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Introducing and testing the personal-collective-governmental efficacy typology: How personal, collective, and governmental efficacy subtypes are associated with differential environmental actions

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ABSTRACT

Efficacy beliefs are pivotal for pro-environmental actions but conceptualized and labeled differently across research lines. Based on research from multiple fields in the social sciences, this paper presents a complete synthesis of how seven efficacy beliefs relate to pro-environmental action in the Personal-Collective-Governmental typology (PCG). The goal of this typology is to bridge social science disciplines, spark future research, and help explain environmentally significant behavior. A cross-sectional study ($N = 556$) confirms, using CFA, that seven efficacy subtypes can be discerned. Further, we used the typology to investigate how the seven efficacy subtypes are associated with a range of pro-environmental actions. OLS regressions showed that different efficacy subtypes are associated with different classes of pro-environmental action (e.g., private sphere behavioral intentions, public sphere behavioral intentions, private sphere policy support, and public sphere policy support). Supplemental Relative Importance Analyses gave an indication of which efficacy subtypes are most important for the different classes of pro-environmental action. This new PCG classification generates novel predictions and enables researchers to select fitting efficacy interventions for specific behaviors.

1. Introduction

Environmental problems are rooted in human actions, and behavior change interventions are key to remediation. Vital in instigating and maintaining environmental behavior change is what people believe they are capable of doing (i.e., efficacy beliefs) and achieving (response efficacy beliefs; Bandura, 1977). This article brings together research on efficacy and response efficacy beliefs from fields like environmental communication, environmental psychology, green marketing, and behavior change in a typology. The overarching goals of a typology are to integrate across disconnected streams of literature and facilitate knowledge exchange between these fields (Fransen, Verlegh, Kirmani, & Smit, 2015).

To date, no encompassing overview of the different efficacy subtypes exists, in part because of conflicting and overlapping terms across research programs. *Efficacy* beliefs reflect the capability of engaging in action and *response efficacy* beliefs represent the effectiveness of this behavior for addressing the problem (Bandura, 1977, 1995; Koletsou & Mancy, 2011). For example, an individual might believe they are capable of voting for conservation policies (high *efficacy*) but think that voting is ineffective at creating change (low *response efficacy*). Most early behavior change research focused on how personal efficacy and personal response efficacy beliefs related to individual behaviors (Fishbein & Ajzen, 1975; Rogers, 1975; Witte, 1992). However, since groups of individuals, society, organizations, and governments are major causes and necessary components of addressing environmental problems, research started to focus also more on collective and governmental (response) efficacy beliefs (Chater & Loewenstein, 2022; Chen, 2015; Hart & Feldman, 2016; Homburg & Stolberg, 2006).

This led to new efficacy subtypes being studied, and new confusion between similar concepts and terms. In different streams of research similar efficacy subtypes are called different terms. For example, personal response efficacy, outcome expectancy, and perceived consumer

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effectiveness are used interchangeably, which can be confusing. A few studies included multiple efficacy subtypes (Choi & Hart, 2021; Doherty & Webler, 2016; Hamann & Reese, 2020; Lubell, 2002). For example, Doherty and Webler (2016) looked at personal efficacy, personal response efficacy, collective efficacy and collective response efficacy and their respective associations with public-sphere behaviors. Building on this, Choi and Hart (2021) investigated the associations between the same four efficacy subtypes on willingness to save energy and climate change policy support. However, there is a general lack of research simultaneously conceptualizing beliefs on a personal, collective, as well as governmental level. Such work is needed to clarify how the many efficacy terms (seven subtypes have been defined in the literature that can be subsumed under the personal, collective, or governmental level) relate and differ and to determine where aggregation is appropriate. To this end, we present a comprehensive typology in seven efficacy subtypes: the Personal-Collective-Governmental (PCG) typology (see Fig. 1).

Developing effective behavior change interventions depends on knowing which type of efficacy to target, and this will likely depend on the type of action. Therefore, we also investigate how the seven efficacy subtypes identified in the PCG typology differentially relate to different classes of pro-environmental actions. Both pro-environmental behavior and policy support are vital for achieving actual climate change mitigation (Ockwell, Whitmarsh, & O'Neill, 2009). That is, whereas individuals' pro-environmental behaviors can have direct, albeit small effects (e.g., conserving energy), governmental policy (e.g., energy use regulations) can affect actions through millions of people and organizations (Doherty & Webler, 2016; Stern, 2000). In addition, behavior and support can take place in the private or the public sphere (Stern, 2000) and actions in these spheres might be driven by different efficacy subtypes. So far, it is impossible to give clear guidelines on which efficacy subtypes behavior change interventions should focus on when motivating positive behavior change. Therefore, we investigate the associations between the efficacy subtypes and behavioral intentions as well as policy support in both the private and the public spheres.

In sum, the current paper has the following aims:

Aim 1: Create a novel typology of efficacy subtypes.

Aim 2: Test how the classes of pro-environmental action relate to the efficacy subtypes.

1.1. Efficacy subtypes and pro-environmental actions

Many behavior change models state that efficacy and response efficacy beliefs help explain individual pro-environmental actions (Bandura, 1977, 1995; Fishbein & Ajzen, 1975; Rogers, 1975; Rosenstock, 1974a, 1974b). Typically, these models underline that people need to both 1) perceive environmental problems as a *threat* and 2) believe they have the *efficacy* and *response efficacy* to cope with the threat (Lazarus & Folkman, 1984; Rogers, 1975; Witte, 1992). Both are necessary factors for action, if people do not feel that environmental problems are a threat, there is no need to act. Sometimes people perceive a threat but believe that they lack response efficacy to cope, such as when an individual reacts to catastrophic and preventable climate change with inaction. In these cases, people may avoid, ignore, or reject the danger of environmental problems (i.e., motivated reasoning, Kunda, 1990; e.g., derogating the message, skepticism, Witte, 1992). Therefore, to stimulate adaptive responses such as engaging in pro-environmental behaviors and supporting pro-environmental policy (Hoekstra & Wiedmann, 2014), it is vital that people have strong efficacy and response efficacy beliefs in addition to threat perceptions (Rogers, 1975; Witte, 1992; Witte & Allen, 2000).

These efficacy and response efficacy beliefs have been studied for environmental behavior change on three levels: personal, collective, and governmental. Previous research most often focuses only on efficacy subtypes subsumed under the personal level, whereas beliefs subsumed under the collective and governmental level may be just as important. Furthermore, previous research sometimes conflates multiple efficacy subtypes. For example, it is difficult to determine the relative impact of collective efficacy vs collective response efficacy because most studies conflate these concepts during operationalization. Some studies label the concept 'collective efficacy' but conceptualize and measure collective response efficacy instead (see Doherty & Webler, 2016 for a similar argument). In addition, different streams of research have labeled the same efficacy concepts differently, making it difficult to build cumulative findings and comparisons across fields. Next, we describe the seven efficacy subtypes as defined in the literature and their key findings. By doing so, we provide a framework for organizing the different efficacy subtypes, which can serve as a point of departure for future research.

1.2. Personal-collective-government efficacy typology (PCG)

In this new typology (Fig. 1), we distinguish between seven efficacy subtypes: personal, personal response, collective, collective response, internal governmental, external governmental, and governmental response. The next section details the different subtypes as previously defined in the literature.

1.2.1. Personal efficacy and personal response efficacy

Originally, behavior change models mostly focused on personal (response) efficacy beliefs in predicting behavior change. Models like the Cognitive Theory of Stress (Lazarus & Folkman, 1984), Extended Parallel Process Model (Witte, 1992), Protection Motivation Theory (Rogers, 1975), and the Social Cognitive Model (Bandura, 1977) distinguish between the perceived capability to engage in pro-environmental action, *personal efficacy* (Bandura, 1977; also referred to as perceived behavioral control and self-efficacy in the literature), and the belief that their pro-environmental actions can make a difference and provide a solution to the problem, *personal response efficacy* (Bandura, 1977; also referred to as perceived consumer effectiveness and outcome expectancy in the literature). Strong personal efficacy beliefs are associated with more recycling behavior (Tabernero & Hernández, 2011), following a plant-based diet (Urbanovich & Bevan, 2020) and pro-environmental actions in general (Estrada, Schultz, Silva-Send, & Boudrias, 2017; Meinhold & Malkus, 2005). Moreover, strong personal response efficacy beliefs are associated with an increase in pro-environmental purchase behaviors (Cojuharenco, Cornelissen, & Karelaia, 2016) and an increase in clothing recycling intentions (Meijers, Remmelswaal, & Wonneberger, 2019). Furthermore, both personal efficacy and personal response efficacy beliefs are associated with climate-friendly behavioral intentions (Rainear & Christensen, 2017).

However, not all studies found such a positive relationship between personal (response) efficacy beliefs and pro-environmental actions (Ellen, Wiener, & Cobb-Walgren, 1991; Homburg & Stolberg, 2006; Lam, 2006). One explanation for null findings is that environmental issues are a so-called collective problem. While acting in a pro-environmental way is often costly and time consuming for the individual, it mainly benefits society and the benefits only occur when many people act together. As such, personal beliefs may be more strongly linked to individual problems such as personal health and collective beliefs more strongly linked to collective problems such as environmental issues (Chen, 2015; Fritsche, Barth, Jugert, Masson, & Reese, 2018; Homburg & Stolberg, 2006; Jugert et al., 2016; Van Zomeren, Postmes, & Spears, 2008; Van Zomeren, Spears, & Leach, 2010).

1.2.2. Collective efficacy and collective response efficacy

Recent behavior change models sometimes include a collective component, such as the Social Identity Model of Collective Action (SIMCA; Van Zomeren et al., 2008) and the Social Identity Model of

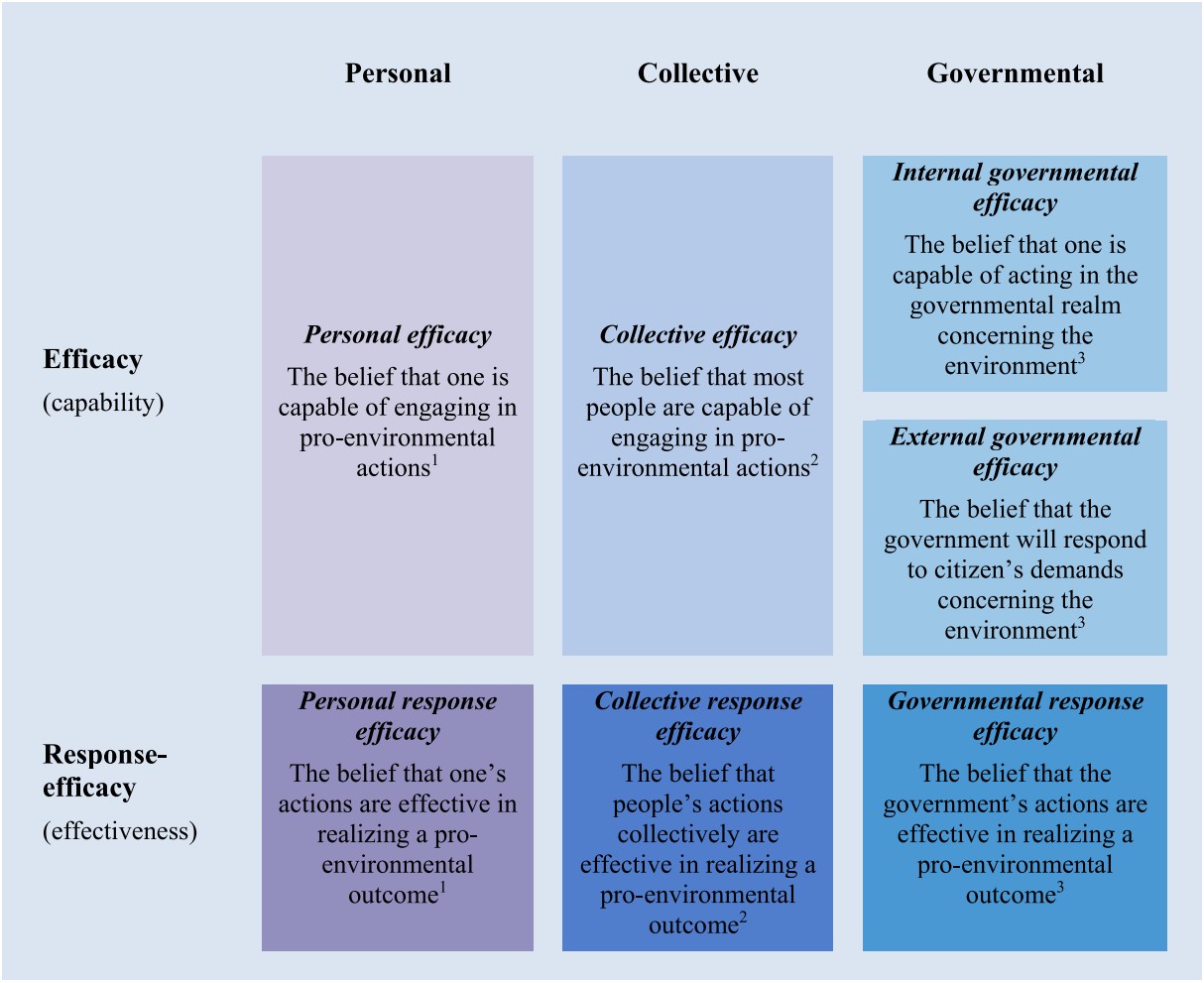

Fig. 1. The personal collective governmental efficacy beliefs typology (PCG) [1]Witte, 1992, [2]Koletsou & Mancy, 2011, [3]Hart & Fieldman, 2016.

Pro-Environmental Action (SIMPEA; Fritsche et al., 2018). Strong beliefs about the (response) efficacy of the collective[3] have been associated with pro-environmental actions (e.g., Barth, Jugert, & Fritsche, 2016; Chen, 2015; Doherty & Webler, 2016; Homburg & Stolberg, 2006; Jugert et al., 2016; Morton, Rabinovich, Marshall, & Bretschneider, 2011; Roser-Renouf, Maibach, Leiserowitz, & Zhao, 2014; Thaker, Howe, Leiserowitz, & Maibach, 2019; Van Zomeren, Spears, & Leach, 2010; Van Zomeren, Leach, & Spears, 2010). Here, we distinguish between people's beliefs about the collective's capability to engage in pro-environmental actions (*collective efficacy*) and people's beliefs in the effectiveness of collective pro-environmental actions (*collective response efficacy;* also referred to as collective outcome expectancy, as well as community and group response efficacy).

Research on collective efficacy beliefs (i.e., capability) is scarce and mostly cross-sectional. It shows that collective efficacy is associated with willingness to reduce private energy use behavior (Choi & Hart, 2021), but not with support for raising taxes and new legislation (Choi & Hart, 2021), nor protesting, voting, or volunteering (Doherty & Webler, 2016). Research on collective response efficacy beliefs (i.e., effectiveness) is more common and shows that stronger collective response efficacy beliefs are associated with a higher willingness to pay an eco-tax while going on holiday (Doran, Hanss, & Larsen, 2015), a higher willingness to engage in pro-environmental behavior at work (Homburg & Stolberg, 2006), a higher willingness to participate in neighborhood initiatives for climate protection (Rees & Bamberg, 2014), and are associated with engaging in private-sphere and public-sphere actions, such as using alternatives to the car, trying to waste less energy and pro-environmental voting, volunteering, and protesting (Chen, 2015; Doherty & Webler, 2016).[4]

1.2.3. Internal governmental efficacy, external governmental efficacy, and governmental response efficacy

Since both individual and system change are vital for alleviating environmental problems, scholars also started focusing more on the role of governmental (response) efficacy beliefs (also referred to as political efficacy beliefs)[5] in environmental behavior change. Although the

[3] In the literature, researchers refer to different groups when referring to "the collective." Some researchers refer to a specific group of people (e.g., people under 30; Jugert et al., 2016, Study 1), whereas others refer to society (e.g., Most people; Koletsou & Mancy, 2011), and yet others also include a reference to the government (e.g., Doherty & Webler, 2016; Van Zomeren, Spears, & Leach, 2010, S2). We adopt the operationalization of the collective referring to society.

[4] Please note that in some of these studies the term "collective efficacy" is used while referring to "collective response efficacy".

[5] We chose *governmental efficacy beliefs* instead of political efficacy beliefs in line with an early study on conservation (Lubell, 2002), because the key processes here are about how citizens relate to the government as an organization, rather than the specific political processes. We use government here to refer to the organization as a whole and the entire political decision-making system.

governmental efficacy subtypes are less often studied in environmental behavior change research, there is some environmental communication research showing the importance of the concept (e.g., Hart & Feldman, 2016). Managing environmental problems might exceed the capacities of individuals even when acting in a collective. Instead, management of environmental problems may depend on the capabilities and effectiveness of governments. Governments have a large impact on the environment, by developing, executing, and enforcing regulations and policies related to the environment, but also by taking part in global environmental measures, such as the Kyoto Protocol and the Paris Agreement. Because of the large influence of governments on the regulation of pro-environmental actions, people's governmental beliefs appear to affect willingness to engage in pro-environmental actions (Lubell, 2002).

We also distinguish between efficacy (capability) and response efficacy (effectiveness) beliefs on the governmental level. In contrast to the personal and collective levels, governmental efficacy has two subtypes: *Internal governmental efficacy* refers to the perceived personal capability to understand governmental organizations and act in the governmental realm (e.g., voting for environmental regulations), and *external governmental efficacy* refers to people's beliefs about the government's capability to be responsive to citizen demands (Balch, 1974; Feldman, Hart, Leiserowitz, Maibach, & Roser-Renouf, 2017; Gil de Zúñiga, Diehl, & Ardévol-Abreu, 2017; Hart & Feldman, 2016; Morrell, 2003; Niemi, Craig, & Mattei, 1991). This split in internal and external efficacy beliefs is done because the perceived capability to engage in environmental action in the governmental realm depends on both the person's own perceived capability to act in the governmental realm and the perceived responsiveness of the government to act on those demands (Balch, 1974). Finally, the third sub-type, *governmental response efficacy* refers to people's beliefs in the effectiveness of governmental pro-environmental actions (Lubell, 2002). It would not be enough to believe oneself capable of acting in the governmental realm and the government capable of listening to citizens demands, if the government was then ineffective in addressing environmental issues (Feldman & Hart, 2016; Hart & Feldman, 2016; Lubell, 2002).

Research shows that governmental response efficacy is related to pro-environmental actions such as supporting fines, taking part in clean-up projects, and voting behavior (Lubell, 2002), whereas external governmental efficacy is unrelated to pro-environmental actions such as being member of an environmental group and signing a petition (Lubell, 2002) or to climate change activism (Feldman et al., 2017). In contrast, another study found that all three governmental efficacy subtypes are related to pro-environmental actions such as contacting government officials and signing a petition (Hart & Feldman, 2016). Efficacy beliefs about governments may be an important cause of pro-environmental actions, but the literature so far is scarce and has mixed findings. Now we have discussed the different efficacy subtypes, we will detail in the next section how these subtypes might relate to different types of pro-environmental actions.

1.3. Types of pro-environmental action

It remains unknown what efficacy subtypes drive individuals to engage in environmentally significant actions. Until now, most studies on efficacy subtypes look at either pro-environmental behavior (Chen, 2015; Homburg & Stolberg, 2006) or policy support (Doherty & Webler, 2016), and very few addressed both (Choi & Hart, 2021). Furthermore, no study has investigated all seven efficacy subtypes concerning the different types of actions.

We distinguish four classes of environmental actions. First, we consider *private* vs *public sphere* actions. Classifying pro-environmental actions in private and public sphere is one of the most common classifications since Stern, Dietz, Abel, Guagnano, and Kalof (1999) showed that these actions are empirically distinct (Chen, 2015; Homburg & Stolberg, 2006; Hunter, Hatch, & Johnson, 2004; Lauren, Smith, Louis, & Dean, 2018; Lu, Liu, Chen, Long, & Yue, 2017; Stern, 2000). Furthermore, we distinguish between *behaviors* and *support* (Hall, Lewis, & Ellsworth, 2018; Hart, 2011; Stern, 2000; Stern et al., 1999). Whereas behaviors entail active participation in pro-environmental actions to reduce environmental harm, support concerns accepting and endorsing pro-environmental policies. This yields four classes: private sphere behavioral intentions, public sphere behavioral intentions, private sphere support, and public sphere support.

Private sphere behaviors include behaviors such as conserving water or recycling garbage at home, thus within the household (Stern et al., 1999). Public sphere behaviors include behaviors such as donating to an environmental organization or being an active member within such an environmental organization (Doherty & Webler, 2016; Stern et al., 1999). Private sphere support entails the willingness to support governmental regulations that require oneself to conserve energy or adapt behavior (e.g., ban on incandescent light bulbs) or pay more taxes personally to support pro-environmental governmental actions (e.g., constructing wildlife crossings, Stern et al., 1999; Zahran, Brody, Grover, & Vedlitz, 2006), whereas public sphere support entails supporting government regulations that require pro-environmental action from companies and industries – that is, focused on large organizations, companies, businesses, and so forth (Hart, 2011; Hart & Nisbet, 2012; Milfont & Duckitt, 2010; Zahran et al., 2006).

All four classes of actions are important in their own right. Private-sphere pro-environmental behaviors have direct, albeit very small effects, that only significantly contribute to solving environmental problems when many people regularly engage in these behaviors. In contrast, public sphere behaviors and private and public sphere support have indirect but often large effects that can mobilize large groups of people, organizations, and/or governments (Stern, 2000). These different classes of action might be linked to different predictors, such as efficacy sub-types.

1.4. Relative importance of efficacy subtypes for pro-environmental actions

We suggest that the importance of the efficacy subtypes will depend on the type of pro-environmental action. There may be a direct correspondence between the level under which the efficacy subtype is subsumed (personal, collective, governmental) and the type of actions. For example, private sphere actions (both behavior and support) take place in the personal realm, and therefore personal efficacy and personal response efficacy may be central for those actions (Hamann & Reese, 2020; Reese & Junge, 2017). This is in line with the findings of multiple studies that have looked at the effects of personal (response) efficacy beliefs on private sphere pro-environmental actions (e.g., Cojuharenco et al., 2016; Ho, Liao, & Rosenthal, 2015; Lauren et al., 2018; Lee, Haley, & Yang, 2019; Lubell, Zahran, & Vedlitz, 2007). Correspondingly, we expect that collective efficacy and collective response efficacy will be especially linked to public-sphere actions, consistent with previous findings that collective (response) efficacy beliefs connect to public sphere pro-environmental actions (Chen, 2015; Doherty & Webler, 2016; Rees & Bamberg, 2014; Roser-Renouf et al., 2014; Van Zomeren, Spears, & Leach, 2010; Van Zomeren, Pauls, & Cohen-Chen, 2019).

However, previous studies also showed that efficacy types can be related to unrelated classes of behavior. For example, collective (response) efficacy beliefs are linked to private sphere pro-environmental actions (Chen, 2015; Doran et al., 2015; Homburg & Stolberg, 2006; Jugert et al., 2016; Morton et al., 2011; Rees & Bamberg, 2014; Reese & Junge, 2017). This could be explained by the tragedy of the commons. Private sphere actions are only effective if done by many, hence collective (response) efficacy beliefs may play a role. Additionally, personal (response) efficacy beliefs are linked to public sphere pro-environmental actions (Chen, 2015; Doherty & Webler, 2016; Lauren et al., 2018; Lubell, 2002). Perhaps collectives need to be perceived as effective and the individual as capable of contributing to collective efforts in order to remedy environmental problems (see also Van Zomeren, Saguy, & Schellhaas, 2013).

We expect that governmental efficacy subtypes will be most related to policy support because policies, taxes, and regulations are governmental processes. This hypothesis has only been tested in one study, which looked at the effects of governmental response efficacy beliefs on a composite pro-environmental actions scale (private and public sphere behaviors and support; Lubell, 2002). However, there are some hints. Perceived policy effectiveness is related to governmental response efficacy, and shows a positive relationship with policy support (Akter & Bennett, 2011; Drews & Van den Bergh, 2016). Also, governmental internal and external efficacy and governmental response efficacy beliefs have been linked to public sphere environmental behavior (Hart & Feldman, 2016).

In sum, the relationships between efficacy subtypes and behavior classes are unclear. To date, no research has investigated all these relationships at once. The current work will contribute to the field by revealing the relative importance of these subtypes and informing interventions for specific pro-environmental actions (e.g., to enhance private sphere policy support).

Research question: Which of the seven efficacy subtypes (Fig. 1) is most strongly associated to the four pro-environmental behavior classes (private vs. public; intentions vs. behavior)?

We conducted a cross-sectional study to answer our RQ. While doing so, we controlled for perceived environmental threat. As said before, to stimulate pro-environmental actions, it is vital that people have strong efficacy and response efficacy beliefs *in addition to* threat perceptions (Rogers, 1975; Witte, 1992; Witte & Allen, 2000) – as without perceiving a problem, there is no need to act pro-environmental in order to solve the problem.

2. Method

2.1. Participants and design

We recruited participants from the Dutch panel of the market research company Survey Sampling International. Participants took part in an online study that included the current survey. The study was approved by the university's ethical review board (PC-8615), and all materials and data are available on the Open Science Framework including a pilot test. The sample was nationally representative for age, education, and gender. After data cleaning, the sample largely reflected the Dutch population for age ($M = 42.9$, $SD = 13.01$), gender (51.4% female, 48.4% male, 0.2% non-binary or other), and education (7-point scale ranging from primary education to master or equivalent; mode = 31.5% intermediate vocational education; median = upper secondary education; $M = 4.71$, $SD = 1.45$). Sample size was determined by power analyses and the available budget. For the whole OLS regression model, we expected a medium effect size ($f^2 = 0.15$). For investigating what each subtype of efficacy individually adds to the OLS model, we expected a small effect size ($f^2 = 0.02$). Using $\alpha = 0.05$ and power = .80 this led to a required sample size of $N = 109$ and $N = 485$ respectively using GPower (Faul, Erdfelder, Lang, & Buchner, 2007), so we aimed for $N = 500$. We made exclusions to improve response quality and then resampled. We took out the speeders (less than 33% of the median time spent) and straight-liners (no variation in more than 75% of the blocks; Greszki, Meyer, & Schoen, 2014; Zhang & Conrad, 2014). In total, 628 participants filled out the survey and after removing the speeders and straight-liners, 556 participants remained.

2.2. Procedure

After providing informed consent, participants completed the questions regarding the seven efficacy subtypes. The order of the questions was randomized within each block (i.e., each of the seven subtypes). After, participants completed filler questions (i.e., concerning identity and values) before answering the dependent variables regarding pro-environmental actions (i.e., private and public sphere behavior and private and public sphere support). After some other filler questions (for a different project), perceived threat of environmental problems was assessed. Lastly, participants reported their demographic characteristics and could leave remarks.

2.3. Measures

We constructed eight items to assess each of the seven efficacy and four environmental action constructs based on previous research. We adapted existing items for the current study and we refer to the papers our items are based on below. All items were scored on a Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). See Appendix A for all items and Cronbach's alphas.

2.3.1. Personal efficacy and personal response efficacy

To measure personal efficacy, we focused on people's capability to engage in pro-environmental actions using items like: *I think I know how I can save energy in everyday life* (Lauren et al., 2018; Tabernero, Hernández, Cuadrado, Luque, & Pereira, 2015; Tabernero & Hernández, 2011). To measure personal response efficacy, we focused on the effectiveness of people's personal pro-environmental actions, using items like: *By saving energy, I can help solve environmental problems* (Antonetti & Maklan, 2014; Ellen et al., 1991; Van Zomeren, Spears, & Leach, 2010).

2.3.2. Collective efficacy and collective response efficacy

We adapted the personal efficacy items by referring to e.g., 'most people' and 'we' rather than 'I', in line with the definition that collective efficacy refers to an individual's belief about the capability of most people to engage in pro-environmental actions (Koletsou & Mancy, 2011), for example: *It is easy for most people to save energy*. Collective response efficacy refers to belief in the effectiveness of collective pro-environmental actions and was measured with items like: *I think that by working together we can solve environmental problems* (Doran et al., 2015; Jugert et al., 2016; Van Zomeren, Spears, & Leach, 2010).

2.3.3. Internal governmental efficacy, external governmental efficacy, and governmental response efficacy

Internal governmental efficacy, which refers to people's beliefs concerning their capability to act in the governmental realm, was measured with items like: *I consider myself expert enough to discuss recycling issues with a government official* (Feldman et al., 2017; Gil de Zúñiga et al., 2017; Hart & Feldman, 2016). External governmental efficacy refers to people's beliefs concerning the responsiveness of the government to their demands and was measured with items like: *People like me have a say about what the government does to limit the use of natural resources* (Feldman et al., 2017; Gil de Zúñiga et al., 2017; Hart & Feldman, 2016). Last, governmental response efficacy refers to the belief that governmental policy can effectively address environmental problems and was measured with items like: *If government officials were to pass laws to reduce the usage of natural resources, it would help protect the environment* (Hart & Feldman, 2016).

2.3.4. Pro-environmental actions

Private sphere behavioral intentions were measured with items like: *I am willing to recycle more whenever possible* (Milfont & Duckitt, 2010; Minton & Rose, 1997). Public sphere behavioral intentions were measured with items like: *If I ever get extra income, I will donate some money to an environmental organization that promotes energy savings* (Milfont & Duckitt, 2010; Minton & Rose, 1997). Private sphere support was measured with items like: *I am willing to follow government regulations to save energy, such as using energy-efficient equipment* (Minton & Rose, 1997). Lastly, public sphere support was measured with items like: *I am willing to support the government's decisions in controlling the amount of energy that should be saved by organizations* (Milfont & Duckitt, 2010).

2.3.5. Environmental threat

To be able to control for participant's perceived environmental

threat, we used six items of the environmental threat sub-scale of the short environmental attitudes inventory (Milfont & Duckitt, 2010). Since the six items together showed a poor fit (see Supplement), we used three non-reverse coded items like: *If things continue on their present course, we will soon experience a major ecological catastrophe*.

2.4. Analysis Strategy

First, we used confirmatory factor analysis (CFA) to investigate 1) convergent validity (whether the items measured the same construct) and 2) discriminant validity (whether we could empirically distinguish the concepts from each other). Given the large number of parameters (Jackson, 2003; Kline, 2011), we performed the measurement model in steps before looking at the full efficacy model (with all seven efficacy subtypes but without behaviors, policy support, and environmental threat) and the full measurement model. The results of these models should be cautiously interpreted given the free parameter/sample size ratios. However, the results of the full efficacy model (encompassing all seven efficacy subtypes) and full model are in line with all the sub-models (see the Supplement), which provides a robustness check for the main findings.

We used multiple indices to estimate the model fit: chi-square values (although they can be expected to be significant, given the relatively large sample; Kenny, n.d.); CFI values, which should be above 0.95 for a good fit and above 0.90 for an acceptable fit; and RMSEA values, which should be below 0.06 (with the upper bound of the 90% confidence interval below 0.10 and the PCLOSE value non-significant) to indicate a close fit (Kenny, n.d.; Kline, 2011).

Based on the results of the CFA structure, we used the factors to predict environmental actions. Generally, in SEM the relational analysis is done by turning the CFA model into a structural regression model, but as stated above this would lead to problems with the free parameter/sample size ratio. Thus, we manually constructed the factors and used them as observed variables in the structural part to make the results more reliable (Kline, 2011). We calculated the value of each type for each respondent by taking the unweighted mean of the item loading on each factor because these results are easier to interpret. The correlation between the weighted and unweighted means was $r > 0.97$, implying that differences were minimal. Next, we built regression models predicting the four dependent variables and used these models to assess which efficacy subtypes were most strongly associated with the different types of pro-environmental actions.

Lastly, we supplemented the OLS regressions with Relative Important Analyses to be able to establish the relative importance of each of the efficacy subtypes for the different pro-environmental actions (Budescu, 1993; Mizumoto, 2022; Tonidandel & LeBreton, 2011). To do so, we used both dominance analyses (Shapley value) and relative weight analyses (RWA). We used the relimp R extension package for SPSS to run dominance analyses to calculate the Shapley value (IBM, 2022). Lastly, to determine whether the relative importance of the different efficacy subtypes significantly differed from one another, we used relative weight analyses (RWA) and generated confidence intervals using the web-based tool Relative Importance Analysis (Mizumoto n.d.).

3. Results

3.1. Measurement model

3.1.1. Convergent and discriminant validity of the efficacy subtypes

First, we assessed the convergent validity of the efficacy measures. For personal efficacy and collective efficacy, all items loaded on the factors as expected. However, for governmental efficacy some items did not load as expected (see Supplement and Appendix A). There were two items about contacting governmental officials (internal governmental efficacy; Hart & Feldman, 2016) and two items about voting (external governmental efficacy; Gil de Zúñiga et al., 2017) that seemed to tap into a different construct, and one item about overall governmental response efficacy that might have been too general. After taking out these items, model fit increased. Furthermore, an item for personal response efficacy was sub optimally framed so we removed it from the analyses. Creating a model with all efficacy subtypes without the items specified above, led to a fitting model: χ^2 ($df = 1134$) $= 2311.88$, $p < .001$, CFI $= 0.93$, RMSEA $= 0.04$, 90%CI [0.04, 0.05], PCLOSE $= 1.000$. According to Kenny (n.d.) a value of the RMSEA of the independence model below 0.16 would indicate that the CFI is underestimated due to relative low correlations between observed variables. In this model, where we added indicators of several different constructs, the correlations are likely to be lower and indeed the RMSEA of the independence model is 0.16. This indicates that the CFI is likely an underestimate. As it still shows an acceptable fit, this supports the model specification.

Next, we assessed discriminant validity of the seven-factor model. Correlations in the CFA model (i.e., between the factors constructed weighting the items by their factor loadings) ranged between 0.20 (between personal efficacy and external government efficacy) and 0.83 (between personal response efficacy and collective response efficacy). To test discriminant validity, we merged factors, but this always led to significant worsened model fit (please see Table B1). For example, even when merging the factors with the highest correlation, that is personal response efficacy and collective response efficacy, model fit significantly worsened: χ^2_{diff} ($df = 6$) $= 483.73$, $p < .001$, indicating sufficient discriminant validity. This result supports the PCG proposition that these seven types of efficacy are distinct.

3.1.2. Convergent and discriminant validity of the full model

Hereafter, we investigated convergent and discriminant validity for the full model, including the efficacy subtypes, the dependent variables, and environmental threat. One item for private policy support was sub optimally framed, so we removed it for the analyses. The CFA model had a good fit: χ^2 ($df = 3380$) $= 6372.06$, $p < .001$, CFI $= 0.92$, RMSEA $= 0.04$, 90%CI [0.04, 0.04], PCLOSE $= 1.000$. When inspecting discriminant validity, the results again showed that merging factors significantly worsened model fit. The highest correlations were between personal response efficacy and collective response efficacy ($r = 0.83$) and between governmental response efficacy and private sphere policy support ($r = 0.83$). Merging the two factors personal and collective response efficacy significantly worsened model fit: χ^2_{diff} ($df = 11$) $= 474.58$, $p < .001$, this was also the case for merging the factors governmental response efficacy and private sphere policy support χ^2_{diff} ($df = 11$) $= 115.92$, $p < .001$, indicating sufficient discriminant validity. This result once more supports the PCG proposition that these seven types of efficacy are distinct, as well as, that the four classes of pro-environmental action are distinct.

The results of all the sub-models (see Supplement) and the overall model testing of convergent and discriminant validity revealed that the individual items measured the intended constructs and that the resulting latent constructs were distinct. The model can therefore be used for the

Table 1
The most promising PCG efficacy belief subtypes for each behavior class.

Private sphere behavior	1 Collective response 2 Personal response 3 Personal
Public sphere behavior	1 External governmental 2 Governmental response 3 Internal governmental
Private sphere policy support	1 Governmental response
Public sphere policy support	1 Collective response 2 Governmental response 3 Internal governmental 4 Collective

Note. The ranking of significant predictors in the OLS regression is based on relative importance analyses. The first ranked predictor and those that do not significantly differ from the first ranked predictor are mentioned.

structural model analysis and OLS regressions based on the constructed variables for each efficacy subtype from the CFA structure. The factors were constructed by the unweighted means of the items (please see section 2.4 Analysis Strategy).

3.2. Associations between the efficacy subtypes and pro-environmental actions

All seven efficacy subtypes were positively correlated with all four different types of behavior (see Appendix B, Table B.2). We ran OLS regression analyses to test the empirical research question about subtypes and behavior classes while controlling for perceived environmental threat. We report the standardized regression coefficients (β) in the text. Furthermore, we conducted relative importance analyses (dominance analyses and relative weight analyses) to give insights into importance of the seven efficacy subtypes.[6] As a criterium for determining the most important efficacy subtypes, we chose those subtypes that had a significant influence on pro-environmental actions and that did not significantly differ in importance (i.e., overlapping confidence intervals) from the first ranked predictor (see Fig. 2 and Table B.3).

3.2.1. Private sphere behavioral intentions

The OLS regression showed that private sphere behavioral intentions were associated with personal efficacy ($\beta = 0.19$, $p < .001$), personal response efficacy ($\beta = 0.18$, $p < .001$), collective response efficacy ($\beta = 0.30$, $p < .001$), internal governmental efficacy ($\beta = 0.11$, $p = .001$), and governmental response efficacy ($\beta = 0.08$, $p = .026$). In contrast, private sphere behavioral intentions were not associated with collective efficacy ($\beta = 0.06$, $p = .138$), nor external governmental efficacy ($\beta = -0.02$, $p = .593$). When looking at the relative importance analyses to assess rela-

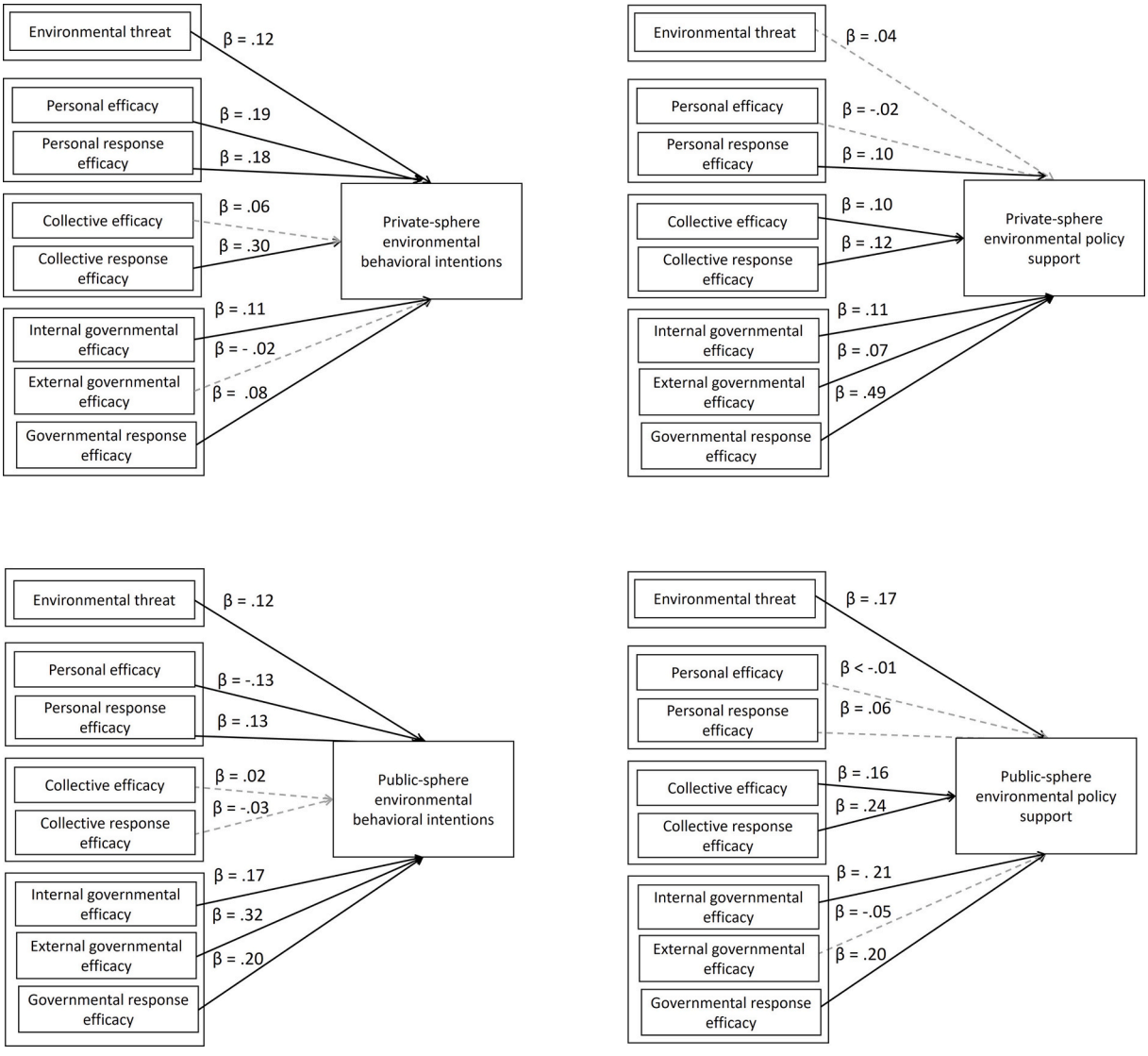

Fig. 2. *OLS Regression Weights between Each Behavior and Efficacy Type*
Note. Beta values are standardized coefficients. Solid lines indicate $p < .05$. N = 556, for full regression table and R^2, please see Table B3.

[6] Please note that since we are interested in the seven efficacy subtypes for the dominance analyses only, we excluded environmental threat from this part of the analysis. Including environmental threat in these analyses as a control variable leads to similar conclusions, please see the Supplements.

tive importance and their accompanying rankings (see Appendix B, Table B3), collective response efficacy (25.7%), personal response efficacy (20.9%), and personal efficacy (19.4%) were the most important predictors. These results are consistent with the idea that private sphere behavioral intentions rely especially on collective response efficacy, and to a lesser extent on personal efficacy and personal response efficacy beliefs.

3.2.2. Public sphere behavioral intentions

Public sphere behavioral intentions were associated with personal efficacy ($\beta = -0.13$, $p = .012$), personal response efficacy ($\beta = 0.13$, $p = .026$), and all governmental efficacy subtypes (internal $\beta = 0.17$, $p < .001$; external $\beta = 0.32$, $p < .001$; response $\beta = .20$, $p < .001$), but not with collective efficacy ($\beta = 0.02$, $p = .673$) or collective response efficacy ($\beta = -0.03$, $p = .575$). The negative relationship between personal efficacy and public sphere behavioral intentions was unexpected and might be due to positive relationships between the different efficacy types (see Discussion). The results of the relative importance analysis show that the most important predictors for public sphere behavioral intentions are external governmental efficacy (37.3%), governmental response efficacy (24.7%), and internal governmental response efficacy (15.8%).

3.2.3. Private sphere policy support

Private sphere policy support was associated with personal response efficacy ($\beta = 0.10$, $p = .020$), collective efficacy ($\beta = 0.10$, $p = .013$), collective response efficacy ($\beta = 0.12$, $p = .006$), internal governmental efficacy ($\beta = 0.11$, $p < .001$), external governmental efficacy ($\beta = 0.07$, $p = .022$), and governmental response efficacy ($\beta = 0.49$, $p < .001$). In contrast, private sphere policy support was unrelated to personal efficacy ($\beta = -0.02$, $p = .660$). The relative importance analysis showed that governmental response efficacy (39.2%) was the most important predictor for private sphere policy support.

3.2.4. Public sphere policy support

Public sphere policy support was associated with collective efficacy ($\beta = 0.16$, $p < .001$), collective response efficacy ($\beta = 0.24$, $p < .001$), internal governmental efficacy ($\beta = 0.21$, $p < .001$), and governmental response efficacy ($\beta = 0.20$, $p < .001$). In contrast, public sphere policy support was not associated with personal efficacy ($\beta = -0.01$, $p = .904$), personal response efficacy beliefs ($\beta = 0.06$, $p = .208$), or external governmental efficacy ($\beta = -0.05$, $p = .120$). When looking at the significant predictors, the relative importance analysis showed that the most important predictors for public sphere policy support were collective response efficacy (22.8%), governmental response efficacy beliefs (16.6%), internal governmental efficacy (16.1%), and collective efficacy beliefs (15.3%).

4. Discussion

Efficacy beliefs appear central to pro-environmental action, but the previous literature was muddled due to inconsistent concept labeling and partial construct coverage. We integrated these findings and proposed the Personal Collective Governmental Efficacy Typology (PCG), highlighting the key distinction between efficacy and response efficacy beliefs on three levels: personal, collective, and governmental. This typology has seven efficacy belief subtypes: personal, personal response, collective, collective response, internal governmental, external governmental, and governmental response. We evaluated this typology using CFA and showed support for seven distinct subtypes. These results bring together disconnected research streams from environmental communication, environmental psychology, green marketing, and behavior change. This clean overview could spark new research into the roles of the seven efficacy subtypes in environmental behavior and communication.

This article also provides early insights into which of the seven efficacy subtypes are most strongly related to engagement in pro-environmental actions including private and public intentions and policy support (see Table 1). As Hornik and Woolf (1999) explain: in order to draw conclusions from cross-sectional studies for interventions, a number of steps should be taken. One of these is testing whether there is a substantial association between the belief and the outcome. Another question is whether the belief can be easily changed and testing the causal relation, something that the current paper does not address. The current findings are therefore primarily suggestions for future research. Below, we discuss which efficacy subtypes to focus on when studying different types of pro-environmental actions. We also offer some initial ideas on how to stimulate these specific efficacy subtypes. Please note that most research about efficacy and environmental actions, including this paper, is cross-sectional (but see e.g., DiRusso & Myrick, 2021). There is a need for experimental manipulations of efficacy subtypes to generate stronger causal evidence.

4.1. Stimulating pro-environmental actions

The current results suggest that private sphere environmental behavioral intentions might be best facilitated through collective response efficacy. Future experimental research could therefore investigate whether this is indeed the case. Collective response efficacy beliefs could be enhanced by messages that focus on the positive environmental social norms (Doherty & Webler, 2016) and messages that strengthen people's social identity and empower them (Fritsche et al., 2018; Van Zomeren et al., 2008). Furthermore, personal response efficacy and personal efficacy were also associated with private sphere intentions. Personal response efficacy beliefs can be stimulated by, e.g., making the environmental impact of people's behavior more visible (Ahn, Fox, Dale, & Avant, 2015; Meijers et al., 2019), whereas personal efficacy beliefs can be stimulated by increasing knowledge e.g. sharing tips and providing education (Michie, Van Stralen, & West, 2011).

When targeting public sphere behavioral intentions, these results suggest focusing on all three subtypes of governmental efficacy beliefs. External governmental efficacy could be enhanced by the government being genuinely responsive to its citizens, as such direct experiences appear most effective in enhancing efficacy belief (Bandura, 1997). Using messages that stress how the government is responsive to public calls for action on environmental problems may be unsuccessful in increasing external governmental efficacy (Hart & Feldman, 2016). More intensive interventions, such as training with workshops and interactive activities led by experienced political social workers might be successful in increasing external governmental efficacy beliefs (Ostrander, Lane, McClendon, Hayes, & Smith, 2017).

Governmental response efficacy, which is also the most important predictor when it comes to private sphere policy support could be stimulated by e.g., showing how the government has been effective in protecting the environment within one's country and across countries like in the Montreal Protocol and fixing the ozone hole. Internal governmental efficacy can be stimulated by messages that stress that most people find it easy to contact the government and that provide examples on how to do this, like writing a letter or sending an e-mail to a government official (Hart & Feldman, 2016). Last, public sphere policy support was most strongly associated with collective response efficacy, internal governmental efficacy, governmental response efficacy, and collective efficacy. Collective efficacy is suggested to be stimulated by group identification and creating a sense of cohesion (Doherty & Webler, 2016), for ideas on how to stimulate the other efficacy subtypes, please see above.

4.2. Future research, implications, and limitations

Some efficacy subtypes appear to be more influential than others. Collective response efficacy, governmental response efficacy, and internal governmental efficacy stood out. The importance of the two

governmental efficacy subtypes is surprising given the general focus on efficacy beliefs subsumed under the personal (and to a lesser extent collective) level in the behavior change literature on pro-environmental actions (Chen, 2015; Cojuharenco et al., 2016; Doherty & Webler, 2016; Doran et al., 2015; Jugert et al., 2016; Lam, 2006; Meijers et al., 2019; Rainear & Christensen, 2017; Tabernero & Hernández, 2011; Thaker et al., 2019). When looking at the unique variance explained of the different overarching levels (personal, collective, governmental – please see "Extra results overarching levels" in the Supplement), governmental efficacy beliefs also stand out. The current research shows that the inclusion of efficacy beliefs on a governmental level in future research could be fruitful and maybe necessary to model pro-environmental action.

A key limitation of this work is the cross-sectional design. Experimental manipulation of the efficacy factors would provide stronger causal evidence for their role in pro-environmental intentions, behaviors, and policy support. We suggest sampling across different countries, because trust in the government and thus governmental efficacy subtypes beliefs likely differ by country (Thaker et al., 2019). Additionally, we recommend studying multiple in-groups. In previous research, different reference groups have been used for the operationalization of collective (response) efficacy. Whereas some research on collective (response) efficacy beliefs focused on a single in-group (e.g., students, people under 30, Americans; Doherty & Webler, 2016; Jugert et al., 2016; Reese & Junge, 2017), other research does not specify a group but instead refers to others in general (Homburg & Stolberg, 2006; Koletsou & Mancy, 2011; Van Zomeren, Spears, & Leach, 2010). Both options have their pros and cons. The operationalization that we used by referring to the reference group of 'most people' and 'we' is more encompassing. By not choosing a specific reference group, we are more likely to ensure that all participants feel a certain level of identification with the reference group – which is key according to social identity models such as SIMPEA and SIMCA (Fritsche et al., 2018; Van Zomeren et al., 2008). However, this makes the operationalization also less precise as some participants might be thinking of the citizens in their country, others of all citizens in the world, whereas others might think of 'we' as not just citizens, but also politicians, companies, and organizations. Depending on who participants think of, when thinking of 'we', there might be an overlap with governmental beliefs. This does not seem to be the case in the current study, given the established discriminant validity. For future research, it might be interesting to test the PCG typology with a more specific reference group, which participants highly identify with. As social identity theories predict that a strong social identification with the group might strengthen the effects of collective beliefs (Fritsche et al., 2018), effects like those observed here might be even stronger for collective efficacy and collective response efficacy when referring to a specific group.

We did not focus on the relationships between the efficacy subtypes. Previous studies showed that collective (response) efficacy beliefs are associated with higher personal (response) efficacy beliefs (Goddard & Goddard, 2001; Fernández-Ballesteros, Díez-Nicolás, Caprara, Barbaranelli, & Bandura, 2002; Jugert et al., 2016; Meijers, Smit, de Wildt, Karvonen, & van der Laan, 2022; Reese & Junge, 2017). Whereas some experimental studies show that stronger collective response efficacy beliefs lead to stronger personal (response) efficacy beliefs (Jugert et al., 2016), others found the opposite pattern (Meijers et al., 2022). Beliefs from different levels may also interact; e.g., collective and personal (response) efficacy beliefs may interact in affecting behaviors (Jugert et al., 2016; Tabernero et al., 2015). In addition, both efficacy and response efficacy beliefs need to be strong to motivate behavior (Bandura, 1977; Koletsou & Mancy, 2011). So, taking different efficacy subtypes and their interrelations into account will be an interesting avenue for future research.

Furthermore, we focused here on seven subtypes of efficacy that are relatively often studied but, in the literature, there are even more (response) efficacy types mentioned. For example, the concept of participative (or participatory) efficacy, which is defined as the incremental difference an individual can make to the group, such that the group as a whole can make a difference. Participative efficacy is sometimes referred to as a bridge concept between personal and collective response efficacy, but has also been successfully discerned from both (Van Zomeren et al., 2013). In the current study we opted for not taking this type of response efficacy into account as we already included both personal and collective response efficacy, as well as personal efficacy, collective efficacy and governmental (response) efficacy. For future research it would therefore be interesting to expand the PCG typology by including participative efficacy, to extend and partially replicate the current research. Lastly, when participants filled out the questionnaire, the items were randomized within blocks. Thus, items belonging to a certain concept were presented on the same page, as is commonly done in research. A more stringent test of the PCG typology would be to randomize the items between blocks and evaluate the factor structure.

In the current study we looked at private and public-sphere behavior and support. While doing so, we focused on environmental movements for public-sphere behaviors, in line with research by Stern et al. (1999, 2000). Public-sphere behaviors could have also been operationalized by talking to peers about climate change, investing in green companies, or lobbying at work for greening one's employer. For future research, it would be interesting to investigate the PCG by more elaborately focusing on one class of actions (e.g., public-sphere behaviors) and test whether the explained variance per efficacy subtype might even differ within classes of environmental actions. Furthermore, we adapted existing items such that each of the scales contained concrete forms of behavior that people frequently engage in: recycling and energy use – actions that should be respectively stimulated and discouraged, and more abstract items concerning the use of natural resources (e.g., use of water, gasoline, wood), and the environment in general. The findings of the PCG might differ when focusing on different types of behaviors, such as decreasing one's digital footprint, as people might have less knowledge on how to do this, and thus lower personal efficacy beliefs, or when focusing on less frequent decisions (e.g., number of offspring, size of house). In line with the principle of compatibility (Fishbein & Ajzen, 1975; Siegel, Navarro, Tan, & Hyde, 2014), we advise that when investigating the PCG typology regarding different topics of pro-environmental action, to also change the efficacy items to maximize prediction accuracy. Thus, when interested in the behavior of downsizing houses, the efficacy items should also be about downsizing houses.

5. Conclusion

In order to behave pro-environmentally, people need to feel a certain threat and believe they have the ability to cope with the threat (Bandura, 1977; Lazarus & Folkman, 1984; Rogers, 1975; Witte & Allen, 2000). In support of this claim, the current results showed that the efficacy subtypes together explained a large variance of the pro-environmental behavior classes, ranging from 34% for public sphere behavioral environmental intentions to 63% for private sphere environmental policy support (see Table B3). For instigating pro-environmental actions, we recommend stimulating positive efficacy and response efficacy beliefs, and matching the efficacy subtype to specific types of pro-environmental action.

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CRediT authorship contribution statement

Marijn H.C. Meijers: Conceptualization, Methodology, Formal

analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition. **Anke Wonneberger:** Conceptualization, Methodology, Investigation, Writing – review & editing, Project administration, Funding acquisition. **Rachid Azrout:** Formal analysis, Data curation, Writing – review & editing, Visualization. **Ragnheiður "Heather" Torfadóttir:** Methodology, Software, Formal analysis, Investigation, Conceptualization, Writing – review & editing. **Cameron Brick:** Writing – review & editing.

Declaration of competing interest

None.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2022.101915.

Appendix A

These items (translated from Dutch) measure the different types of efficacy and pro-environmental actions. Items in italic type were based on previous scales, but not included in the final measurement model because of poor fit or because of lower face validity.

Personal efficacy, α = .89	
(1)	I am able to behave in an environmentally friendly manner.
(2)	I am able to change my lifestyle to behave in a more pro-environmental manner.
(3)	In everyday life, I am able to limit the use of natural resources.
(4)	I consider myself capable of limiting the use of natural resources.
(5)	I think I know how I can save energy in everyday life.
(6)	I find it easy to save energy.
(7)	I am convinced that I can recycle more in everyday life.
(8)	I am confident that I can recycle.
Personal response efficacy, α = .91	
(1)	Environmental problems are partly a consequence of my own behaviors.
(2)	My personal behavior can contribute to solving environmental problems.
(3)	*Limiting the use of natural resources is effective in solving environmental issues.*
(4)	It makes a difference if I limit the use of natural resources.
(5)	By saving energy, I can help solve environmental problems.
(6)	Because my behavior can affect the environment, it makes a difference whether I save energy.
(7)	By recycling, I can help solve environmental issues.
(8)	My recycling behavior can have a positive effect on the environment.
Collective efficacy, α = .87	
(1)	Everyone is capable of behaving in an environmentally friendly manner.
(2)	I trust that everyone is able to change their lifestyle to behave in a more pro-environmental manner.
(3)	In everyday life, most people are able to limit the use of natural resources.
(4)	I think everyone is capable of limiting the use of natural resources.
(5)	I think most people know how to save energy in their daily lives.
(6)	It is easy for most people to save energy.
(7)	I believe everyone is able to recycle.
(8)	I am confident that most people can recycle more in everyday life.
Collective response efficacy, α = .93	
(1)	I think that we can jointly protect the environment.
(2)	I think that by working together we can solve environmental problems.
(3)	When everyone tries to limit the use of natural resources, it helps the environment.
(4)	People can together, through collective effort, solve environmental issues.
(5)	I think that we can collectively solve environmental problems by saving energy.
(6)	If we all reduce energy consumption, it will contribute enormously to solving environmental issues.
(7)	When everyone starts to recycle more, we can prevent the negative consequences of environmental problems.
(8)	It is useful if everyone starts recycling, because together we can protect the environment.
Internal governmental efficacy, α = .86	
(1)	*I am confident that I can contact a government official about decision-making concerning natural resources.*
(2)	I consider myself to be well qualified to participate in politics concerning environmental problems.
(3)	When I vote, I am able to consider positions on environmental issues.
(4)	I am confident that I can follow political decision making regarding natural resources.
(5)	I am confident that I can discuss the regulations about the use of energy with others.
(6)	When I vote, I am able to consider positions on energy policy.
(7)	*I belief I can contact a government official about decision-making on recycling issues.*
(8)	I consider myself expert enough to discuss recycling issues with a government official.

(*continued on next page*)

(*continued*)

External governmental efficacy, α = .93	
(1)	The government pays attention to the opinion of citizens when they make decisions about environmental problems.
(2)	The government decides how to protect the environment based on what people want.
(3)	*It matters who I vote for, because it makes a difference in the protection of natural resources.*
(4)	People like me have a say about what the government does to limit the use of natural resources.
(5)	The government cares about the opinion of citizens regarding energy savings.
(6)	*My vote can make a difference in government policies to reduce energy use.*
(7)	The government is interested in what people like me think about recycling.
(8)	The government cares a lot about what citizens think about recycling.
Governmental response efficacy, α = .87	
(1)	*The government is effective in protecting the environment.*
(2)	The government could effectively protect the environment by introducing stricter laws.
(3)	Natural resources can be protected by raising taxes.
(4)	If government officials were to pass laws to reduce the usage of natural resources, it would help protect the environment.
(5)	If the government increased subsidies for energy savings, it would be effective in reducing emissions.
(6)	Stricter laws for energy conservation would effectively contribute to saving energy
(7)	Stricter recycling legislation would be effective for environmental protection.
(8)	If the government increased taxes for waste disposal, it would promote recycling.
Private sphere behavioral intentions, α = .93	
(1)	To save energy, I am willing to make sure that the heating in my room is not set too high.
(2)	I plan to find ways to save energy in everyday life.
(3)	In my daily life I am willing to recycle.
(4)	I am willing to recycle more whenever possible.
(5)	I intend to limit the use of natural resources.
(6)	I will try to limit the use of natural resources by using less water where possible.
(7)	I am willing to take a shorter shower to protect the environment.
(8)	In my daily life I am willing to take measures to protect the environment.
Public sphere behavioral intentions, α = .96	
(1)	If I ever get extra income, I will donate some money to an environmental organization that promotes energy savings.
(2)	I am willing to join and to actively participate in an environmental group that promotes energy savings.
(3)	I am willing to raise funds for an environmental group that wants to promote recycling.
(4)	I intend to become a member of an environmental organization that protects natural resources.
(5)	I intend to donate money to support an environmental organization.
(6)	I am willing to take time to support a recycling campaign.
(7)	I would like to support an environmental organization.
(8)	Since protecting natural resources costs a lot of money, I am willing to participate in a fundraiser.
Private sphere policy support, α = .91	
(1)	I am willing to follow government regulations to save energy, such as using energy-efficient equipment.
(2)	I would be willing to save energy by following laws that help protect the environment.
(3)	I would agree with a higher tax for stricter government oversight of compliance with environmental laws.
(4)	I would agree with a legal restriction to change my behavior in order to protect the environment.
(5)	I support strict regulations to limit the use of natural resources.
(6)	*I would be willing to switch to alternative energy sources, such as solar energy, to limit the use of non-renewable natural resources.*
(7)	I would agree with the government requiring recycling whenever possible.
(8)	I agree with raising taxes to promote recycling.
Public sphere policy support, α = .93	
(1)	I support policies aimed at improving energy savings in industry.
(2)	I am willing to support the government's decisions in controlling the amount of energy that should be saved by organizations.
(3)	I am willing to support the government in limiting the number of natural resources used by companies.
(4)	I support the government controlling and regulating the way industry uses natural resources.
(5)	I would support policies that compel manufacturers to protect the environment.
(6)	I support the government in providing funding for research related to environmental protection.
(7)	I am willing to support a law that requires companies to recycle.
(8)	I am willing to support the government in taking measures that would force organizations to recycle.
Environmental threat, α = .70	
(1)	If things continue as they are, we will soon experience a severe ecological catastrophe.
(2)	When people interfere with nature it often produces disastrous consequences.
(3)	People are heavily abusing the environment.
(4)	*The idea that nature's balance is very sensitive and quickly disrupts is far too pessimistic. [reversed]*
(5)	*I do not believe the environment is heavily abused by humans. [reversed]*
(6)	*People who say that the continued exploitation of nature has driven us to the brink of an ecological fiasco are wrong. [reversed]*

Appendix B

Table B.1
Testing discriminant validity of the seven efficacy subtypes

				Test statistics merging factors		
			r	χ^2_{diff}	df	*p*
Personal efficacy	<–>	Personal response efficacy	.74	485.48	6	<.001
Personal efficacy	<–>	Collective efficacy	.73	421.59	6	<.001
Personal efficacy	<–>	Collective response efficacy	.73	514.02	6	<.001
Personal efficacy	<–>	Internal governmental efficacy	.61	389.98	6	<.001
Personal efficacy	<–>	External governmental efficacy	.20	1406.48	6	<.001
Personal efficacy	<–>	Governmental response efficacy	.56	326.03	6	<.001
Personal response efficacy	<–>	Collective efficacy	.73	516.90	6	<.001
Personal response efficacy	<–>	Collective response efficacy	.82	483.73	6	<.001
Personal response efficacy	<–>	Internal governmental efficacy	.53	490.85	6	<.001
Personal response efficacy	<–>	External governmental efficacy	.35	1319.92	6	<.001
Personal response efficacy	<–>	Governmental response efficacy	.64	249.32	6	<.001
Collective efficacy	<–>	Collective response efficacy	.78	443.25	6	<.001
Collective efficacy	<–>	Internal governmental efficacy	.44	551.87	6	<.001
Collective efficacy	<–>	External governmental efficacy	.31	1340.72	6	<.001
Collective efficacy	<–>	Governmental response efficacy	.62	262.79	6	<.001
Collective response efficacy	<–>	Internal governmental efficacy	.51	514.54	6	<.001
Collective response efficacy	<–>	External governmental efficacy	.29	1364.14	6	<.001
Collective response efficacy	<–>	Governmental response efficacy	.65	253.17	6	<.001
Internal governmental efficacy	<–>	External governmental efficacy	.36	667.00	6	<.001
Internal governmental efficacy	<–>	Governmental response efficacy	.52	329.83	6	<.001
External governmental efficacy	<–>	Governmental response efficacy	.49	349.93	6	<.001

Note. The change in model fit is reported for when the two factors mentioned are merged.

Table B.2
Pearson's R Zero-Order Correlations Between the Factors

	1	2	3	4	5	6	7	8	9	10	11	12
Mean	5.10	4.97	4.98	5.23	4.64	3.60	4.36	5.19	3.43	4.54	4.98	4.89
SD	0.94	1.08	1.00	1.05	1.12	1.34	1.20	1.16	1.50	1.29	1.20	1.08
1. Personal efficacy												
2. Personal response efficacy	.66											
3. Collective efficacy	.65	.65										
4. Collective response efficacy	.65	.75	.68									
5. Internal governmental efficacy	.50	.46	.36	.44								
6. External governmental efficacy	.20	.33	.29	.28	.33							
7. Governmental response efficacy	.43	.53	.49	.52	.40	.50						
8. Private sphere behavior	.66	.69	.60	.72	.50	.26	.51					
9. Public sphere behavior	.31	.30	.23	.33	.26	.02*	.25	.39				
10. Private sphere policy support	.22	.35	.27	.30	.37	.49	.46	.41	.21			
11. Public sphere policy support	.48	.59	.54	.59	.47	.44	.74	.66	.28	.58		
12. Environmental threat	.53	.57	.56	.63	.50	.25	.53	.68	.41	.41	.68	

Note: Entries are correlations between the factors using the unweighted means to construct the factors. All correlations are significant at $p < .001$, except for the correlation indicated with an * which is non-significant. $N = 556$.

Table B.3
Results of OLS Regressions and Relative Importance Analyses (Relative Weight Analyses and Shapley value)

	b	se	β	*t*	*p*	LLCI	ULCI	RWA	LLCI	ULCI	Shapley	%	Rank
Private-sphere behavior													
Constant	−0.48	0.20		−2.34	.020	−0.87	−0.08						
Personal efficacy	0.23	0.05	0.19	4.70	<.001	0.14	0.33	0.12	0.09	0.15	0.12	19.4	3
Personal response efficacy	0.20	0.05	0.18	4.21	<.001	0.10	0.29	0.13	0.10	0.15	0.13	20.9	2
Collective efficacy	0.07	0.05	0.06	1.48	.138	−0.02	0.16	0.08	0.06	0.11	0.08	13.3	4
Collective response efficacy	0.33	0.05	0.30	6.71	<.001	0.23	0.43	0.15	0.13	0.18	0.16	25.7	1
Internal governmental efficacy	0.11	0.03	0.11	3.47	.001	0.05	0.18	0.07	0.04	0.10	0.06	9.9	5
External governmental efficacy	−0.01	0.03	−0.02	−0.53	.593	−0.07	0.04	0.01	0.01	0.02	0.01	1.8	7
Governmental response efficacy	0.08	0.03	0.08	2.23	.026	0.01	0.14	0.06	0.04	0.08	0.06	9.1	6
Environmental threat	0.13	0.03	0.12	4.30	<.001	0.07	0.19						
$R^2 = 0.64$									$R^2 = 0.62$				
Adj-$R^2 = 0.63$													
$F(p\text{-value}) = 119.22(<.001)$													
	b	se	β	*t*	*p*	LLCI	ULCI	RWA	LLCI	ULCI	Shapley	%	Rank
Public-sphere behavior													
Constant	−0.49	0.35		−1.42	.157	−1.18	0.19						
Personal efficacy	−0.21	0.08	−0.13	−2.52	.012	−0.38	−0.05	0.01	0.00	0.01	0.01	3.1	7
Personal response efficacy	0.18	0.08	0.13	2.24	.026	0.02	0.34	0.03	0.02	0.05	0.03	10.0	4
Collective efficacy	0.03	0.08	0.02	0.42	.673	−0.12	0.19	0.01	0.01	0.03	0.01	4.1	6
Collective response efficacy	−0.05	0.08	−0.03	−0.56	.575	−0.21	0.12	0.02	0.01	0.03	0.02	5.1	5
Internal governmental efficacy	0.23	0.06	0.17	4.01	<.001	0.12	0.34	0.05	0.03	0.09	0.05	15.8	3
External governmental efficacy	0.36	0.05	0.32	7.76	<.001	0.27	0.45	0.13	0.08	0.18	0.13	37.3	1
Governmental response efficacy	0.24	0.06	0.20	4.23	<.001	0.13	0.36	0.08	0.05	0.12	0.08	24.7	2
Environmental threat	0.16	0.05	0.12	3.10	.002	0.06	0.26						
$R^2 = 0.35$									$R^2 = 0.34$				
Adj-$R^2 = 0.34$													
$F(p\text{-value}) = 36.42(<.001)$													
	b	se	β	*t*	*p*	LLCI	ULCI	RWA	LLCI	ULCI	Shapley	%	Rank
Private-sphere policy support													
Constant	−0.72	0.23		−3.17	.002	−1.16	−0.27						
Personal efficacy	−0.02	0.06	−0.02	−0.44	.660	−0.13	0.08	0.04	0.03	0.06	0.04	7.0	7
Personal response efficacy	0.12	0.05	0.10	2.33	.020	0.02	0.22	0.08	0.06	0.10	0.08	12.8	3
Collective efficacy	0.13	0.05	0.10	2.49	.013	0.03	0.23	0.07	0.05	0.09	0.07	10.5	4
Collective response efficacy	0.15	0.05	0.12	2.75	.006	0.04	0.26	0.08	0.06	0.10	0.08	13.4	2
Internal governmental efficacy	0.12	0.04	0.11	3.33	.001	0.05	0.19	0.06	0.04	0.08	0.05	8.3	6
External governmental efficacy	0.07	0.03	0.07	2.30	.022	0.01	0.13	0.06	0.04	0.09	0.05	8.7	5
Governmental response efficacy	0.53	0.04	0.49	14.04	<.001	0.45	0.60	0.24	0.20	0.30	0.25	39.2	1
Environmental threat	0.05	0.03	0.04	1.46	.146	−0.02	0.12						
$R^2 = 0.63$									$R^2 = 0.63$				
Adj-$R^2 = 0.63$													
$F(p\text{-value}) = 117.18(<.001)$													
	b	se	β	*t*	*p*	LLCI	ULCI	RWA	LLCI	ULCI	Shapley	%	Rank
Public-sphere policy support													
Constant	−0.38	0.24		−1.62	.106	−0.85	0.08						
Personal efficacy	−0.01	0.06	−0.01	−0.12	.904	−0.12	0.11	0.06	0.04	0.08	0.06	11.7	6
Personal response efficacy	0.07	0.05	0.06	1.26	.208	−0.04	0.17	0.07	0.05	0.10	0.08	15.1	5
Collective efficacy	0.20	0.05	0.16	3.70	<.001	0.09	0.30	0.08	0.05	0.11	0.08	15.3	4
Collective response efficacy	0.27	0.06	0.24	4.78	<.001	0.16	0.38	0.11	0.08	0.14	0.12	22.8	1
Internal governmental efficacy	0.22	0.04	0.21	5.85	<.001	0.15	0.30	0.09	0.05	0.13	0.08	16.1	3
External governmental efficacy	−0.05	0.03	−0.05	−1.56	.120	−0.11	0.01	0.01	0.01	0.02	0.01	2.4	7
Governmental response efficacy	0.20	0.04	0.20	5.04	<.001	0.12	0.27	0.09	0.06	0.13	0.09	16.6	2
Environmental threat	0.19	0.04	0.17	5.36	<.001	0.12	0.26						
$R^2 = 0.54$									$R^2 = 0.51$				
Adj-$R^2 = 0.53$													
$F(p\text{-value}) = 79.61(<.001)$													

Note: b-values (b) are the unstandardized OLS regression coefficients, with standard errors in parentheses. Betas (β) are the standardized coefficients. $N = 556$, 95% CI. Relative importance regressions with efficacy beliefs only (not controlled for environmental threat). Percentage and rank based on Shapley.

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