

What can Work in Climatic Campaigns: Review of Information-Based and Framing Approaches

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Abstract

This paper reviews two approaches which may be useful in climatic campaigns: the provision of information and framing of information about aspects of global climate change. Both of these approaches can be easily implemented in climatic campaigns aiming at the general public. Our review has revealed that information about the impacts of global climate change is likely to make climatic beliefs, attitude and behaviour more positive. Likewise, approaches that use negative benefit framing (i.e. informing about losses that can be avoided through climatic action) are likely to produce positive change in beliefs, attitude and behaviour. On the other hand, there is some uncertainty in other approaches (e.g. provision of information about solutions to GCC, consensus framing) as to their effects, probably owing to as yet unknown mediators and moderators. Still other approaches seem promising (e.g. use of mechanistic information) but they await further empirical corroboration.

Key words

global climate change, campaign, attitude change, behaviour change, framing

Abstrakt

Tento článek předkládá čtenářům přehled dvou nástrojů, které mohou být užitečné v klimatických kampaních: jedná se o přístupy založené na poskytování informací o některých aspektech klimatické změny a přístupy založené na rámování. Oba tyto přístupy mohou být snadno implementovány v klimatických kampaních zaměřených na veřejnost. Náš přehled odhaluje, že informace o dopadech globální klimatické změny bude mít pravděpodobně pozitivní vliv na klimatické představy, postoje a chování. Podobně i přístupy, které využívají rámování negativních zisků (tím, že informují o ztrátách, kterým může být zamezeno skrze klimatickou akci), povedou pravděpodobně k pozitivním změnám v představách, postojích a chování. Naproti tomu existují některé přístupy (např. informování o možnostech řešení klimatických problémů, prezentování konsensu odborníků o klimatické změně), u nichž je stále nejistota o jejich efektech, pravděpodobně v důsledku vlivu moderujících a mediujících faktorů, které nejsou ještě zcela popsány. Některé jiné přístupy (např. přístupy využívající informace o mechanismu klimatické změny) se zdají být nadějně, ale dosud chybí dostatečné empirické důkazy o jejich efektech.

Klíčová slova

globální změna klimatu, kampaň, změna postoje, změna chování, rámování

Global climate change (GCC) is one of the most serious problems that humankind is faces currently (World Economic Forum, 2017). Humans are responsible for the worsening of this problem by increasing their emissions of greenhouse gases due to industrial and agricultural production, transportation, and household energy use (Boden, Andres, & Marland, 2017).

One of the widely accepted approaches to climate change mitigation consists in the adoption of a large number of smaller steps, known as stabilization wedges, which would use currently available technologies and tools to achieve stabilization and reversal of the greenhouse gas emission trend in the near future (Pacala & Socolow, 2004). An important part of this mitigation approach consists in the change of individual behaviour, particularly transportation behaviour, and energy and food consumption (Vandenbergh, Barkenbus, & Gilligan, 2007). However, change of everyday behaviour of individuals is not easy and interventions aiming at such change usually achieve only moderate effects at best, as evidenced by numerous meta-analysis of energy- and resource-conservation interventions (e.g., Abrahamse & Steg, 2013; Abrahamse, Steg, Vlek, & Rothengatter, 2005; Karlin, Zinger, & Ford, 2015; Staddon, Cyclic, Goulden, Leygue, & Spence, 2016).

The fact that many interventions aiming at the change of mitigation and adaptation behaviour, or related factors (such as attitudes, knowledge and beliefs), do not have large effects makes it even more important to rely on those approaches which have sufficiently large demonstrable effects. The purpose of this paper is to present illustrative examples of interventions that are based on information provision and message framing. Information-based intervention aim to change people's beliefs, attitude and climatic behaviour by providing information about some aspects of global climate change which general population is missing (e.g., Ranney & Clark, 2016; Hornsey, Fielding, McStay, Reser, & Bradley, 2015). Framing approaches aim at the same change of beliefs, attitude and behaviour through the change of the frame in which information about some aspect of global climate change is provided (e.g., Schuldt & Roh, 2014; Whitmarsh, 2009).

Both information-based and framing-based approaches are easy to use in global climate change communication and have been used frequently by governmental and non-governmental organizations in the past (e.g., Segerberg, 2017). Our hope is that this review will inspire practitioners who are planning on doing their own climatic campaign, and motivate them to look more closely at the existing academic literature and help them avoid approaches which have a lower probability of success.

In this review, we are interested in whether certain climatic intervention have demonstrable effects on a rather wide range of outcome variables, including beliefs, attitude, and behaviour. For this reason, we mainly focus on experimental research, which provides the strongest evidence of causation (e.g., Rubin, 1974). We ignore the fact that there is an ongoing debate as to the nature of the relationship between beliefs, attitude, and behaviour, with some scholars arguing that beliefs, attitude, and behaviour are causally related (Albarracín, Johnson, & Zanna, 2005; Fishbein & Ajzen, 2010) and others arguing that this relationship is logical rather than causal (e.g., Kaiser, Byrka, & Hartig, 2010). What is important here is that all would probably agree that once a certain intervention is shown to enhance positive beliefs or attitude towards global climate change, there is a good chance that behaviour will follow suit. On the other hand, few would argue that more positive attitudes or beliefs toward global climate change result in more anti-climatic behaviour. Thus, we are convinced that an intervention which changes attitudes to, or beliefs about, global climate change is certainly worth considering for climatic campaign until more direct evidence is gathered on its behavioural effects.

1. Method

We started the literature search using the Scopus database (<https://www.scopus.com>) and a logical search expression¹, which restricted our search to published experimental research targeting mitigation or adaptation behaviours with specific focus on information-based and framing-based interventions. We limited our search to journal articles that, unlike books, typically report the most recent research findings.

After screening the list of 430 articles provided by Scopus search engine, we selected 51 research papers which reported the results of experimental research focusing on information-based and framing-based interventions. Another 39 papers were identified through backward search in reference lists of papers and by forward search in the list of papers that quoted them (details of the literature can be found here: <https://osf.io/7f8k3>). Thus, in total, we reviewed 90 papers published between 2007 and 2018.

In this review, we generally provide illustrative examples to back our claims concerning the effects of various interventions. Where such evidence was available in the existing studies, we also compare effects of specific interventions. However, we do not systematically quantify and compare effect sizes of various interventions as such undertaking would require a meta-analytical approach.

2. Goal of the review

The goal of this paper is to review climate change interventions that are based on information provision and information framing. Specifically, we are interested in whether such interventions have demonstrable effects on climatic beliefs, attitude and behaviour (i.e. mitigation, adaptation, and policy support). We focus on information provision and framing because such approaches can be easily implemented in climatic campaigns targeting the general public.

3. Information-based interventions

Information-based interventions form a rather diverse group of approaches. These interventions are generally based on the provision of scientifically sound information regarding some aspects of GCC such as its physical and chemical mechanism (e.g. Ranney & Clark, 2016), its impacts (e.g. Hornsey, Fielding, McStay, Reser, & Bradley, 2015), or the level of scientific knowledge about GCC (e.g. van der Linden, Leiserowitz, Feinberg, & Maibach, 2014). In spite of their diversity, these approaches share the basic premise that the public knowledge of GCC is deficient in some respects and that filling this gap with scientifically accurate knowledge can ultimately lead to attitude and behavioural change. Unlike earlier deficiency models of scientific communication (e.g., Bauer, Allum, & Miller, 2007), these information-based interventions acknowledge the fact that not just any information provision will do. Instead these approaches point to the fact that provision of some very specific types of information is likely to lead to attitude change and possibly also behavioural change (e.g. Ranney & Clark, 2016; van der Linden et al., 2014), whereas

1 The logical search expression used in the Scopus database was as follows: (("mitigation" OR ("adaptation")) AND ("behaviour") AND (("intervention") OR ("manipulation") OR ("experiment")) AND (("information provision") OR ("information campaign") OR ("information intervention") OR ("framing")) AND (("climate change") OR ("climatic change") OR ("global warming"))).

provision of other types of information can either be inefficient or even counterproductive, resulting in the further polarization of public opinion on GCC (see Hart & Nisbet, 2012).

Besides these basic commonalities, various information-based approaches usually differ in the underlying models of attitude change, and also in the types of information they use to drive the attitude change. Recently, four different groups of information-based interventions have crystalized that will be reviewed here in more detail: approaches focusing on (i) communication of the mechanism of GCC, (ii) communication of the level of scientific consensus about GCC, (iii) communication of impacts of GCC and (iv) approaches that focus on communication of solutions to GCC-related problems.

2.1 Provision of mechanistic information

The first group of information-based interventions focuses on provision of information about the mechanism of GCC. By providing such information, these interventions hope to increase the rather low levels of mechanistic knowledge found widely among the public and thus remove one of the obstacles to acceptance of anthropogenic causes of GCC (Ranney & Clark, 2016). Such information can be disseminated in the form of educational videos (Ranney & Lamprey, 2013) or as descriptive textual information of different lengths, with longer and visually more attractive formats having typically larger effects (see Lamprey, Fricke, & Raney, 2016).

Several empirical studies have demonstrated that acceptance of anthropogenic causes of GCC is related to the mechanistic knowledge of GCC and that by increasing the mechanical knowledge, one can also increase the acceptance of anthropogenic causes of GCC (Ranney & Clark, 2016; e.g. Ranney, Clark, & Cohen, 2012; Ranney, Munnich, & Lamprey, 2016). Crucially, provision of mechanistic information about GCC affects attitudes to GCC regardless of the political ideology of the recipient, overriding the ideologically motivated cognitive processes of information assimilation (cf. Hart & Nisbet, 2012).

The exact mechanism that makes mechanistic information about GCC an efficient leverage of attitude change is not very well known. One plausible explanation is that mechanistic explanations contain a large number of causal statements, which generally make the argument more attractive and credible to recipients (Dahlstrom, 2010). Another explanation is that a lack of mechanistic knowledge of GCC plays a key role in attitude formation and therefore provision of such information results in attitude change (Ranney et al., 2016). However, this latter explanation is speculative because no evidence has yet been provided that would demonstrate the mediating effect of mechanistic knowledge in attitude change.

2.2 Provision of information about scientific consensus on GCC

The second group of information-based interventions aims at correcting the misconception (known also as consensus gap, Cook, 2013) among the public that the scientific consensus on anthropogenic cause of GCC is only moderate (see ComRes, 2014; Kohut, Keeter, Doherty, & Dimock, 2009; Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Rosenthal, 2014). In reality, this consensus is extremely high (see Anderegg, Prall, Harold, & Schneider, 2010; John Cook et al., 2013, 2016; Doran & Zimmerman, 2009).

Information-based interventions focusing on the communication of scientific consensus about the GCC (known also as *consensus communication*) work on the assumption that beliefs about scientific consensus are important causal precursors of attitude formation. The key role of perceived scientific consensus in the process of attitude formation has been evidenced by studies demonstrating that belief in scientific consensus

has a positive effect on the acceptance of scientific knowledge (Lewandowsky, Gignac, & Vaughan, 2013; van der Linden, Leiserowitz, Feinberg, & Maibach, 2015) as well as on acceptance of anthropogenic causes of GCC and intention to engage in mitigation behaviour (e.g. Bolsen, Leeper, & Shapiro, 2014; Myers, Maibach, Peters, & Leiserowitz, 2015; van der Linden et al., 2014, 2015). It is noteworthy that consensus communication seems to be relatively immune to biases due to ideologically motivated cognitive processes (Bolsen et al., 2014).

Scientific consensus on anthropogenic causes of GCC can be communicated visually (e.g. van der Linden et al., 2015), through descriptive textual information (e.g. Myers et al., 2015), by metaphorical textual representation (e.g. van der Linden et al., 2014), or through a combination of these. Even though these communication forms seem to be effective as a means of attitude change, communication that employs either graphical form (pie charts) or descriptive text changes the perception of scientific consensus most dramatically (e.g. van der Linden et al., 2014).

Evidence regarding the effectiveness of the consensus messaging is mixed. Results of a study by Kerr and Wilson (2018) show that consensus messaging is an effective tool which changes lay persons' beliefs about the anthropogenic causes of global climate change. However, a study by Zhang et al. (2018) reveals that effects of consensus messaging are heterogenous and vary geographically. On the other hand, a study by Landrum et al. (2018) reveals that consensus messaging did not change lay persons' attitudes to genetically modified organisms (GMOs). In addition, a study by Kahan (2017) points to some technical deficiencies of the study by van der Linden et al. (2015) that provided the original support for the consensus messaging approach.

2.3 Provision of information about impacts of GCC

The third major group of information-based interventions focuses on provision of information about impacts of GCC. The working assumption of these approaches is that by providing information about impacts of GCC, they will increase worry and concern related to GCC, which will ultimately lead to an increase in willingness to do something about GCC (Hart, 2013). The mediating role of fear and concern in attitude change is evidenced by findings that pessimistic framing of information about greenhouse gas emissions results in comparatively higher GCC-related distress and motivation to mitigate GCC (Hornsey & Fielding, 2016). However, messages producing high-emotion fear have sometimes been found to have a smaller effect on attitude than neutral messages (Hornsey et al., 2015), particularly when fear inducing messages collided with other beliefs held by recipients, such as beliefs in a fair world (see Feinberg & Willer, 2011).

Information about the direction of future impacts of GCC are typically conveyed in textual, visual, or numerical format (Hart, 2013; Hornsey et al., 2015; Ranney et al., 2016). Systematic comparison of these approaches is still lacking. Nonetheless, the numerical format seems to be special in that its effect is moderated by numeracy and thus the effect can be lower in persons with a lower level of numeracy (Hart, 2013). On the other hand, numerical format also has some unique properties which allow for a relatively smooth transformation of attitudes through numerically-driven inferencing (Ranney et al., 2016).

2.4 Provision of information about solutions to GCC-related problems

Another group of information-based approaches aims at informing recipients about existence of measures that could be used to deal with GCC and about efficiency of these measures. Studies pertaining to this group are relatively scarce and theoretical understanding of the mechanism triggered by these information approaches is not well

established yet. Two competing hypotheses have been formulated. The first of these hypotheses, the *compensation hypothesis*, posits that informing people about ways to minimize risks can reduce the perceived risk and, as a result, can also reduce the intention to minimize the risk further. This hypothesis has been corroborated by several studies focusing on high-risk situations in other contexts (e.g. Bolton, Cohen, & Bloom, 2006; Dilley, Woods, & McFarland, 1997) and also by research on the closely related Peltzman Effect (Peltzman, 1975)². An alternative hypothesis, the *risk salience hypothesis*, argues that informing people about ways to deal with impacts of GCC can increase the otherwise low salience of GCC risks and thus increases intention to mitigate GCC (Carrico, Truelove, Vandenberg, & Dana, 2015).

Available evidence from three existing experimental studies supports the salience hypothesis in GCC context by demonstrating that provision of information about adaptation options increases (rather than decreases) intention to mitigate GCC (Evans, Milfont, & Lawrence, 2014) and also raises support for mitigation policies (Carrico, Truelove, Vandenberg, & Dana, 2015; Greenhill, Dolšak, & Prakash, 2018).

Besides informing about the existence of adaptation and mitigation options, another potentially promising approach consists of focusing on the efficacy of mitigation (and adaptation) measures. Evidence from correlational studies suggests that efficacy plays an important role as a factor of political activism related to GCC (Hart & Feldman, 2014; Roser-Renouf, Maibach, Leiserowitz, & Zhao, 2014). However, as of now, there is very limited evidence that messages seeking to increase internal efficacy (individual is able take effective action), external efficacy (elected officials will respond), or response efficacy (action will have an effect) have any direct effect on political activism. Instead, it appears that the effect of efficacy messages on political activism is mediated by emotions related to GCC (particularly hope and fear) and moderated by the political ideology of recipients (Feldman & Hart, 2016). Thus, information that seeks to increase efficacy is likely to affect recipients' emotions related GCC but not necessarily their political activism.

2.5 Critique of information-based interventions and the theory of motivated reasoning

The usefulness of information-based interventions has been contested by some scholars who argue that provision of information about GCC can be counter-productive by leading to further polarization of public opinion on GCC (Kahan et al., 2012; Kahan, Jenkins-Smith, & Braman, 2011). These views are grounded in the theory of motivated reasoning (Kunda, 1990), which posits that cognitive processes employed to process information and arrive at conclusions are biased so that they allow people to reach conclusions they want to reach and which are in line with their previous beliefs. Thus, for instance, people tend to undermine the credibility of scientific information about GCC that contradicts their previous beliefs by attributing lower academic credential to the source of the information (Kahan et al., 2011). Likewise, people tend to express lower levels of trust in the scientific community when they encounter scientific arguments that contradict their views, including those about GCC (Nisbet, Cooper, & Garrett, 2015). Crucially, higher cognitive skills of individuals seem to exacerbate these biases by making people more skillful in using cognitive strategies to arrive at conclusions congruent with their prior beliefs (Kahan et al., 2012).

2 Peltzman effect refers to reduction of predicted benefit from regulations that intend to increase safety (see Peltzman, 1975).

The claim that provision of factual and scientifically accurate information about aspects of GCC is an ineffective mean of attitude change and that it can even aggravate attitude polarization is sometimes referred to as the *stasis theory* (e.g., van der Linden, 2016). The term stasis theory highlights the fact that theory effectively precludes any attitude change through education. The stasis theory has been contradicted by recent findings of association between climate literacy and concern about GCC which holds regardless of political affiliation (Bedford, 2016) and findings regarding the effect of information about scientific consensus on attitude to GCC which seems to be independent of political affiliation (Lewandowsky et al., 2013; Myers et al., 2015). Also recent findings that provision of information about the mechanism of GCC has a positive effect on acceptance of GCC without producing the polarization effect (Ranney et al., 2016) seems to contradict the stasis theory. Thus, it appears that polarization of opinion about GCC due to information provision is—if it happens at all—less widespread than proponents of stasis theory claim.

Overall, there seems to be convincing evidence that the provision of information regarding impacts of GCC has a positive effect on climatic beliefs, attitude and behaviour. However, such information must strike the balance between being sufficiently worrisome and yet not overwhelmingly threatening on one side and being optimistic and yet not overly optimistic on the other. Messages presenting scientific consensus and messages presenting solutions to GCC seem to have mixed effect, probably due moderators and mediators which have not been well established yet. Information about mechanism of GCC seems to be a promising approach but only limited evidence about its effects is available. Importantly, there seem to be little evidence that providing correct factual information can backfire and lead to polarization of public opinion on GCC.

3. Framing interventions

After reviewing approaches that are based on information provision, we now turn to another important group of interventions which can be used in public climatic campaigns and which can be generally denoted as framing approaches. The concept of frames refers to “schemata of interpretation” which allow individuals “to locate, perceive, identify, and label” issues and topics within their own personal context (Goffman, 1974, p. 21). Framing approaches typically emphasize certain dimensions of an issue and affect how people relate to this issue contingent on their pre-existing schemata, values, and mental models (Myers, Nisbet, Maibach, & Leiserowitz, 2012). By changing how issues are framed, these approaches affect beliefs, attitudes, and preferences related these issues (Schuldt & Roh, 2014).

Framing approaches used in the domain of GCC typically focus on the effects produced by (i) the use of different labels describing the phenomenon of GCC; (ii) the proximity or distance framing of GCC impacts, and (iii) gain and loss framing of messages about trends and impacts of GCC. Let us briefly review these framing approaches and their effects on beliefs, attitude, and behaviour related to GCC.

3.1 Labels describing the Global Climate Change

Labels which are used to describe the GCC influence beliefs and attitudes towards this issue by drawing attention to certain aspects of the phenomenon at the expense of others and by inviting specific associations (Schuldt, Konrath, & Schwarz, 2011). Whereas the term *global warming* focuses attention on increase of the average temperature, the term *climate change* refers to complex processes of climatic change which involve many other aspects of GCC apart from temperature rise. The term climate change is therefore more compatible with the occurrence of weather extremes such as unseasonably cold temperatures and

record snowfalls (Schuldt et al., 2011). Several studies (e.g. Schuldt & Roh, 2014; Whitmarsh, 2009) have revealed considerable differences in peoples' perceptions of the two terms. In a similar vein, a sentiment analysis³ of Twitter comments showed that the two labels produce different connotations, with climate change being seen more positively than the global warming (see Lineman, Do, Kim, & Joo, 2015). Interestingly, the two labels are also perceived differently by political groups that typically disagree about aspects of GCC (Schuldt & Roh, 2014). Conservative voters typically perceive climate change to be more serious than global warming (Schuldt et al., 2011; Villar & Krosnick, 2011), whereas the reverse is true among liberals (Villar & Krosnick, 2011). The framing effect of the two labels has not been found universally though. Recent studies conducted in the US and Europe have found only a small or no effect of these two labels on the perception of the seriousness of GCC (Jaskulsky & Besel, 2013; Villar & Krosnick, 2011).

Relatively little evidence has been gathered regarding the framing effect of other labels used to denote climatic phenomenon, such as *climate crisis* and *climate disruption*. A recent study (Jaskulsky & Besel, 2013) suggests that the use of the term climate crisis may backfire and reduce belief in GCC and perceived seriousness of this phenomenon, whereas the use of the term climatic disruption may increase belief in GCC and concern about the phenomenon in comparison to conventional labels of global warming and climate change (Jaskulsky & Besel, 2013).

3.2 Proximal vs. distant impacts of the Global Climate Change

Second group of framing interventions focuses on framing of impacts of GCC as proximal rather than distant. By highlighting the proximity of climate-related impacts, these approaches aim to promote emotional and cognitive engagement with GCC and thus increase motivation to respond to GCC (Brügger, Morton, & Dessai, 2016; Spence & Pidgeon, 2010). Contrary to the hopeful expectations of the proximizing framing approach, most studies that have tested this approach did not find the expected positive effect of proximity framing on personal importance of GCC (Schoenefeld & McCauley, 2016), GCC policy support (Brügger et al., 2016; Schoenefeld & McCauley, 2016; Shwom, Dan, & Dietz, 2008), attitudes towards climate change mitigation (Spence & Pidgeon, 2010) or willingness to mitigate GCC and to adapt to GCC (Brügger et al., 2016; Schoenefeld & McCauley, 2016). One study has even revealed evidence directly contradicting expectations of the proximity framing, specifically that framing of GCC impacts as distant has resulted in them being perceived as more severe (Spence & Pidgeon, 2010). Only one recent study known to us has found that the proximally framed information increased participants' engagement with GCC (Scannell & Gifford, 2013; but see Brügger et al., 2016 for critique of this study).

A generic problem related to studies of proximity framing is that these studies usually lack cross-cultural and geographical generalization and therefore may confound the effects of proximity framing with effects of cultural and geographical factors (Spence & Pidgeon, 2010). Moreover, there appear to be several potential mediators that can hinder or accentuate the effect of proximization on attitude to GCC and climatic behaviour such as construal level (i.e. whether people represent GCC as psychologically close and relevant or psychologically distant and irrelevant), place attachment (i.e. how people relate to different local, national and cross-national regions), and response tendencies to certain threat

3 Sentiment analysis identifies how sentiments are expressed in texts and whether they indicate positive (favorable) or negative (unfavorable) opinions about the topic. Sentiment analysis involves identification of sentiment expressions, polarity and strength of the expressions, and their relationship to the subject (Nasukawa & Yi, 2003).

reactions (i.e. the tendency to become overwhelmed by GCC threats and manifest defensive reactions; see Brügger, Dessai, Devine-Wright, Morton, & Pidgeon, 2015). Thus, according to the available evidence, the proximizing approach does not offer a robust approach to the change of climatic attitude and behaviour.

3.3 Gain vs. loss framing

A third broad category of framing interventions is known as gain and loss framing. The founding idea of this approach is derived from prospect theory, which points to the asymmetry in the subjective perception of gains and losses (e.g., Tversky & Kahneman, 1974). According to prospect theory, people generally ascribe higher subjective value to losses than to gains, they prefer probabilistic losses to certain losses but they also prefer certain gains to probabilistic gains. In the domain of global climate change, people should be concerned about losses due to GCC more than about gains. However, since most impacts of GCC are known only probabilistically, people should not mind high-probability losses because, after all, such probabilistic losses are more acceptable to most persons than equivalent certain losses. However, people should prefer high-probability (or certain) benefits to equivalent low-probability (risky) benefits.

Consistent with predictions of the prospect theory, presenting high-probability gains that can result from mitigation behaviour has been found to be a more powerful means of motivation of mitigation behaviour than presenting high-probability losses due lack of mitigation (see Spence & Pidgeon, 2010).

Another successful application of prospect theory in the climatic context has been presented by Morton and colleagues (2011) who found that when GCC-related predictions were framed in terms of losses that will happen (negative framing), the increasing uncertainty of the predictions resulted in decreased intentions to engage in GCC mitigating action. Conversely, when GCC predictions were framed in terms of losses that might not materialize (positive framing), the effect of the increased uncertainty reversed. The implication of this pattern is that when communicating the uncertainties of GCC, the positive frame could be more effective as a factor of action than the negative frame. Essentially the same results were obtained in a study by Feinberg and Willer (2011) who have shown that negative frames (e.g., dire messages about consequences of GCC) can backfire and increase skepticism regarding existence of GCC and effectiveness of mitigation because such information collides with established norms of justice and equality. Positively framed messages about GCC can, on the other hand, increase belief in the existence of GCC (ibid.).

The framing of losses and gains related to GCC can be further elaborated by differentiating between positive gains (gaining benefits through climatic action), negative gains (avoiding loss through climatic action), and losses (incurring losses due to inaction). Existing evidence suggests that negative gain frames have the strongest effect on motivation to make sacrifices to mitigate GCC (Bilandzic, Kalch, & Soentgen, 2017).

Even though advantages of positive framing of GCC are widely acknowledged, some studies point to the fact that in certain situations (e.g. informing about the rate of progress in reducing global carbon emissions) pessimistic messages could be more effective in increasing motivation to mitigate GCC than optimistic messages (Hornsey & Fielding, 2016). The lower effectiveness of the optimistic message could be, in this case, due to the reduction of GCC-related distress and ensuing lack of concern about GCC.

To sum up, there is evidence that some framing approaches can be powerful means of attitude and behavioural change. Gain vs. loss framing, and especially the use of negative-gain framing, seem to offer a robust and efficient way to affect people's attitudes and behaviour related to GCC. Other framing strategies, such as the use of different labels to

describe GCC and proximizing framing approaches, appear to be subject to mediators and moderators, which have not been well described yet. As such, these approaches may yield mixed results or no effects at all.

4. General discussion

In this paper we have reviewed empirical findings concerning the effectiveness of two broad groups of approaches to the change of climatic beliefs, attitude and behaviour, namely information-based approaches and framing approaches. Our motivation for focusing on these approaches was that they can be easily implemented in climatic campaigns aiming at the general public.

Our review of empirical studies has revealed that information-based interventions and interventions using framing approaches can be potent drivers of climatic beliefs, attitude, and behaviour in many circumstances. However, we have also found that many of these approaches involve a high degree of uncertainty regarding potential moderators and mediators of these effects. As a result, some of these approaches are more likely to deliver desired outcomes than others.

If we were to list approaches which we think, based on existing evidence, are most robust and most likely to lead to change in climatic beliefs, attitude and climatic behaviour, we would select interventions which seek to inform about the impacts of GCC. Another approach which seems to be relatively robust is the framing approach, particularly the one that uses negative benefit framing (i.e. informing about losses that can be avoided due to taking action). Overall, these approaches should be fruitful especially if their applications avoid conveying either an overly positive message, which decreases the importance of climate change, or too threatening messages, which overwhelm individuals and provoke psychological resistance and denial.

Other approaches that we have reviewed have either produced mixed evidence (e.g. the provision of information about solutions to GCC and information about scientific consensus about GCC), implying the possibility of unknown moderators and mediators of these effects. Still other approaches seem promising but have not been sufficiently corroborated (e.g. use of mechanistic information). In either case, future research may sufficiently reduce the margin of uncertainty for these approaches to become valuable tools in climatic campaigns.

The majority of studies that we have reviewed were academic experimental studies and only a few of them have focused specifically on climate-related behaviour – either individual mitigation or adaptation behaviour or policy support – whereas the majority of these studies focused on variables which are believed to be related to behaviour, such as climatic beliefs and attitude. The aim of this study was to provide a review of recent literature concerning these approaches with some illustrative examples of how they can be employed. Our study did not attempt to systematically quantify and compare effect sizes of different approaches for such a goal can only be achieved through meta-analysis, which may not be currently feasible due to heterogeneity and the small number of studies representing some of these approaches (e.g. studies focusing on effects of numerical information).

In spite of these limitations, we believe that this review offers a useful summary of the state of the art, which can benefit practitioners who are planning climatic campaigns and also researchers who are compiling literature reviews for their empirical studies.

We hope that future research will help to consolidate the field by examining potential moderators and mediators apparent in some mixed results that we have reviewed. In addition, replications of existing studies will be valuable as a way to increase our confidence that the approaches reviewed here have robust effects. Obviously, time is running out for humankind to take action on climate change but the urgency of this problem also means that time and money should not be wasted on campaign approaches with uncertain effectiveness.

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