

[a] Sustainability brand for new and refurbished buildings.

2.2.3. Perceived costs

Following Diekmann and Preisendörfer's (2003) suggestions, we asked, if applicable for the actions, whether participants perceived the behaviors as costly in terms of *financial costs* (e.g., "Avoiding flights for holidays would involve higher costs for me"), *time* (e.g., "Avoiding car use for commuting to work would be too time-consuming for me"), *discomfort* (e.g., "Taking a shower instead of a bath would reduce my quality of life"), and *inconvenience* (e.g., "Eating less meat would be inconvenient for me"). As policy measures usually do not involve behavioral costs, we assessed to what extent participants perceived the policies as costly for themselves, society, and the economy.

As the length of the questionnaire did not allow us to assess the perceived costs of all climate-friendly actions, we measured only the costs of selected behaviors and policy measures. However, to ensure that all types of climate-friendly actions were represented in the perceived costs, we chose behaviors and policy measures that differed considerably from each other. We measured the perceived costs of the hypothesized *low-cost direct behavior*, namely of inrush airing (2 items), taking a shower instead of a bath (2 items), and reducing meat consumption (4 items). The costs of the assumed *high-cost direct behavior* were represented by mobility behaviors, namely reducing car use in spare time, reducing car use for work, and avoiding flights for holidays (4 items each). We assessed the costs of the hypothesized *indirect behavior* with one item about donating money to climate projects. The expected *low-cost policy measures* were represented by one item about the perceived costs of subsidies for renewable energy. For the hypothesized *high-cost policy measures*, we assessed the perceived costs of an increased CO_2 tax on heating oil (3 items) and of a bonus malus system for car taxes (3 items). For each type of action, we used the mean score as an indicator of respondents' perception of how costly this kind of behavior or policy was. For the scales with more than one item, the reliabilities were satisfactory with Cronbach αs > .73.

2.2.4. Attitudes and sociodemographics

To predict willingness to address climate change, we examined the influence of concern, feeling of powerlessness, and skepticism, which are described below.

Concern about climate change included several items related to risk perception, including concern about climate change and the seriousness of its consequences (similar to the risk perception scale, see Leiserowitz, 2006). Additionally, we added consumers' perception of the importance of climate protection. Overall, concern about climate change was measured with four items (e.g., "I worry about the climate's state"). The scale included statements that the climate's delicate equilibrium must be protected, that climate protection is important for the future, and that climate change has severe consequences for humans and nature.

Feeling of powerlessness described the feeling of being unable to do something about climate change and represented an external locus of control. For the scale, we included items measuring locus of control from the literature (McCarty & Shrum, 2001; Smith-Sebasto, 1992) and adapted them to the subject of climate change (e.g., "Climate protection measures are determined by a few powerful persons; as a single citizen, I have no effect"). The five items generally measured the feeling that climate protection lies in the hands of others (a few powerful persons, or the industry) and the feeling that one cannot contribute to climate protection, for instance, as a citizen or with one's behavior.

Skepticism assessed people's doubts regarding the sources of information and the extent to which they feel unthreatened by climate change. The seven skepticism items were developed based on past studies (Leiserowitz, 2007a; Lorenzoni et al., 2007). We included statements indicating distrust (e.g., "Climate change and its consequences are being exaggerated in the media" or "Climate change is a racket"). Further aspects included respondents' perception of climate change as a low or nonexistent danger (such as the notion that there are more important problems than climate protection, or that respondents did not feel threatened by climate change).

Finally, the respondents indicated their gender, age, level of education, and political affiliation. The latter was rated on a 7-point Likert scale, ranging from 1 ("left-wing") over 4 ("center") to 7 ("right-wing").

2.3. Data analysis

We used principal component analysis with varimax rotation to test whether the dependent variables (willingness to act and to support policy measures) could be grouped into different types of climate-related action. With the same procedure, we examined the underlying factors among the items measuring perceived climate benefit, costs, and attitudes. All resulting scales were then tested for reliability.

To test the different determinants' influence on willingness to act and to support policy measures, we conducted multiple linear regression analyses, where all predictor variables were entered simultaneously. We used different predictors, namely (1) *personal characteristics*, such as the respondents' sociodemographic variables and attitudes related to climate change, and (2) *characteristics of the respective behaviors or policies*, namely the perceived climate benefit and the perceived costs.

The interpretation of the significance level depends on the sample size; thus, achieving $p < .05$ can be very uninformative in a large sample (Lindley & Scott, 1984; Royall, 1986). Due to our large sample size, we therefore judged the results to be significant at the minimum significance level of $\alpha < .01$ in all our analyses.

3. Results

3.1. Principal component analyses

We conducted principal component analyses in order to find a meaningful categorization of the willingness to behave in a climate-friendly manner and the willingness to accept climate policy measures. The resulting categories are described in the following sections.

3.1.1. Willingness for climate-friendly behavior

Based on the scree plot and interpretability, we identified three dimensions of climate-friendly behaviors, which confirmed our expected categorization: (a) *low-cost behaviors* mainly included routine consumer behaviors, such as airing, recycling paper, meal choice, and saving electricity and water, (b) *indirect behavior* comprised actions that delegate climate-friendly activities, such as electing politicians committed to climate protection, offsetting CO_2 emissions, and donating money to climate protection projects, and (c) *mobility* covered avoiding using the car for commuting to work and for regular purchases, as well as avoiding flights for holidays (see Table 1). The item about meat reduction actually loaded higher on the mobility dimension. However, since its content was better suited for the low-cost behaviors scale (and had a similarly high loading on this dimension), we decided to include it in the low-cost behaviors scale. The three dimensions could explain 49% of the variance. Cronbach's αs for the three types of climate-friendly behavior were: $\alpha = .77$ for low-cost behaviors, $\alpha = .62$ for mobility, and $\alpha = .75$ for indirect behavior.

Because the explained variance of the three dimensions solution may seem rather low, we additionally conducted principal component analyses with four and five components on the climate-friendly behaviors, which could explain a somewhat higher percentage of the variance. However, both yielded components that were difficult to interpret. Furthermore, both resulted in factors consisting of fewer than three items, which is considered a weak and unstable scale (Costello & Osborne, 2005). As unexplainable models have little value, Fabrigar et al. recommend researchers should always consider interpretability when deciding on the numbers of factors to retain (Fabrigar, Wegener, MacCallum, & Strahan, 1999). We therefore retained the three factors (see Table 1), as they formed plausible scales with satisfactory reliabilities.

3.1.2. Willingness to accept climate policy measures

Table 2 shows that the acceptability of policy measures resulted in two dimensions: (a) *supportive measures*, offering incentives and infrastructure for climate-friendly action, such as subsidies for sustainable building and renovating, and the extension of public transportation, and (b) *CO_2 restrictions*, limiting and charging CO_2 emissions, such as CO_2 taxes on heating oil or gasoline. With these two components, we explained 65% of the variance. The reliabilities of the scales were good (Cronbach's $\alpha = .83$ for supportive measures and $\alpha = .85$ for CO_2 restrictions).

Across all climate-friendly behaviors (i.e., low-cost behaviors, mobility, and indirect behavior), respondents were most willing to engage in low-cost climate-friendly behaviors. The high mean indicates that the majority already exhibited this type of behavior (see Table 3). The participants' willingness to avoid car and plane use was substantially lower, followed by their willingness to show indirect climate-friendly behavior. With regard to the policy measures, participants were more willing to accept supportive measures than CO_2 restrictions.

Table 3 shows that, generally, all manners of addressing climate change were positively correlated. Particularly, the relationships between indirect behavior and the support of climate policy measures proved to be strong and positive. Furthermore, there was a strong positive relationship between the willingness to show climate-friendly low-cost behaviors and the acceptability of supportive measures.

With the dimensions *low-cost behaviors* and *indirect behavior*, our results distinguished between direct and indirect behaviors, as suggested in the literature. To test whether the three different types of climate-friendly behaviors also differed in terms of perceived costs, we performed a one-way repeated-measures ANOVA and *post hoc* pairwise comparisons. The mean perceived costs differed significantly across the three different climate-friendly behaviors, $F(2, 1784) = 273.36$, $p < .001$, and all pairwise comparisons yielded

Table 3
Means, standard deviations (*SD*), and Pearson correlations for the willingness to act and the acceptability of climate policy measures.

	Mean	*SD*	1	2	3	4
1. Low-cost behaviors[a]	6.18	.74	–			
2. Mobility[a]	4.92	1.58	.34**	–		
3. Indirect behavior[a]	4.41	1.51	.42**	.41**	–	
4. Supportive measures[b]	5.15	.89	.51**	.25**	.55**	–
5. CO_2 restrictions[b]	4.34	1.35	.40**	.38**	.60**	.57**

**$p < .001$.
[a] Willingness to act was rated on a 7-point Likert scale.
[b] Acceptability of policy measures was rated on a 6-point Likert scale.

significant differences (*ps* < .001). Indirect behaviors were perceived as the most costly behaviors ($M = 3.15$, $SD = 1.66$). The costs of changing mobility behavior ($M = 2.74$, $SD = 1.20$) were perceived as higher than the costs of climate-friendly low-cost behaviors ($M = 1.93$, $SD = .78$). Thus, compared to the low-cost behaviors, mobility could be considered high-cost.

A *t*-test showed that among the policy measures' costs, the costs of supportive measures ($M = 2.85$, $SE = .05$) were perceived as significantly lower than those of CO_2 restriction measures ($M = 3.11$, $SE = .04$), $t(898) = -4.99$, $p < .001$. Accordingly, we viewed supportive measures as low-cost policy options while CO_2 restriction measures were perceived as high-cost policy measures. Thus, overall, our results support the assumption that we were able to differentiate the various behaviors and policy measures according to their costs.

3.2. Regression analyses

Based on the results of the previous principal component analyses, we conducted multiple regressions separately for all three types of climate-friendly behavior and both types of climate policy measures to examine which predictors influenced them.

To build the attitudinal scales, we conducted a principal component analysis among our 16 attitudinal items. Based on the scree plot and Kaiser's criterion (eigenvalues > 1), we constructed three scales with satisfactory reliabilities: (a) concern about climate change ($\alpha = .83$), (b) feeling of powerlessness ($\alpha = .71$), and (c) skepticism ($\alpha = .83$).

3.2.1. Climate-friendly low-cost behaviors

Table 4 shows that the perceived climate benefit of low-cost behaviors was the most influential factor of all predictors on willingness to show climate-friendly low-cost behaviors. The more respondents thought that low-cost behaviors were beneficial for the climate, the more they were willing to exhibit these behaviors. Participants' willingness to show climate-friendly low-cost behaviors was further decreased by perceived behavioral costs and increased by concern about climate change. Furthermore, older individuals tended to be more willing to show climate-friendly low-cost behaviors. The determinants could explain 42% of the variance, $F(9, 728) = 59.25$, $p < .001$.

3.2.2. Indirect behavior

Perceived climate benefit was the strongest predictor of participants' willingness to show indirect climate-friendly behavior (see Table 4). Political affiliation was the second most influential determinant; participants who allocated themselves on the right end of the political spectrum were less willing to show indirect climate-friendly behavior. High perceived costs and skepticism further decreased the willingness to exhibit this type of behavior. The regression model explained 61% of the variance, $F(9, 723) = 126.11$, $p < .001$.

3.2.3. Mobility

If respondents perceived the renouncement of cars and flights as costly, this significantly decreased their willingness to reduce car and plane use (see Table 4). Another influential factor was the perceived climate benefit of changing mobility behavior. Further significant, but substantially weaker determinants were sociodemographic variables: people of younger age and with higher education were less willing to reduce car and plane use. Fifty-five percent of the variance in the willingness to change mobility behavior could be explained by the model, $F(9, 724) = 98.96$, $p < .001$.

3.2.4. Supportive policy measures

Table 4 shows that perceived climate benefit was, by far, the most predictive factor explaining the willingness to accept supportive policy measures. This determinant was followed by political affiliation: people who oriented themselves on the right wing of the political spectrum were less willing to accept supportive measures. The acceptability of supportive measures was further decreased by perceived costs and skepticism, and increased by concern about climate change. The regression model could explain 68% of the variance in the acceptability of supportive policy measures, $F(9, 725) = 167.79$, $p < .001$.

3.2.5. CO_2 restrictions

Perceived climate benefit was clearly the strongest predictor for the acceptability of measures restricting CO_2 emissions (see Table 4). If these measures' costs were perceived as high, respondents' willingness to accept them decreased. Left-wing political affiliation further increased respondents' willingness to accept CO_2 restrictions. Seventy-four percent of the variance in acceptability of CO_2 restrictions could be explained by the model, $F(9, 725) = 229.32$, $p < .001$.

In sum, perceived costs and climate benefits were the strongest predictive determinants for all five approaches to addressing climate change. In particular, perceived climate benefit proved to be a strong predictor, increasing both people's willingness to show

Table 4
Summary of multiple regression analyses predicting the willingness for climate-friendly actions.

Predictor variables	Low-cost behaviors			Indirect behavior			Mobility			Supportive measures			CO_2 restrictions		
	B	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*
Constant	3.54	.29		3.62	.49		5.51	.56		1.96	.25		2.04	.36	
Sociodemographics															
Gender[a]	.09	.04	.06	−.12	.08	−.04	−.05	.09	−.02	−.03	.04	−.02	.06	.05	.02
Age	.00	.00	**.10***	.00	.00	.04	.01	.00	**.08***	.00	.00	.00	.00	.00	.01
Education	.01	.02	.01	−.04	.03	−.03	−.10	.04	**−.07***	.01	.02	.01	.01	.02	.01
Political affiliation[b]	−.03	.02	−.05	−.29	.03	**−.24****	−.09	.04	−.07	−.08	.02	**−.11****	−.07	.02	**−.06***
Attitudes															
Concern	.12	.03	**.15****	.05	.05	.03	.07	.06	.04	.08	.03	**.08***	.09	.04	.06
Skepticism	.01	.03	.01	−.14	.05	**−.10***	.13	.05	.09	−.05	.03	−.07	−.01	.04	−.01
Powerless	.00	.02	.00	−.03	.04	−.02	−.10	.05	−.06	.03	.02	.03	.03	.03	.02
Costs & benefits															
Perceived climate benefit	.40	.03	**.44****	.65	.04	**.54****	.29	.04	**.20****	.66	.03	**.68****	.65	.03	**.61****
Perceived costs	−.18	.03	**−.20****	−.14	.02	**−.15****	−.78	.04	**−.60****	−.05	.01	**−.10****	−.29	.02	**−.29****
	$R^2 = .42$			$R^2 = .61$			$R^2 = .55$			$R^2 = .68$			$R^2 = .74$		

Note. A predictor variables with a standardized regression value (*β*) in bold had a significant impact on its respective climate-friendly action, * $p < .01$, ** $p < .001$.
[a] Gender was coded 1 = male, 2 = female.
[b] Political affiliation was measured on a 7-point Likert scale, 1 = left-wing, 4 = center, 7 = right-wing.

climate-friendly behavior and to support mitigation policy measures.

Among the sociodemographic variables, political affiliation was the most influential determinant. People on the right wing of the political spectrum were less willing to show indirect climate-friendly behavior and to support any type of climate mitigation policy measures. Older participants were more willing to adopt climate-friendly low-cost behaviors and to reduce car and plane use. Participants with higher education tended to be less willing to reduce the use of cars and flights.

Concern about climate change increased participants' willingness to show climate-friendly low-cost behaviors and to accept supportive policy measures. Skepticism negatively influenced people's willingness to engage in indirect behaviors, whereas feeling of powerlessness had no significant influence on people's willingness to address climate change.

Overall, the chosen determinants seemed appropriate to explain willingness to act in a climate-friendly manner and to support policy measures as, with the exception of the model predicting mobility behavior ($R^2 = 42\%$), all models could explain more than 55% of the variance.

4. Discussion

In this study, we aimed to find a meaningful classification for a broad range of climate-friendly actions, ranging from recycling to accepting CO_2 taxes. Furthermore, we intended to determine which factors influence the different types of climate-friendly action.

4.1. Classification of climate-friendly actions

Based on the literature, we considered a distinction between direct and indirect behaviors for classifying climate-friendly actions (Kollmuss & Agyeman, 2002). In fact, we found one dimension in our study for *indirect behavior*, namely actions that delegate climate-friendly activities to others, such as electing politicians committed to climate protection, offsetting CO_2 emissions, and donating money to climate protection projects. Additionally, we found that direct behavior split into (a) *low-cost behaviors*, mainly consisting of routine consumer behaviors, such as airing, recycling paper, meal choice, or saving electricity and water, and (b) *mobility*, which included avoiding car use and flights. Thus, a classification in terms of directness does not seem to suffice and an additional distinction might be needed.

As a second way of classifying climate-friendly action, we considered financial and behavioral costs (such as inconvenience or loss of time). Among the direct behaviors, mobility and low-cost behaviors differed in terms of perceived costs. Reducing car and plane use was perceived as more costly and inconvenient than the low-cost behaviors. Indirect behaviors, however, were perceived as most costly, perhaps because they merely involved financial costs and no direct benefits that might reduce cost perceptions.

Climate mitigation policy measures could be divided into (a) *supportive measures* that enable climate-friendly action (e.g., subsidies), and (b) *CO_2 restrictions* putting charges on CO_2 emissions (e.g., CO_2 taxes on heating oil or gasoline). Supportive measures were perceived as less costly than CO_2 restriction measures, indicating that supportive measures represent low-cost policy options, whereas CO_2 restriction measures belong to high-cost policy measures. Taken together, these results therefore suggest that both a distinction in terms of a behavior's directness as well as a differentiation according to perceived costs seem to be appropriate to classify climate-friendly actions.

Not surprisingly, consumers were most willing to perform climate-friendly low-cost actions, but not to avoid car or plane use. This result highlights the fact that people prefer to show their environmental concern in low-cost areas (Diekmann & Preisendörfer, 1998). Generally, the willingness to address climate change was, however, positively correlated among all types of climate-friendly actions. Thus, different forms of pro-environmental behavior seem to be based on the same motivational roots, which could be considered a general conservation stance (Thøgersen, 2004). This finding to some extent supports the assumption of a positive spillover. People showing some kind of climate-friendly behaviors might thus be willing to adopt other climate-friendly actions. However, the extent of this positive spillover seems to vary among the different types of climate-friendly action. There was a particularly strong positive relationship between the willingness to show indirect behavior and the support of both types of climate policy measures, probably because they all represent an indirect way of addressing climate change. Willingness to perform low-cost climate-friendly behaviors and the acceptability of supportive policy measures were also strongly and positively correlated. This might be due to the fact that both involve relatively low-costs and generate benefits that go beyond climate mitigation (e.g., saving money).

4.2. Determinants of climate-friendly actions

For all five types of climate-friendly actions, we examined which factors predict consumers' willingness to address climate change. Across all forms of action addressing climate change, perceived costs and perceived climate benefit of the respective behaviors or policies turned out to be the strongest predictors for willingness to act or to support climate policy measures.

This finding might support the assumption that consumers make reasoned decisions, weighting costs and benefits of an action and choosing the option they believe to have the best balance. However, it is important to note that, whereas respondents were directly affected by costs (e.g., in terms of inconveniences, loss of time, or financial costs), they would not immediately profit from the benefit of their actions, as these were related to the climate. Still, climate benefit outweighed perceived costs as the most influential determinant for most types of climate-relevant actions.

This could indicate that consumers were concerned about the climate's state and altruistically put more weight on climate benefit than on personal costs. However, climate benefit, like climate change, cannot be experienced because the connection between today's action and its effects on the climate is difficult to perceive (Moser, 2007). Thus, respondents' perceptions of the climate benefit of different types of climate-friendly actions may not necessarily mirror the actual benefit. In line with our results, a recent study found a discrepancy between the actions recommended by policy makers (e.g., using public transport) and those taken by the public (e.g., recycling) (Whitmarsh, 2009). The author concluded that the public might have an incomplete understanding of which actions are most effective in terms of climate mitigation. Whitmarsh suggested that people tend to overestimate their contribution to climate mitigation while underestimating the negative impact of their actions. Thus, the strong influence of perceived climate benefit in our study could also reflect a strategy of reducing cognitive dissonance (Festinger, 1957). As high-cost behaviors are more difficult to adopt, consumers might be unwilling to change their lifestyle, and therefore experience an uncomfortable tension. As a result, to reduce the cognitive dissonance, consumers might dismiss high-cost behaviors as not effective in terms of climate mitigation.

For mobility behavior, however, perceived costs and inconveniences did prevail over perceived climate benefit as the most influential factor. A possible explanation for this result might be

that CO_2 emissions by planes and cars are commonly known to have a major negative impact on the climate (e.g., Bord et al., 2000; Read, Bostrom, Morgan, Fischhoff, & Smuts, 1994; Reynolds et al., 2010). Thus, one cannot argue that renouncing cars and planes is not beneficial for the climate. As the climate benefit of these behaviors could not be denied, perceived costs might have outweighed this factor as the most influential determinant.

With regard to attitudes, we found that consumers concerned about climate change were more willing to show climate-friendly low-cost behaviors and accept supportive climate policy. Concern about climate change, however, did not significantly influence consumers' willingness to reduce car and plane use, to show indirect behavior, or to support CO_2 restrictions. This stands in contrast to the suggestion that attitudes might have a stronger influence on indirect actions than on direct ones (Kollmuss & Agyeman, 2002). Rather, it appears that attitudes have a stronger influence on low-cost behaviors and policies, because high-costs hamper the transformation of attitudes into the corresponding action (Diekmann & Preisendörfer, 2003; Lee & Holden, 1999). Therefore, consumers concerned about climate change seem to be willing to show climate-friendly low-cost behaviors and support low-cost policies, but not costlier and more inconvenient ways of addressing climate change (i.e., mobility, indirect behaviors, and CO_2 restrictions).

Our findings are in line with past research findings that attitudes and environmental concern were influential predictors for people's indoor greenhouse gas reduction behaviors (such as turning off lights and recycling) but not for their automobile greenhouse gas emissions (Ngo, West, & Calkins, 2009). Poortinga et al. (2003) even found that consumers with a high level of environmental concern found measures with small energy savings more acceptable than measures resulting in large energy savings. They suggested that measures with small savings (such as switching off the light) could be highly symbolic. Therefore, particularly people concerned about the environment might believe that at least these should be adopted.

The willingness to avoid cars and planes was further influenced by the respondents' age and education. Participants of a higher age were more willing to avoid cars and planes, probably because elderly people are less mobile. The negative influence of education was possibly related to the fact that qualified jobs often require more traveling to meetings abroad or commuting as, in many cases, they are situated in larger cities. However, compared to the perceived costs and climate benefits, the predictive strength of the other factors was rather weak. We therefore suggest focusing on the former two.

Political affiliation proved to be the most influential determinant among the sociodemographic variables. Participants on the right wing were less willing to show indirect climate-friendly behaviors, change their mobility behaviors, and to support any type of climate mitigation policy measures. These results are in line with past research indicating that a conservative political ideology has a negative effect on people's concern for climate change (Dunlap & McCright, 2008; Zia & Todd, 2010), which, ultimately, might reduce their willingness to address the subject.

Climate-friendly low-cost behaviors, however, were not influenced by political affiliation. A possible explanation for that result might be that climate-friendly low-cost behaviors often include co-benefits that are not associated with climate change. Furthermore, among all tested types of climate-friendly actions, our determinants could explain the least variance in low-cost climate-friendly behaviors. Consumers' willingness to show this type of behavior might be determined by further factors that are not necessarily related to climate change. Past research found that the reasons for engaging in several climate-related actions are not always connected to the environment (Whitmarsh, 2009). For instance, the most frequent reason for saving electricity was to save money, and eating organic food was primarily motivated by health concerns. Thus, in contrast to the other types of climate-friendly actions, the reasons for showing climate-friendly low-cost behaviors could be manifold.

4.3. Limitations

Our study has several limitations. For instance, we cannot claim that our sample was entirely representative. First, we only examined the German-speaking part of Switzerland. Although the German-speaking population represents the vast majority of Switzerland's population in general, and the area covered by our mail survey comprised 78% of the population, we cannot exclude that the population of the French- and Italian-speaking part differs from the examined sample. Second, men were overrepresented in the sample. Despite our attempt to randomize within the household using the birthday method, we could not control which household member actually completed the questionnaire. As men were overrepresented, it is possible that they felt more inclined to participate. Thus, we cannot rule out a self-selection bias, leading only persons particularly interested in climate change to participate in the survey. However, the mean scores for concern about climate change covered the entire response spectrum (ranging from 1.00 to 6.00), indicating that all levels of concern were represented in our sample. Furthermore, the large response rate and the fairly representative sample still allow us to conclude that the results can be applied to a large percentage of the Swiss population.

Another limitation was that we measured self-reported willingness to act as the dependent variable, rather than actual behavior. Although intention is one of the key predictors of behavior for social psychologists, past research has shown that intentions to act are not necessarily transformed into actual behavior. Meta-analyses show that intention explains about 27–28% of the variance across general behavior (Sheeran, 2002) and pro-environmental behavior (Bamberg & Möser, 2007). Furthermore, the responses might have been influenced by social desirability or other self-report distortions (such as recalling difficulties). As an alternative, we could have avoided these problems by directly observing the actual behavior. However, we aimed to classify a broad range of manners of addressing climate change and intended to compare the determinants of these different options. Therefore, our main focus was to include a large variety of climate-friendly actions. Unfortunately, the measurement of such a wide range of behaviors would not have been feasible by observation.

Lastly, we are aware that our list of predictors is not conclusive. The inclusion of additional determinants, such as values or social norms, could have added to the explanation of the willingness to act and to support climate policy measures. Although our models could explain a considerable fraction of the variance, further research could examine whether other determinants might be stronger predictors.

5. Conclusions and implications

Generally, people seem to be concerned about climate change, but perceive it as less important than other environmental, personal, or social issues (Leiserowitz, 2007b; Leiserowitz et al., 2011a; Lorenzoni & Pidgeon, 2006). The insufficient sense of urgency about climate change might be due to the time lags in the climate, the fact that climate change is largely invisible for individuals, and the existence of other, more immediate problems (Moser & Dilling, 2004). People communicating about climate change, therefore, might be tempted to use fear or guilt as a motivating force. Such appeals, however, could result in resentment,

denial, or apathy if no potential solutions are offered. Moser and Dilling (2004), therefore, recommended that communication about climate change should rather highlight the effectiveness of the recommended action and address concerns about costs. Similarly, Ngo et al. (2009) concluded that green attitudes and knowledge of environmental problems might not be sufficient to encourage people to change consumption behaviors and suggested that public information campaigns should instruct the public about how they can feasibly reduce greenhouse gas emissions.

Our study provides empirical support for these recommendations. Although concern about climate change influenced some climate-friendly actions, it was not among the most influential factors encouraging people to address climate change. The perceptions of climate benefits and costs, however, were the strongest predictors of participants' willingness to engage with climate change. In line with Moser and Dilling's (2004) and Ngo and colleagues' (2009) recommendations, our results indicate that future communication should highlight the climate benefit of climate-friendly actions and aim to reduce consumers' perceptions of costs and inconveniences. Emphasizing the climate benefit of climate-friendly actions might be particularly promising as it represents a positive form of communication. This might prove more successful in engaging and empowering individuals to change their behaviors and support public policy changes than fear appeals (Moser, 2007; Moser & Dilling, 2004). Furthermore, information about how to contribute to climate mitigation might give people a feeling of control.

It seems particularly important to communicate the climate benefits associated with climate-friendly actions if these involve higher costs. On the one hand, if consumers actually misjudge the effectiveness of climate-friendly actions, such information would help them to realistically estimate the consequences of their actions, and to accordingly set priorities to change behaviors. Thus, consumers would, for instance, be reminded that avoiding flights has a greater impact on climate mitigation than recycling. On the other hand, knowledge about the actions' actual climate benefit would impede the strategy to reduce cognitive dissonance by dismissing more costly climate-friendly actions as ineffective.

For high-cost behaviors, such as reduction of car use, it seems to be difficult to motivate consumers to change their behavior by appealing to their concern about climate change. As high personal costs prevent people from acting according to their attitudes, it seems more important to focus on how consumers perceive the costs and inconveniences of climate-friendly behavior and their estimation of its associated climate benefit. Changing the perception of costs and inconveniences might be challenging but could substantially increase people's willingness to change their mobility behavior.

As political affiliation was another important predictor, it seems important to reach people on the right wing of the political spectrum. This might be challenging, as this group probably tends to distrust many information sources, such as scientists or environmentalists. Like skeptics, this group may be more approachable with arguments that are in line with their values (Leiserowitz, 2007a). For instance, the economic opportunities of technological innovations could be highlighted. Another possibility would be to address the dependence on other countries for fossil fuel.

For future research, it might be interesting to examine how information about the actual climate benefit associated with climate-friendly actions influences consumers' willingness to act. Furthermore, it could be worthwhile to investigate how an intervention could reduce the perceived costs of climate-friendly actions (Zia & Todd, 2010).

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References

Andersson, M., & von Borgstede, C. (2010). Differentiation of determinants of low-cost and high-cost recycling. *Journal of Environmental Psychology, 30*(4), 402–408.

Balderjahn, I. (1988). Personality variables and environmental attitudes as predictors of ecologically responsible consumption patterns. *Journal of Business Research, 17*(1), 51–56.

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology, 27*(1), 14–25.

BFS. (2009). *Statistisches Lexikon der Schweiz (ESPOP)*. [*Statistical lexicon of Switzerland*]. Neuchâtel, Switzerland: Bundesamt für Statistik.

Bord, R. J., Fisher, A., & O'Connor, R. E. (1998). Public perceptions of global warming: United States and international perspectives. *Climate Research, 11*(1), 75–84.

Bord, R. J., O'Connor, R. E., & Fisher, A. (2000). In what sense does the public need to understand global climate change? *Public Understanding of Science, 9*(3), 205–218.

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research and Evaluation, 10*, 1–9.

Crompton, T., & Thørgersen, J. (2009). *Simple & painless? The limitations of spillover in environmental campaigning*. Godalming, Surrrey, UK: World Wildlife Federation.

Diekmann, A., & Meyer, R. (2008). *Klimawandel, ökologische Risiken und Umweltbewusstsein in der Schweizerischen Bevölkerung. Kurzbericht*. [*Climate change, ecological risks and environmental awareness in the Swiss public. Short report*]. Zurich: Chair of Sociology, ETH Zurich.

Diekmann, A., & Preisendörfer, P. (1998). Environmental behavior: Discrepancies between aspirations and reality. *Rationality and Society, 10*(1), 79–102.

Diekmann, A., & Preisendörfer, P. (2003). Green and greenback: The behavioral effects of environmental attitudes in low-cost and high-cost situations. *Rationality and Society, 15*(4), 441–472.

Dunlap, R. E., & McCright, A. M. (2008). A widening gap: Republican and democratic views on climate change. *Environment: Science and Policy for Sustainable Development, 50*(5), 26–35.

Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods, 4*(3), 272–299.

Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford University Press.

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1986/87). Analysis and synthesis of research on responsible environmental behaviour: A meta-analysis. *Journal of Environmental Education, 18*(2), 1–8.

Kaiser, F. G., & Biel, A. (2000). Assessing general ecological behavior: A cross-cultural comparison between Switzerland and Sweden. *European Journal of Psychological Assessment, 16*(1), 44–52.

Kaiser, F. G., Wölfing, S., & Fuhrer, U. (1999). Environmental attitude and ecological behaviour. *Journal of Environmental Psychology, 19*(1), 1–19.

Kaiser, F. G., & Wilson, M. (2000). Assessing people's general ecological behavior: A cross-cultural measure. *Journal of Applied Social Psychology, 30*(5), 952–978.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239–260.

Lee, J. A., & Holden, S. J. S. (1999). Understanding the determinants of environmentally conscious behavior. *Psychology & Marketing, 16*(5), 373–392.

Leiserowitz, A. (2006). Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Climatic Change, 77*(1), 45–72.

Leiserowitz, A. (2007a). Communicating the risks of global warming: American risk perceptions, affective images, and interpretive communities. In S. Moser, & L. Dilling (Eds.), *Creating a climate for change* (pp. 44–63). New York, NY: Cambridge University Press.

Leiserowitz, A. (2007b). Global public perception, opinion, and understanding of climate change: Current patterns, trends, and limitations. *Thematic paper for: Human development report 2007: Climate change and human development – Rising to the challenge*. United Nations Development Program. Retrieved 22.10.2008, from http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/leiserowitz_anthony.pdf.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., & Smith, N. (2011a). *Climate change in the American mind: Americans' global warming beliefs and attitudes in May 2011*. New Haven, CT: Yale University and George Mason University.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., & Smith, N. (2011b). *Global warming's six Americas, June 2010*. New Haven, CT: Yale University and George Mason University.

Lindley, D. V., & Scott, W. F. (1984). *New Cambridge statistical tables*. Cambridge: University Press.

Lorenzoni, I., Nicholson-Cole, S., & Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global Environmental Change, 17*(3–4), 445–459.

Lorenzoni, I., & Pidgeon, N. (2006). Public views on climate change: European and USA perspectives. *Climatic Change, 77*(1), 73–95.

McCarty, J. A., & Shrum, L. J. (2001). The influence of individualism, collectivism, and locus of control on environmental beliefs and behavior. *Journal of Public Policy & Marketing, 20*(1), 93–104.

Minton, A. P., & Rose, R. L. (1997). The effects of environmental concern on environmentally friendly consumer behavior: An exploratory study. *Journal of Business Research, 40*(1), 37–48.

Moser, S. C. (2007). More bad news: The risk of neglecting emotional responses to climate change information. In S. C. Moser, & L. Dilling (Eds.), *Creating a climate for change: Communicating climate change and facilitating social change* (pp. 64–80). New York, NY, US: Cambridge University Press.

Moser, S. C., & Dilling, L. (2004). Making climate hot. *Environment: Science and Policy for Sustainable Development, 46*(10), 32–46.

Ngo, A.-T., West, G. E., & Calkins, P. H. (2009). Determinants of environmentally responsible behaviours for greenhouse gas reduction. *International Journal of Consumer Studies, 33*(2), 151–161.

O'Connor, R. E., Bord, R. J., & Fisher, A. (1999). Risk perceptions, general environmental beliefs, and willingness to address climate change. *Risk Analysis, 19*(3), 461–471.

O'Connor, R. E., Bord, R. J., Yarnal, B., & Wiefek, N. (2002). Who wants to reduce greenhouse gas emissions? *Social Science Quarterly, 83*(1), 1–17.

Poortinga, W., Pidgeon, N. F., & Lorenzoni, I. (2006). *Public perception of nuclear power, climate change and energy options in Britain: Summary findings of a survey conducted during October and November 2005. Technical report*. Norwich: Center for Environmental Risk.

Poortinga, W., Steg, L., Vlek, C., & Wiersma, G. (2003). Household preferences for energy-saving measures: A conjoint analysis. *Journal of Economic Psychology, 24*(1), 49–64.

Read, D., Bostrom, A., Morgan, M. G., Fischhoff, B., & Smuts, T. (1994). What do people know about global climate change? 2. Survey studies of educated laypeople. *Risk Analysis, 14*(6), 971–982.

Reynolds, T. W., Bostrom, A., Read, D., & Morgan, M. G. (2010). Now what do people know about global climate change? Survey studies of educated laypeople. *Risk Analysis*.

Royall, R. M. (1986). The effect of sample size on the meaning of significance tests. *The American Statistician, 40*(4), 313–315.

Semenza, J. C., Hall, D. E., Wilson, D. J., Bontempo, B. D., Sailor, D. J., & George, L. A. (2008). Public perception of climate change: Voluntary mitigation and barriers to behavior change. *American Journal of Preventive Medicine, 35*(5), 479–487.

Sheeran, P. (2002). Intention–behavior relations: A conceptual and empirical review. *European Review of Social Psychology, 12*, 1–36.

Smith-Sebasto, N. (1992). The revised perceived environmental control measure: A review and analysis. *Journal of Environmental Education, 23*(2), 24–33.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309–317.

Stern, P. C. (1992). Psychological dimensions of global environmental change. *Annual Review of Psychology, 43*(1), 269–302.

Swim, J., Clayton, S., Doherty, T., Gifford, R., Howard, G., Reser, J., et al. (2009). *Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges*. Washington, DC: American Psychological Association.

Thøgersen, J. (2004). A cognitive dissonance interpretation of consistencies and inconsistencies in environmentally responsible behavior. *Journal of Environmental Psychology, 24*(1), 93–103.

Whitmarsh, L. (2009). Behavioural responses to climate change: Asymmetry of intentions and impacts. *Journal of Environmental Psychology, 29*(1), 13–23.

Zia, A., & Todd, A. M. (2010). Evaluating the effects of ideology on public understanding of climate change science: How to improve communication across ideological divides? *Public Understanding of Science, 19*(6), 743–761.