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Social Psychology and Climate Change Engagement in Canada: Bridging the Gap between Awareness and Action

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Résumé

Cette thèse s'appuie sur une constatation à la fois troublante et paradoxale : augmenter la sensibilisation du public et combler les lacunes de connaissances sur les défis liés aux changements climatiques ne parviennent pas nécessairement à susciter un engagement accru en faveur de l'environnement et du climat, et peuvent même le compromettre dans certains cas. Si la sensibilisation ne suffit pas à catalyser l'action pour le climat et l'appui aux politiques climatiques, la question demeure : quels sont les véritables moteurs de l'engagement? Pour tenter de résoudre cette énigme, cette thèse fusionne les idées de trois avancées clés en psychologie sociale, et teste leur potentiel pour faire progresser l'engagement envers les changements climatiques au Canada.

Le premier article examine comment différentes audiences au sein de la population canadienne pensent par rapport à l'environnement et aux changements climatiques, et explore si et comment le niveau d'engagement de l'audience modère l'effet de divers messages sur le soutien à la tarification du carbone. En analysant les données recueillies lors d'un sondage à probabilité aléatoire mené en octobre 2017 auprès d'adultes canadiens, cet article montre que la population canadienne peut être divisée en cinq segments distincts, offrant des cibles potentielles pour communiquer autour de la tarification du carbone. En étendant les conclusions de la littérature sur la segmentation de l'audience au cas canadien, et en explorant la façon dont chaque segment répond à différents messages sur la taxe carbone, cette étude souligne l'importance des données basées sur l'audience pour la recherche, la politique et la communication sur l'environnement et le climat, tout en jetant les bases pour de futures recherches visant à adapter les messages à différents publics.

Le deuxième article examine comment les messages négatifs et positifs influencent les émotions et l'action climatique chez divers publics au sein du mouvement environnemental canadien. S'appuyant sur une enquête par panel auprès de membres d'ONG environnementales au Canada (N = 308) menée en 2019 et 2021, cette étude montre que les messages négatifs sur le changement climatique (par exemple, sonner le "code rouge pour l'humanité") peuvent être moins mobilisateurs que les messages positifs, même lorsque le message s'adresse à des publics

relativement engagés et qu'il est suivi de la possibilité de prendre une action concrète et efficace. Ces résultats mettent en évidence le rôle que le cadrage du message peut jouer pour surmonter les défis cognitifs et émotionnels de la communication sur le changement climatique, tout en soulignant l'importance d'inspirer les gens avec des messages optimistes.

Le troisième article examine le rôle de l'identité sociale dans la prédiction des intentions de mobilisation pour un changement au niveau du système (par rapport à un changement au niveau individuel) au sein de divers publics d'activistes et de non-activistes. S'appuyant sur deux enquêtes en ligne menées en 2021 et 2022 auprès d'un échantillon de partisans de Greenpeace Canada (N=1 394) et du public canadien (N=1 514), cette étude fournit des preuves empiriques suggérant que l'identité sociale peut jouer un rôle important dans l'explication de l'action collective, tout en soulignant l'importance de considérer soigneusement les publics lorsqu'on cherche à mobiliser en faveur d'un changement systémique. En offrant un test empirique du rôle de l'identité sociale dans la prédiction de l'action collective parmi divers publics, cet article offre une nouvelle perspective sur la façon dont les conditions individuelles et sociales peuvent interagir et agir ensemble pour favoriser la mobilisation environnementale.

Ces résultats suggèrent que la communication et les interventions sur les changements climatiques sont susceptibles d'échouer si elles ne sont pas informées par des données empiriques basées sur une compréhension approfondie de l'audience. Cependant, comme le démontre cette dissertation, tirer parti des connaissances de la psychologie sociale peut aider à surmonter plusieurs des défis associés à la mobilisation du public sur les changements climatiques.

Mots-clés : changements climatiques, communication, psychologie sociale, segmentation de l'audience, cadrage du message, identité sociale, action collective.

Abstract

Paradoxically, increasing public awareness and addressing knowledge gaps about the causes and consequences of climate change are not sufficient to spur climate change engagement and may even undermine it in some circumstances. But if raising awareness about the issue is not enough to motivate climate action and support for climate policy, the question remains as to what will. To help address this puzzle, this dissertation fuses insights from three key findings in social psychology and tests their potential for advancing climate change engagement in Canada.

The first article examines how unique audience segments within the Canadian population think about climate change and explores whether and how the level of audience engagement moderates the effect of various messages on support for carbon pricing. Analyzing data collected from a random probability survey of adult Canadians conducted in October 2017, this article shows that the Canadian population can be divided into five distinct segments, offering potential targets for communicating about carbon pricing. By extending the findings from the audience segmentation literature to the Canadian case and exploring how each segment responds to different messages about carbon taxes, this study emphasizes the importance of audience-based data for climate research, policy and communication while laying the groundwork for future research aimed at tailoring messages for different audiences.

The second article examines how negative and positive messaging influence emotional arousal and climate action across unique audiences within Canada's environmental movement. Drawing on a two-wave panel survey of Canadian environmentalist NGO members (N = 308) conducted in 2019 and 2021, this study shows that negative messages about climate change (e.g. sounding "code red for humanity") can be less mobilizing than positive messaging, even when the message is directed toward relatively engaged audiences and followed by the opportunity to take specific and effective action. This finding highlights the role message framing may play in overcoming the cognitive and emotional challenges of climate change communication while further emphasizing the importance of inspiring people with optimistic messages.

The third article examines the role of social identity in predicting intentions to mobilize for system change across diverse audiences of activists and non-activists. Drawing on two online surveys conducted in 2021 and 2022 with samples of Greenpeace Canada supporters (N = 1,394) and the Canadian public (N = 1,514), this study provides empirical evidence that social identity can be a powerful predictor of collective action intention and emphasizes the importance of integrating notions of audiences and group goals into existing social identity models of collective action. By offering an empirical test for the role of social identity in predicting collective action among diverse audiences, this article offers a fresh perspective on how individual and social conditions can interact and work together to foster environmental mobilization.

These findings suggest that climate change communication and interventions are likely to fail if not informed by context-relevant, empirical, audience-based data. However, as this dissertation demonstrates, leveraging insights from social psychology can help overcome many of the challenges associated with engaging the public on climate change.

Keywords: climate change, communication, social psychology, audience segmentation, message framing, social identity, collective action

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To my beloved father.

You light my way.

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Foreword

This dissertation showcases three scientific articles that collectively deepen our understanding of how Canadians perceive and engage with climate change. These articles were produced with the invaluable support of my thesis advisor and environmental group representatives in Canada, whose contributions are outlined below.

The first article (Chapter 2), co-authored with my advisor Erick Lachapelle and published in *PLOS One* in November 2022, examines the views of different Canadian segments on climate change and the influence of various messages on their support for carbon pricing. Erick Lachapelle and I were both actively involved in the paper's conceptualization and writing. My primary contributions centered on data analysis and methodology, while Erick Lachapelle led the way in securing the necessary funding. The second article (Chapter 3), another collaboration with Erick Lachapelle, appeared in *Frontiers in Communication* in November 2022. This article explores the impact of messaging on emotions and climate actions within Canada's environmental community. Erick Lachapelle and I jointly conceived the study, conducted data collection, and actively participated in the writing and editing processes. My responsibilities extended to data analysis, methodology, and crafting data visualizations and figures. This work was made possible with support from EcoAnalytics, a research initiative backed by leading environmental organizations in Canada, all of whom provided invaluable insights and feedback throughout the research. The last article (Chapter 4), submitted to the *Journal of Environmental Psychology in May 2023*, stands as an independent effort. Its realization was made possible through an agreement with Greenpeace Canada allowing me to leverage data from other collaborative research efforts. This article investigates how social identity shapes intentions to engage in system change among activists and non-activists in Canada. While Greenpeace Canada's team offered guidance and feedback throughout the research, I had complete autonomy in shaping the analysis.

Chapter 1 – Introduction

In light of the large gap between scientific certainty and public engagement on climate change, climate change communication has been described as one of the greatest science communication failures of all time (Brunhuber 2015). Illustrating the many challenges associated with communicating wicked problems like climate change, public concern, engagement and policy support for climate action remain largely inadequate in spite of the fact that the scientific community has developed an increasingly clear understanding of the severity of climate change.

For decades, climate change communication was initially guided by the information deficit model (Boykoff 2019; Suldovsky 2018). The assumption behind the deficit model was that low public engagement with climate change was the result of inadequate knowledge or insufficient information about the issue. Consistent with this assumption, the deficit approach to communication was centred on providing more information, data and evidence to the public in order to fill the knowledge gap and move public opinion in a direction that reflected a scientific understanding of climate change's severity (Suldovsky 2018). Over the last decade, however, many studies have indicated that the lack of public engagement with climate change is often not the result of insufficient knowledge or information (Kahan et al. 2012; Moser 2007) but rather of disagreements over the way in which climate change affects society and how it is organized (Kahan et al. 2015). Several studies in science communication have also shown that in addition to failing to improve public engagement (Priest 2016), simply providing more information can often produce the opposite effect of what is intended and cause some people – skeptical audiences, in particular – to disengage from the issue even further (i.e. boomerang effect) (Hart and Nisbet 2012).

If information about environmental problems and the urgency to act is not sufficient to motivate engagement and policy support for environmental protection and may even undermine them in some instances, then what will? This dissertation proposes that climate change communication and interventions can be enhanced by better integrating what we know about the social-psychological challenges associated with engaging the public on climate change. Specifically, it

builds on three key findings from social psychology that lend valuable insights into why climate change is such a challenging issue to communicate and tests their potential for advancing climate change engagement in Canada. First, research in social psychology has long demonstrated that individuals with different values, ideologies and worldviews may interpret uncertain or contradictory evidence differently, a phenomenon known as biased assimilation (Corner, Whitmarsh, and Xenias 2012; Kunh and Lao 1996; Lord, Ross, and Lepper 1979). In addition, the literature has highlighted the cultural and group-identity underpinnings of climate change disagreements, which suggests that people may be reluctant to engage in social change and action that promotes environmental protection not only because it contradicts their preexisting beliefs but also because it signals being part of a group they do not identify with (Bashir et al. 2013; Brick and van der Linden 2018). Besides these directional or "motivated" barriers, researchers have identified other cognitive and affective challenges related to climate change communication (for a review, see Gifford 2011). Among these challenges is the tendency for people to feel overwhelmed once they begin to pay attention to climate change, which may lead to denial and disengagement in many cases (Norgaard 2011; Ungar 2000).

These findings offer three important insights for engaging the public on climate change. The first is that a one-size-fits-all approach to communication has little chance of resulting in any meaningful change in public opinion and behaviour (Markowitz and Guckian 2018). In response, scholars have emphasized the importance of understanding one's audience and tailoring communication to match their emotional and informational predispositions and needs (Boykoff 2019; Chapman, Lickel, and Markowitz 2017; Markowitz and Guckian 2018; Scheufele 2018). An increasingly popular method to achieve this is audience segmentation, which involves identifying groups within a population with similar values, motivations, beliefs and behaviours (Hine et al. 2014). Another important insight is that social identity may play an important role in motivating climate action. Similar to how people may resist social change when it signals being part of a group they do not identify with, research has indicated that strongly identifying with a pro-environmental group may increase an individual's willingness to participate in environmental efforts (for a review, see Schulte et al. 2020). This research further suggests that it may be possible to build momentum for climate action by better understanding how individual and social

conditions interact and work together to foster pro-environmental mobilization. Finally, a third promising strategy to overcome the challenges identified above is message framing, a process that involves selectively emphasizing certain key aspects of the perceived reality over others in order to enhance their saliency in the communication process (Entman 1993). However, the existing research suggests that disembodied analyses of framing are likely to provide only partial insights into why, when and how framing works (Brulle 2010; Lakoff 2010) and that developing more effective communication strategies requires understanding how specific audience segments respond to different message frames (Boykoff 2019; Markowitz and Guckian 2018; Scheufele 2018).

Although these findings provide useful insights into improving climate change communication and interventions in general, few studies have examined whether and how these findings can be used to enhance climate change engagement, specifically in Canada. To be sure, Canada is one of the world's leading energy exporters, and is thus an important case for climate change mitigation. The regional cultural and geographic disparities across the country further provide fertile ground for exploring communications insights across a heterogenous population. In an effort to better fill this research gap, this dissertation explores creative social-psychological approaches to engaging Canadians on the issue of climate change. Specifically, it sets out to examine how unique audience segments of the Canadian population think and act toward environmental issues and explores the potential of different communication and intervention strategies for motivating policy support and climate action across various audiences. The rest of this dissertation proceeds as follows. The remainder of the introduction discusses the research puzzle, reviews the literature relevant to the three empirical articles presented in this thesis (i.e. audience segmentation, social identity and message framing), identifies research gaps, discusses the methodology and presents the dissertation's organization. Chapters 2, 3 and 4, respectively, present the three empirical articles that make up the core of the dissertation (two of which have already been published). Lastly, Chapter 5 summarizes the findings, contributions and implications of the dissertation, discusses its limitations and outlines future research avenues.

Research puzzle

The puzzle of this dissertation can be summarized as follows. Paradoxically, increasing public awareness of climate change and filling knowledge gaps about its causes and consequences have not been sufficient to spur public engagement with climate change (Hart and Nisbet 2014; Priest 2016). Several studies in science communication have indicated that in addition to failing to improve public engagement (Priest 2016), providing more factual information on the issue of climate change can have the opposite effect of what is intended, leading some people, particularly those who are skeptical, to withdraw from the issue even further (i.e. boomerang effect) (Hart and Nisbet 2014).

In light of the rapid pace of climate change and the impending deadline to ensure a livable future for humanity, scholars and communicators are being challenged to find new ways of engaging the public on climate change (Boykoff 2019). However, if raising awareness and providing information about the issue does not motivate climate action and support for climate policy, then the question remains as to what will. The articles that make up this thesis are all aimed at addressing this general puzzle. The overarching argument is that environmental communication and interventions can be enhanced by better integrating what we know about the social-psychological factors that drive public engagement and policy support for environmental protection (or lack thereof).

Specifically, the dissertation draws on three key findings from social psychology and tests their potential for advancing climate change engagement in Canada. The first insight relates to research testing biased assimilation theory, which emphasizes the importance of considering the audience's preexisting values and beliefs in the process of communication. A second insight concerns the cultural and group-identity underpinnings of climate change disagreements and the potential role social identity may play in motivating climate action. The third insight applied to climate engagement in Canada relates to the cognitive and emotional challenges of communicating climate change and the potential of message framing to overcome these challenges. The following sections discuss these insights and reviews the literature on climate change audience segmentation, social identity and message framing.

Fostering public engagement with climate change

Successful communication in addressing the science-action gap hinges on fostering public engagement with climate change and environmental issues. As Moser and Dilling (2011) define it, engagement encompasses three facets: cognitive engagement, where individuals mentally grapple with and comprehend the issue; affective engagement, involving emotional responses like interest, concern, or worry; and behavioural engagement, manifesting as changes in climate-relevant actions or political involvement (Lorenzoni, Pidgeon, and O'Connor 2005; Moser 2009; Moser and Dilling 2007). This definition of engagement rests on three fundamental normative assumptions (Moser and Dilling 2011), which also serve as the foundational premises for this dissertation. First, although science alone is not enough to motivate action, science has provided compelling evidence that climate change is occurring and is primarily the result of human activity, which means immediate and significant action must be taken to reduce climate change-related risks. Second, within a democratic system, policymaking demands public input and support, and as a result, ambitious climate policies inevitably call for a certain level of active public engagement. And finally, communication plays an important role, as it provides a useful link between scientists, politicians, and the public, thereby facilitating public engagement with climate change.

For many years, climate change communication has predominantly centered around promoting cognitive engagement while neglecting the affective and behavioural facets of public involvement in climate change and broader environmental issues (Moser and Dilling 2011). This approach rested on the assumption that the lack of public concern and participation was primarily due to an information and comprehension deficit, commonly referred to as the knowledge or information deficit model (Boykoff 2019; Sturgis and Allum 2004; Suldovsky 2017). Under this model, scientific information was often disseminated in a one-way manner from experts to the public, with limited attention paid to the values and beliefs held by the audience. The foundational idea was that by enhancing public knowledge, climate action would naturally follow. Yet, it has become clear that this presumption not only lacks accuracy (Priest 2016) but can also yield counterproductive results, particularly when it characterizes the public as irrational or

uninformed. As emphasized by Nisbet and Scheufele (2009), persistently adhering to the deficit model is likely to worsen conflicts related to science, inadvertently fostering condescension. Condescending assertions of "public ignorance" often serve to alienate important audiences, further fueling discord (Nisbet and Scheufele 2009). This can contribute to a breakdown in communication, resulting in diminished public trust in government and a sense of disconnection from the political process, ultimately discouraging citizens from active engagement.

There is no doubt a compelling case for the widespread dissemination of science education, as it can provide individuals with the ability to distinguish misleading and factually incorrect arguments and resist their appeal (Tseng, Bonilla, and MacPherson 2021). However, the absence of in-depth knowledge about climate change isn't the primary barrier to generating greater concern and action (Moser and Dilling 2011). While there is indeed a moderate correlation between understanding the causes of climate change and adopting appropriate behavioural responses (O'Connor et al. 2002), the evidence also indicates that heightened knowledge about climate change doesn't automatically result in increased concern, nor does it guarantee effective behavioural change (Gardner and Stern 2002).

It has been shown that understanding pro-environmental concerns and behaviour is much more complex than what the information deficit model might initially suggest, with numerous factors intricately linked to engagement. A number of attempts have been made to describe the categories of factors that contribute to pro-environmental behaviour or lack thereof (Gifford and Nilsson 2014). The macro-scale includes a variety of non-psychological factors, such as geophysical conditions and political influence (Gifford 2006; 2008). At the meso-scale, research has dived into various psychological influences, yielding models where attitudes, norms, and behaviours take center stage. To succinctly describe pro-environmental concerns and behaviour, several models have been proposed, including the theory of planned behaviour (Ajzen 1991), the value-belief-norm model (Stern 2000; Stern et al. 1999), the norm activation theory (Schwartz 1977), and the focus theory of normative conduct (Cialdini, Reno, and Kallgren 1990).

The theory of planned behaviour (Ajzen 1991) posits that behavioural intentions can be accurately predicted from attitudes toward behaviour, subjective norms, and perceived behavioural control.

These intentions, in turn, account for a substantial portion of the variance in actual behaviour. In contrast to the theory of planned behaviour, which is primarily based on self-interested motivation, the Norm Activation Model developed by Schwartz (1977) leans toward pro-social motives. According to this model, behavioural change begins with an individual's awareness of the consequences of destructive behaviours, leading to a sense of responsibility for these consequences, which ultimately fosters intentions to act pro-socially. Stern's value-belief-norm theory of environmentalism (Stern 2000; Stern et al. 1999) offers an additional framework for the examination of normative factors promoting sustainable attitudes and behaviour. Combining value theory (Schwartz 1992), the new environmental paradigm (Dunlap et al. 2000), and norm-activation theory (Schwartz 1977), the value-belief-norm theory outlines a chain of variables, stretching from core values and overarching environmental concerns to specific beliefs about the detrimental consequences of certain actions. These beliefs, in turn, activate sustainable personal norms for behaviour. The Focus theory of normative conduct (Cialdini, Reno, and Kallgren 1990) enhances the understanding of social norms, refining the definition by distinguishing between two distinct types of social norm: descriptive and injunctive. Descriptive norms describe what is typically or commonly done, while injunctive norms convey what other group members believe ought to be done. Additionally, the theory introduces the concept of normative focus, shedding light on which type of social norm influences individuals' behaviour in specific situations and why. Cialdini, Reno, and Kallgren (1990) came to the conclusion that, under normal circumstances, behaviour tends to lack guidance from normative considerations if such considerations are not salient. They also cautioned against the misconception that norms, though constantly present within individuals or cultures, are continually influential.

While these models offer valuable insights into pro-environmental action, numerous studies have highlighted the necessity of expanding these models to encompass additional personal and social factors (Chen and Tung 2010; Heath and Gifford 2002; Hinds and Sparks 2008; Raymond, Brown, and Robinson 2011). In a more comprehensive review of the personal and social influences of pro-environmental concern and behaviour, Gifford and Nilsson (2014) identified 18 key personal and social factors that play a pivotal role in shaping pro-environmental attitude and action. Personal factors encompass a wide range of variables, including early childhood experiences,

levels of knowledge and education, personality traits, self-construal, the perception of control, individual values, political and worldviews, personal goals, a sense of responsibility, cognitive biases, attachment to specific places, age, gender, and chosen activities. In parallel, social factors encompass elements such as religious affiliations, urban-rural disparities, prevailing social norms, distinctions in social class, proximity to environmentally problematic sites, and cultural and ethnic diversities.

Rethinking climate change communication

While criticisms of the information deficit approach to climate change have proliferated in the last two decades (Kahan 2013; Pidgeon 2012; Hart and Nisbet 2014; Loewenstein et al. 2001), our knowledge of effective alternative strategies for climate communication in different contexts remains relatively limited. As Stoknes (2014) notes, in order to understand the science-action gap—often referred to as the climate paradox—it is insufficient to solely attribute it to inadequate communication models. Research suggests that several underlying and more profound psychological barriers contribute to our collective response to the challenges posed by climate change (Pidgeon 2012; Gifford 2011; Lorenzoni, Nicholson-Cole, and Whitmarsh 2007). While faulting communication models alone is insufficient, a deeper comprehension of these barriers is imperative for crafting more effective climate communication strategies.

In his examination of the factors hindering action on climate change and environmental issues, Gifford (2011) identifies seven distinct barriers labeled "dragons of inaction." These barriers shed light on various cognitive and psychological challenges that hinder proactive responses to environmental issues. The first barrier, referred to as "limited cognition", encapsulates the difficulty many individuals encounter in comprehending the full magnitude and seriousness of environmental challenges. This limited cognitive grasp impedes their ability to engage in well-informed and effective actions to address these issues. The second barrier, labeled as "ideological worldviews", highlights how specific belief systems can act as substantial obstacles to adopting pro-environmental attitudes and behaviours. These ingrained belief systems can significantly hinder individuals' willingness to engage in environmentally-friendly action or support pro-environmental policy. The third barrier, known as "social comparisons", offers insight into how

people tend to evaluate their environmental actions in comparison to those of others. This comparative assessment can lead to the rationalization of inaction, as individuals may justify their own lack of action by comparing themselves to others who appear to be doing little to address environmental risks. The fourth, "sunk costs and behavioural momentum," delves into the influence of past investments and entrenched behavioural patterns. Even when it becomes evident that change is necessary, individuals often find it challenging to break free from these deeply ingrained habits and investments in the status quo. The fifth barrier, termed "discredence toward experts and authorities," sheds light on the skepticism and reluctance exhibited by many when it comes to trusting information from credible sources. This mistrust can lead to a reluctance to take action on environmental issues, as individuals may question the validity of expert advice. The sixth barrier, "perceived risks of change", delves into the fear of potential discomfort or uncertainty associated with behavioural change. Many individuals are wary of departing from familiar routines and practices due to the fear of encountering adverse consequences or discomfort. Finally, the seventh barrier, referred to as "positive but inadequate behaviour change," highlights instances where individuals initiate positive actions but fall short of making a substantial impact in addressing sustainability challenges. This discrepancy between intent and outcome can be an important hindrance to achieving meaningful environmental progress.

Focusing on communication, Stoknes (2014) has examined various psychological traditions and identified five key barriers that underscore the intricate challenges in effectively conveying the urgency and significance of addressing climate change through climate change communication. The first barrier lies in the way climate change is often presented to the public, making the issue seem distant in time and space. Climate change has long been framed as a problem with impacts seemingly far in the future and often located in far-flung places like the Arctic, Antarctica, or remote Himalayan glaciers. Adding to this remoteness, carbon dioxide is highly invisible, making it challenging for non-experts to grasp fully. The global scale of the climate issue and its often abstract and delayed effects make many feel helpless, as climate disruptions seem very distant from individuals' own locus of control. Research indicates that individuals tend to be more concerned about environmental harm and responsibility when it pertains to their local

surroundings, with these concerns diminishing as the perceived impacts move further away (Leiserowitz et al. 2013a; Uzzell 2008). As Stoknes (2014) highlights, it is easier for many people to assign responsibility for addressing climate change to distant figures like politicians or international leaders who are perceived as having greater social power. This psychological distancing ultimately diminishes the sense of risk and urgency associated with imminent climate disruptions (Spence, Poortinga, and Pidgeon 2012; Weber 2006), leading individuals to disengage and relegate climate change to a realm of "someone else's problem" or a concern to be addressed in the future (Uzzell 2008).

The second psychological obstacle arises from the unintended consequences of how traditional climate communication has typically framed messages. For many years, the prevailing approaches in climate discourse and policy have focused on portraying scenarios of apocalypse, uncertainty, and high costs/losses (Feinberg and Willer 2011; Painter 2013; Schlichting 2013). These framing strategies pose a challenge because humans are known to be risk averse, which means they tend to dislike losses more than equivalent gains (Kahneman and Tversky 1979). As cognitive psychology shows, it follows that communication predominantly emphasizing images of loss and sacrifice is likely to trigger reactions characterized by aversion. Combining doom, cost, and sacrifice frames can be counterproductive as it makes actions to combat climate change seem to necessitate significant short-term sacrifices of immediate and tangible benefits for abstract, distant goals (Hardisty, Johnson, and Weber 2010). The repetitive use of apocalyptic and fear-inducing narratives may have contributed to "issue fatigue" or "apocalypse fatigue" (Feinberg and Willer 2011; O'Neill and Nicholson-Cole 2009; Chen 2016; Hart and Nisbet 2012). While these urgent portrayals of climate change may indeed align with the objective reality, the continuous use of fear and doom framing have been found to have diminishing effects on people's minds (O'Neill and Nicholson-Cole 2009).

The third barrier relates to cognitive dissonance, where a lack of meaningful action weakens people's attitudes toward the issue that requires action. Attitudes typically comprise three components: affect, behaviour, and cognition (Eagly 1993). To maintain positive engagement, these three components should align (Harmon-Jones 1999; Lorenzoni, Nicholson-Cole, and Whitmarsh 2007). As mentioned above, a challenge with conventional rational climate

communication approaches is their predominant focus on the cognitive component of attitudes and engagement more broadly. While it is widely known at a cognitive level that CO2 emissions from fossil fuels contribute to global warming (Leiserowitz et al. 2013a), the link to the other two components—affect and behaviour—is less evident. The dominant emotions associated with attitudes toward this issue often include underlying unease, fear, and guilt, generated by climate messages that continually emphasize the need to reduce activities that generate high levels of emissions (Lorenzoni, Nicholson-Cole, and Whitmarsh 2007; O'Neill and Nicholson-Cole 2009; Stoll-Kleemann, O'Riordan, and Jaeger 2001), yet are also deeply ingrained in most people's lifestyles, making them difficult to alter. Adding to this complexity, research reveals that when actual behaviour doesn't align with cognition and affect, it tends to trigger cognitive dissonance (Pidgeon 2012; Stoll-Kleemann, O'Riordan, and Jaeger 2001). According to dissonance theory, when beliefs and behaviours do not align with each other, individuals often reshape their beliefs to match their actions. Moreover, they may adapt their attitudes to align with those of significant people in their lives, such as colleagues, friends, and family, to avoid social dissonance (Hernes 2012). This interplay sets the stage for persistent inaction on climate change. Doom-laden climate communications evoke negative emotions that should, in theory, encourage attitudes favorable to climate action. However, over time, they also contribute to issue fatigue. Given that addressing climate change necessitates altering deeply ingrained behaviours that are notoriously resistant to change, the persistence of these behaviours weakens attitudes, ultimately undermining the entire objective of climate communication.

The fourth barrier is denial reinforced by doubt and dissonance. While denial can be fueled by cognitive dissonance, it represents a more potent obstacle as it entails an outright refusal to acknowledge the issue. Research shows that many individuals only consider problems serious if they believe there are actionable solutions (Norgaard 2011; Krosnick et al. 2006). As a result, many people tend to stop paying attention to global climate change when they realize there are no easy solutions. This underscores the ongoing challenge of capturing and retaining public attention in climate change communication.

Finally, the fifth barrier is that climate messages are influenced by cultural identity. The concept of "cultural cognition of risk" refers to individuals' tendency to shape their risk perceptions in

ways that align with their values (Kahan, Jenkins-Smith, and Braman 2011). This aligns with the confirmation or assimilation bias, a well-documented cognitive mechanism (Newell and Pitman 2010; Whitmarsh 2011; Milfont 2012) which will be delved into more deeply in following sections. Essentially, those who are already concerned and engaged in climate issues tend to consume content that confirms their existing beliefs, while those with opposing attitudes often steer clear of, mistrust, or rationalize away information containing unsettling climate facts. Another prevailing tendency among most people is to seek information from sources that already align with their established viewpoints (Kahan et al. 2007).

While progress has been made in integrating psychological barriers into climate change communication in recent years, there is still considerable potential for exploring alternative approaches rooted in a more psychologically-oriented perspective. This could have significant implications for climate change communication in Canada, enhancing its resonance and effectiveness. The next section explores three crucial insights from the field of social psychology, underscoring both the recent advancements and the enduring gaps in knowledge. The first insight emphasizes the significance of biased assimilation theory, highlighting the importance of taking into account the preexisting values and beliefs of the audience during communication efforts. The second insight explores the complex interplay of cultural and group-identity factors that contribute to disagreements regarding climate change, shedding light on the potential role of social identity in motivating climate action. The third insight addresses the complex landscape of cognitive and emotional challenges involved in communicating climate change, all while considering the promising potential of message framing to surmount these challenges. These insights are elaborated upon in the subsequent section.

Climate change audience segmentation

Social psychology has long reported that individuals with opposing prior attitudes tend to process uncertain or conflicting evidence in very different ways (Kunh and Lao 1996; Lord et al. 1979). Research in this field suggests that people often assimilate new information in a way that matches their existing values and attitudes, a process known as biased assimilation (Druckman and McGrath 2019). Besides being stronger predictors of engagement and policy support than

sociodemographic characteristics and knowledge (Kahan 2013; Whitmarsh 2011), values, ideologies and worldviews can also serve as perceptual filters when interpreting information about climate change. Known to be rooted in values and worldviews (Whitmarsh 2011), climate change skepticism has further been characterized as a psychological mechanism against threatening information. Thus, beyond influencing general attitudes toward climate change and policy (Bernauer and McGrath 2016; Drews and van den Bergh 2016), values, worldviews and ideologies can play a crucial role in determining the outcome of climate change communication and interventions.

In light of this phenomenon of biased assimilation, a one-size-fits-all approach to climate change communication has little chance of generating significant changes in public opinion and behaviours on the aggregate (Markowitz and Guckian 2018). In response, scholars have pointed out the importance of knowing one's audience and tailoring communication strategies based on their preexisting values and beliefs (Boykoff 2019; Markowitz and Guckian 2018; Scheufele 2018). An increasingly common strategy to achieve this goal is audience segmentation, which involves identifying groups within a population that share values, motivations, beliefs and behaviours (Hine et al. 2014). One of the most well-known and long-established efforts to segment climate change audiences can be found in the "Global Warming's Six Americas" studies conducted by the Yale and George Mason Program on Climate Change Communication (Maibach et al. 2011). In order to identify the original six audiences, the authors subjected 36 variables assessing the climate change beliefs, issue involvement, policy preferences and behavioural responses of a nationally representative survey of United States residents to latent class analysis (LCA). The six audiences identified in this study reflect quantitative shifts from high to low levels of climate concern and issue engagement, ranging from Alarmed (18%) to Concerned (33%), Cautious (19%), Disengaged (12%), Doubtful (11%) and Dismissive (7%). The use of audience segmentation by climate change researchers has grown significantly over the past few years, with the Global Warming's Six Americas model being extended to several countries, including India (Leiserowitz et al. 2013b), Australia (Hine et al. 2013, 2016; Morrison et al. 2013), Germany (Metag, Füchslin, and Schäfer 2017), Singapore (Detenber 2016), the Netherlands (Wonneberger, Meijers, and Schuck 2019) and New Zealand (Thaker 2021).

While there is a growing interest in harnessing audience segmentation principles to enhance climate change communication, some scholars have expressed concerns regarding these methods, apprehensive that they may inadvertently amplify individual differences and contribute to community polarization (Corner and Randall 2011; Hine et al. 2014). The association of audience segmentation with marketing strategies has raised worries that it could potentially prioritize individualistic values and short-term interests over communal objectives and long-term sustainability. However, when employed judiciously to ensure a focus on collective values, the advantages of audience segmentation far outweigh its shortcomings. Substantial evidence clearly demonstrates that tailored communication strategies outperform generic ones. In fields such as health communication and politics, research consistently indicates that tailored messages are better received and are viewed as more credible than non-tailored ones (Skinner et al. 1999; Rimer and Glassman 1999; Kreuter et al. 2000). In the realm of climate change communication, studies reveal that audiences exhibit varying responses to distinct messaging approaches, highlighting the imperative need for tailored communication strategies. For instance, Hine et al. (2016) found that messages highlighting local climate change impacts primarily resonated with dismissive individuals, while adaptation-specific advice had a broader appeal. This indicates that a nuanced understanding of audience characteristics can significantly enhance the effectiveness of communication efforts.

Though the aim of audience segmentation studies is generally to communicate with audiences more effectively through tailored messages, the impact of tailored climate change communication on different audience segments has received scant empirical attention to date, especially in Canada where no study had been published about climate change audience segments prior to this dissertation.

Social identity and collective climate action

Other research has pointed to the cultural and group-identity underpinnings of climate change disagreements. The cultural theory of risk posits that people ascribe to certain beliefs in a way that supports and reinforces their convictions about how society should be organized (Douglas and Wildavsky 1982; Rayner 1992). According to Douglas and Wildavsky (1982), individuals draw

attention to certain risks and disregard others depending on their cultural worldviews. These worldviews can be classified according to two factors, the first determining whether the worldviews of an individual cohere with a communitarian social order (the group factor) and the second whether it favours a hierarchical or egalitarian society (the grid factor). Although Douglas and Wildavsky provided evidence that individuals develop risk perceptions that are consistent with their cultural worldviews, they did not offer any systematic explanation as to why this occurs. A potential explanation can be found in identity-protective cognition, which asserts that individual well-being is closely related to group membership and that consequently, people are strongly motivated to evaluate information in a way that reinforces beliefs associated with belonging to particular groups (Cohen 2003; Cohen, Aronson, and Steele 2000). From this perspective, group membership affects information processes through the emotional and psychic investment that people place in seeing their group's beliefs validated (Chen et al. 1999; Giner-Sorolla and Chaiken 1997).

Bringing these two bodies of research together, cultural-identity-protective cognition (Kahan and Braman 2006) suggests that individuals form perceptions of risk based on cultural meanings in a way that tends to reinforce the group's position regardless of the actual content (Kahan et al. 2015). This entwining of beliefs and identity suggests that people may resist social change and action promoting environmental protection not only because it contradicts their preexisting beliefs but also because it signals being part of a group with which they do not identify (Bashir et al. 2013; Brick and van der Linden 2018). As an example of this phenomenon, correlational studies in the US have found that people's highly visible pro-environmental behaviour decreased when associated with an unwanted identity (Brick et al. 2017).

In addition to explaining climate inaction, group membership can also act as a powerful motivator of collective action. Similar to how people may resist social change when it signals being part of a group they do not identify with, strongly identifying with an environmental group may increase an individual's willingness to participate in environmental efforts. Hence, to gain a better understanding of group-related processes underlying responses to climate change, one strategy is to examine why and under what circumstances individuals come to believe that they belong to

a larger group for which they are willing to act collectively (Fielding et al. 2008; Tajfel and Turner 1979). According to social identity theory (Tajfel and Turner 1979), social identification or the extent to which one identifies with a social group is among the strongest predictors of collective action intentions (Drury and Reicher 2009; Stürmer and Simon 2004; van Zomeren, Postmes, and Spears 2008). Although social identity has a long history in the study of social movements, its potential role as a predictor of climate action has only recently begun to receive consistent scholarly attention (Masson and Fritsche 2021). Among the main findings emerging from this field of research are that social identity plays a greater role in predicting *collective* pro-environmental action than *individual-level* action (Schulte et al. 2020) and that it may have greater predictive power among non-activists than activists (Pozzi et al. 2022). While these results suggest that social identity's predictive power may vary across audiences and contexts, the role of social identity in explaining the willingness to engage in collective action among diverse audiences remains largely underexplored. This is important, as the environmental psychology field has been arguing for better integration of the collective dimension of climate action in recent years, notably highlighting the important role social identity may play in motivating collective action (Bamberg et al. 2018; Barth et al. 2021; Schulte et al. 2020). However, to date, little research has explored how individual and social factors interact and work together to foster collective environmental action.

Message framing

Beyond these directional or motivated barriers, research has also identified other cognitive and affective challenges associated with climate change communication. In part as a result of the uneven distribution of severe climate change impacts geographically and the fact that many have not yet experienced significant climate change impacts personally (Markowitz and Guckian 2018), climate change risks are generally perceived as a relatively low-priority issue compared with other political challenges (Borick and Lachapelle 2022; Pidgeon 2012; Smith and Leiserowitz 2014). As climate change is often not a top-of-mind concern for the public, capturing people's attention with communication efforts is challenging in itself. Adding to this complexity, studies have indicated that even when people do begin to pay attention to the issue, they tend to feel

overwhelmed by the issue (Lertzman 2015), which may lead many to disengage from it both emotionally and cognitively and, in some cases, to even actively avoid climate change-related information (Norgaard 2011; Ungar 2000).

In this context, climate change communicators are being challenged to convey the urgency of climate change without instilling a sense of helplessness in the public. A promising strategy to overcome these challenges is message framing, a process that involves selectively emphasizing certain key aspects of the perceived reality over others in order to enhance their saliency in the communication process (Entman 1993). While there are many ways of framing climate change, framing effects are thought to occur in two major ways: when individuals change their attitudes or behaviours as a result of the same information being presented differently (e.g. equivalence framing) or when certain aspects of an issue are being emphasized over others (e.g. emphasis framing (Cacciatore, Scheufele, and Iyengar 2016; Chong and Druckman 2007; Druckman 2001; Entman 1993). Many experimental studies of equivalency framing have examined how the exposure to messages presenting information either positively (e.g. gains from action) or negatively (e.g. losses from inaction) influences perceptions about climate change (Morton et al. 2011; Spence and Pidgeon 2010). On the one hand, several studies have found that messages expressed in loss terms are more effective at influencing climate change attitudes and behaviours than their positive counterparts. These results are consistent with the literature on prospect theory, which suggests that individuals tend to be risk averse (Kahneman and Tversky 1979) and should therefore be motivated more by the prospect of losing something than gaining its equivalent. On the other hand, the cognitive and emotional challenges of communicating climate change may limit the effectiveness of loss frames, as evidenced in many other studies in which loss-framed messages were less effective than gain-framed ones (e.g. Cho and Sands 2011; Quick et al. 2015; Spence and Pidgeon 2010). Spence and Pidgeon (2010), for example, found that framing climate change mitigation efforts in terms of gains (e.g. preventing floods and sea level rise) as opposed to losses (e.g. more floods and further sea level rise) resulted in stronger perceptions of climate change severity and greater support for climate change mitigation in the United Kingdom. Similarly, Gifford and Comeau (2011) tested the impact of motivational and sacrifice frames on perceived competence, engagement and behavioural intentions in Canada.

Their findings revealed that exposure to motivational framing resulted in significantly higher levels of perceived competence, engagement, and various behavioral intentions compared to sacrifice framing. This study further identified moderated factors such as gender, age, income, and educational level. These moderating factors might help explain the divergent findings in the broader literature regarding the effectiveness of positive and negative messaging, as variations in sample composition among studies may influence the efficacy of different messaging approaches. Another potential explanation is that the effect of messaging may be mediated by specific message-induced emotions. Although message-induced emotions, particularly hope, fear, and worry, have been identified as mediators in framing effects (Nabi, Gustafson, and Jensen, 2018), many studies comparing different framing approaches tend to overlook the emotional responses evoked by these frames.

According to a meta-analysis of experimental studies on emphasis-based frames (Li and Su 2018), messages emphasizing climate change's environmental, economic and moral aspects generally increase individuals' engagement with climate change, whereas frames emphasizing public health and geographical identity have little impact. This research also provided evidence in line with biased assimilation theory and highlighted the importance of employing frames that resonate with specific audiences (Bolsen and Shapiro 2017; Li and Su 2018). Importantly, this study found strong evidence of boomerang effects, where mismatches between messages and target audiences generate responses that are opposite to those intended (Myers et al. 2012; Whitmarsh and Corner 2017; Zhou 2016). For instance, Zhou (2016) found that a message emphasizing the reasons for climate action increased opposition to a variety of climate policy initiatives even when the message appeared to align with conservative values (e.g. national security or economic freedom).

While these results stress the importance of empirically examining audience responses to various messaging frames, few studies have adopted an audience segmentation approach to studying framing effects. Among the exceptions, Myers et al. (2012) found that framing climate change as a health issue had a positive effect across all segments, with positive reactions increasing in size

across the segments from Dismissive to Concerned. However, the national security frame produced an unanticipated boomerang effect – eliciting more negative emotions – on Doubtful and Dismissive. In another study conducted in Australia, Hine et al. (2016) found that messages with strong negative emotional content increased adaptation intentions in their three audience segments (Dismissive, Uncertain and Alarmed), while messages focusing on local impacts were effective in increasing engagement among the Dismissive audience only. Overall, this research suggests that disembodied analyses of framing provide only partial insights into how, when and why framing occurs (Nylund-Gibson and Choi 2018) and that understanding audience responses to different message frames is crucial to developing effective communication strategies (Boykoff 2019, Markowitz and Guckian 2018; Scheufele 2018).

Research gaps

Notwithstanding these insights, two important research gaps remain in the climate change literature. First, despite the implicit and explicit aims of audience segmentation studies to communicate with specific audiences more effectively through tailored messages, relatively few empirical studies have examined the effect of climate change communication and interventions on specific audience segments. While several studies have stressed the importance of focusing on specific audiences when communicating climate change (e.g. Hine et al. 2016; Myers et al. 2012), the effect of message framing across audiences remains largely understudied, especially in the Canadian context where no study had been published about climate change audience segments prior to the research presented in this dissertation. Second, although the environmental psychology field has been arguing for better integration of the collective dimension of climate action (Bamberg et al. 2018; Barth et al. 2021; Schulte et al. 2020), notably highlighting the important role social identity may play in motivating collective action, little research has explored how individual and social factors interact and work together to foster collective environmental action. Much remains to be understood about how audience segmentation relates to other influential theories in social psychology, including the social identity approach, which could play an important role in explaining collective action in the context of climate change, as evidenced in recent research findings (e.g. Schulte et al. 2020).

Methodology

Each of the three research articles presented in this dissertation uses a variety of research methodologies, including LCA, survey experiments, ordinary least squares regression and multigroup structural equation modelling. The following section discusses these methodologies.

Audience segmentation

As mentioned previously, audience segmentation involves identifying subgroups within a population who share similar characteristics, such as values, motivations, beliefs and behaviours (Hine et al. 2014). Audience segmentation procedures are used to identify clusters of individuals with similar patterns of responses across a given set of observed indicators, with the aim of minimizing within-group differences and maximizing between-group differences (Hine et al. 2014).

In this dissertation, four unique audience segments were created using LCA modelling: the first on Canadian public opinion (article 1), the second on supporters of Canada's environmental movement (article 2) and the third and fourth on two samples of activists and non-activists in Canada (article 3). LCA is a statistical technique used to identify and describe latent classes within a population based on a set of observed indicators. These classes can be considered unobserved subgroups or typologies that reflect heterogeneity in a population relative to a given phenomenon (Nylund-Gibson and Choi 2018). One may think of LCA as a way to group similar people together (whereas factor analysis groups items). Contrary to factor analysis, which identifies similar variables by estimating a latent factor referred to as the common factor, LCA groups people based on their heterogeneity or according to their divergent responses to a set of observed indicators (Nylund-Gibson and Choi 2018).

Compared with other clustering techniques, such as k-means, LCA offers several advantages. First, LCA is a probabilistic version of k-means clustering (Magidson and Vermut 2002). While k-means groups cases that are close to k centres (based on an ad-hoc distance measure for classification), LCA relies on probabilities to define closeness to each centre (McLachlan and Basfort 1988). In LCA, an individual contributes to a cluster k's mean with a weight equal to its posterior

membership probability for cluster k, whereas in the case of k-means, this weight takes the value of zero or one, which is incorrect in the case of misclassification. In such cases, individuals' weights can bias the clusters' mean, which, in turn, causes additional misclassifications. Moreover, k-means does not provide any indicator to determine the number of clusters (Magidson and Vermut 2002), whereas LCA provides several indicators, including the Bayesian information criterion (BIC). Finally, k-means only allow for interval scale quantitative variables, while LCA allows for both continuous and categorical (nominal or ordinal) variables.

Experimental survey designs

Each article in this dissertation combines LCA with experimental survey designs. Experimental survey designs are experiments generally embedded within large survey samples (Lavrakas et al. 2019). Among the greatest strengths of this methodology is its ability to draw causal conclusions based on a true experimental design while still allowing a high degree of confidence in the generalizability of the findings (Fienberg and Tanur 1987, 1989, 1996; Mutz 2011). Experimental designs of this type involve the random assignment of respondents to experimental conditions. In general, the causal treatment effect of an experimental condition is assessed by comparing its effects with those of the control condition on the dependent variables of interest (Morgan and Winship 2007). Various methods are employed in this dissertation to assess causal effects across experimental conditions, including ordinary least square regression (article 1) and simple mediation analysis(article 2), as well as multigroup structural equation modelling (article 3).A detailed description of the methodology is provided in each article. As structural equation models are less common in experimental data analysis, the following section provides some details about the use of structural equation models in experimental design.

Structural equation modelling and experimental designs

First-generation multivariate data analysis techniques, such as multiple regression, logistic regression, and analysis of variance are fundamental tools for empirically testing hypothesized relationships between variables of interest. Numerous researchers in various scientific disciplines have applied these methods to generate findings that have significantly shaped the way we see

the world today. However, these techniques share three important limitations (Hair et al. 2021). First, they assume a simple model structure. Assuming a straightforward model involving a single layer or dependent and independent variables, these models are not able to simultaneously estimate complex causal chains such as "A leads to B leads to C", which can have important effects on result accuracy (Sarstedt et al. 2020). Second, these models require that all variables be considered observable. Theoretical concepts, which are abstract and unobservable properties of a social unit of entity (Bagozzi and Philipps 1982) can only be considered after prior stand-alone validation by means of a confirmatory factor analysis (CFA), for example, and these measures of theoretical concept ex post comes with various drawbacks. Third, first generation multivariate data analysis techniques presume variables are measured without error (Haenlen and Kaplan 2004). Yet, all real-world observations are accompanied by a certain degree of measurement error, either systematic or random. Strictly speaking, first-generation techniques are only truly suitable without these errors, a situation rarely occurring, especially when estimating relationships among theoretical concepts like perceptions, attitudes and intentions, which are frequently used in social and political sciences.

To address these issues, researchers have increasingly been turning to second-generation techniques, which are referred to as structural equation modeling (SEM). SEM allows for the simultaneous modeling of complex relationships between multiple variables, often unobservable and measured via multiple indicators. It also accounts for measurement errors, providing a clearer measure of the theoretical concepts (Cole and Preacher 2014).

Within SEM, two main methods prevail: covariance-based SEM (CB-SEM) and partial least squares SEM (PLS-SEM). CB-SEM tests theories by gauging how well a theoretical model aligns with the covariance matrix of observed data. This approach confirms/rejects hypotheses by determining how closely a proposed theoretical model can reproduce the covariance matrix for an observed sample dataset. In contrast, PLS has been introduced as a "causal–predictive" approach to SEM (Jöreskog and Wold 1982), focusing on explaining variance in dependent variables (Chin et al. 2020).

While SEM can be useful for researchers conducting experiments (Breitsohl 2018), and SEM variants for analyzing data from experiments have been available for decades (e.g. Bagozzi 1977; MacCallum and Austin 2000; Ployhart and Oswald 2004), its application remains limited. Researchers traditionally use variants of the general linear model (GLM)—encompassing ANOVA and multiple linear regression—to analyze to data collected through experiments. For instance, a review of 117 articles from the 2015 Journal of Applied Psychology showed that of 28 experimental articles, 86% employed the GLM (Breitsohl 2018). Such reliance on conventional techniques contrasts with non-experimental studies, where SEM is increasingly recognized as a valuable analytical framework (Hancock and Mueller 2013; Kline 2016).

Central to experimental designs is the systematic comparison of groups with randomly assigned members that correspond to the levels of the independent variables on the dependent variable (Tabachnick & Fidell, 2007a). This can also be achieved using variants of SEM, such as multigroup SEM (Breitsohl 2018). While ANOVA examines average differences in observed dependent variables among groups, multigroup SEM variants delve deeper, contrasting *latent* dependent variable differences. Furthermore, multigroup analysis extends beyond ANOVA by modeling multiple indicators and their measurement errors. This enhanced modeling approach addresses potential biases arising from overlooking measurement inaccuracies, a noted limitation in traditional experiments (Culpepper and Aguinis 2011; Ree and Carretta 2006). Moreover, with explicit measurement error modeling, SEM can remove unsystematic variance from treatment effect estimates, increasing power over other more conventional methods (Phillips and Jiang 2016; Ree and Carretta 2006).

In multigroup SEM, analysis begins with an unconstrained model estimation, followed by a series of more constrained models, where each restricts an effect of interest (e.g. the main effect of an independent variable) to zero—representing the corresponding null hypothesis. These constraints essentially map experimental groups to their conceptual independent variable levels. Comparing a model's fit to an unconstrained version helps determine the validity of the null hypothesis, which posits no difference between independent variable levels. Each comparison is tailored to assess a distinct null hypothesis. When the fit of a more constrained model worsens

and the χ2 difference test indicates significance, the null hypothesis can be rejected (Breitsohl 2018). Essentially, the constraints applied within the SEM methodology mirror the null hypotheses utilized in ANOVA (Tabachnick and Fidell 2007). A similar methodology is employed in the third article, where further details are provided.

Overview of the dissertation

Each of the three empirical chapters presented below explores creative social-psychological approaches to engaging Canadians on the issue of climate change. Together, these chapters set out to answer the following two questions: 1) how are unique audience segments of the Canadian population perceiving and acting upon climate change? and 2) how can social psychology insights be used to inform climate change communication and intervention strategies in Canada?

Specifically, the first article, published in *PLOS One* (Chapter 2), examines how unique audience segments within the Canadian population think about climate change and explores whether and how the level of audience engagement moderates the effect of various messages on support for carbon pricing. Analyzing the data collected from a random probability survey of adult Canadians conducted in October 2017, this article shows that the Canadian population can be divided into five distinct segments, offering potential targets for communicating about carbon pricing. By extending the findings from the audience segmentation literature to the Canadian case and exploring how each segment responds to different messages about carbon taxes, this study emphasizes the importance of audience-based data for climate research, policy and communication while laying the groundwork for future research aimed at tailoring messages for different audiences.

The second article, published in *Frontiers in Communication* (Chapter 3), examines how negative and positive messaging influence emotional arousal and climate action across unique audiences within Canada's environmental movement. Drawing on a two-wave panel survey of Canadian environmentalist NGO members (N = 308) conducted in 2019 and 2021, this study shows that

negative messages about climate change (e.g. sounding "code red for humanity") can be less mobilizing than positive messaging even when the message is directed toward relatively engaged audiences and followed by the opportunity to take specific, actionable and effective action. This finding highlights the role message framing may play in overcoming the cognitive and emotional challenges of climate change communication while further emphasizing the importance of inspiring people with hopeful and optimistic messages.

The third article, submitted to the *Journal of Environmental Psychology* (chapter 4), examines the role of social identity in predicting intentions to mobilize for system change across diverse audiences of activists and non-activists in Canada. Drawing on two online surveys conducted in 2021 and 2022 with samples of Greenpeace Canada supporters (N = 1,394) and the Canadian public (N = 1,514), this study provides empirical evidence that social identity can be a powerful predictor of collective action intention and emphasizes the importance of integrating notions of audiences and group goals into existing social identity models of collective action. By offering an empirical test for the role of social identity in predicting the intention to participate in system-challenging collective action among diverse values-based audiences, this article offers a fresh perspective on how individual and social conditions can interact and work together to foster environmental mobilization.

Finally, the concluding chapter summarizes the findings, contributions and implications of the dissertation, discusses its limitations and outlines future research avenues.

Chapter 2 – The Five Canadas of Climate Change: using audience segmentation to inform communication on climate policy[1]

Introduction

A well-established finding in social psychology suggests that people with different values, ideologies and worldviews process uncertain or conflicting evidence very differently (Kunh and Lao 1996; Lord, Ross, and Lepper 1979). This research suggests that people tend to assimilate new information in a way that is consistent with their preexisting attitudinal positions, a process referred to as "biased assimilation" (Druckman and McGrath 2019). The role of prior attitudes in the interpretation and assimilation of new information helps to explain why values, worldviews and ideology are so important in the formation of attitudes toward climate change and climate policy (Bernaueur and McGrath 2016; Drews and van den Bergh 2016). In addition to being stronger predictors of engagement than socio-demographic characteristics and knowledge (Kahan 2013; Whitmarsh 2011), values, ideologies and worldviews act as perceptual filters in the process of interpreting information about climate change, thus making them a crucial component of climate communication (Corner 2014). This phenomenon of biased assimilation and motivated reasoning more generally significantly undermines any hope of generating a "one-size-fits-all" approach to climate change communication that is expected to produce change in public opinion and behaviours (Markowitz and Guckian 2018).

In response to these challenges, many scholars have emphasized the importance of knowing one's audience and tailoring communication to fit the audiences' preexisting dispositions and needs (Markowitz and Guckian 2018; Maxwell 2019; Scheufele 2018). An increasingly common approach used to identify specific targets is audience segmentation, which aims to identify subgroups that share similar characteristics in terms of values, motivations, beliefs and

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[1] This is a pre-print version of what appears in Martel-Morin and Lachapelle (2022a).

behaviours within a population (Hine et al. 2016; 2017). While the use of audience segmentation in the context of climate change is growing (Hine et al. 2016; Maibach et al. 2011; Metag, Füchslin, and Schäfer 2017), to our knowledge, there exists no detailed audience segmentation of the Canadian population in the peer-reviewed literature. Research on Canadian climate change attitudes is relatively small but growing. This literature has examined climate change perceptions across ideological (Heath and Gifford 2006), partisan (Lachapelle, Borick, and Rabe 2012), and geographic (Mildenberger et al. 2016) dimensions, demonstrating substantial heterogeneity in Canadian public opinion. Other studies are more focused on mitigation policy preferences (Rhodes, Axsen, and Jaccard 2017), attitudes toward energy technologies (Donald et al. 2021) and communication strategies around proposed energy infrastructure (Lachapelle, Morin-Chassé, and Nadeau 2021). Yet little is known as to whether and how communication strategies ought to be adapted to speak to the different audiences and interpretative communities within this geographically large and culturally diverse top 5 fossil-fuel producing country. This remains an important limitation, as better integration of the principles of effective communication could potentially improve climate change communication across diverse audiences, especially when applied to controversial climate policies that are debated in public discourse.

To address these gaps, our study examines how unique audiences think and act toward climate change in Canada and explores whether and how the level of audience engagement moderates the effect of message framing on support for carbon pricing, a policy that has received substantial academic attention while generating much political debate. The aim pursued is twofold. First, to identify and describe climate change audience segments in Canada and, second, to assess whether emphasis-framing effects around carbon pricing vary as a function of audience segment. To answer these questions, we examine data from a random probability survey of adult Canadians conducted in October 2017. Building on the pioneering approach developed by the Yale/George Mason University Program on Climate Communication (Maibach et al. 2011), we apply Latent Class Analysis modeling to create a novel typology of Canadian public opinion regarding climate change. We find that the Canadian population can be divided into five distinct segments, offering potential targets for climate change communication. These audience segments range along a continuum of knowledge, attitudes and behaviours, from the Alarmed (who accept climate

change as a serious problem and take personal and political action to counter it) to the Dismissive (who reject the reality of climate change and oppose action). We then examine a factorial 2 X 4 survey experiment embedded in the same survey in order to explore whether audience segments moderate the effect of alternative messaging strategies for communicating carbon pricing in Canada. Overall, our results suggest that Canadians vary significantly in their level of engagement with climate change and that some messages may be better suited at speaking to specific audiences than others.

The remainder of the paper is organized as follows. We begin by examining the literature on climate change audience segments and carbon pricing communication. After outlining our research design, we present the results of our audience segmentation and survey experiment. We conclude by presenting the potential implications of our findings and proposing some new avenues for further research.

Audience segmentation for climate change

Perhaps the best-known and long-standing effort at climate change audience segmentation to date is found in the "Global Warming's Six Americas'' studies realized by the Yale and George Mason Program on Climate Change Communication (Maibach et al. 2011). To identify the six audience segments, 36 variables assessing climate change motivations, behaviours and preferred societal responses of a nationally representative survey of U.S. residents were subjected to Latent Class Analysis. The six audiences identified by this method reflect quantitative shifts from high to low levels of concern, issue engagement and degree of certainty that global warming is occurring. Though some scholars have raised important concerns regarding the limits of audience segmentation as a tool of social marketing (Corner 2011), the use of audience segmentation by climate change researchers has grown considerably (Hine et al. 2017). For instance, the Global Warming's Six Americas' model has now been adapted and extended to India (Leiserowitz et al. 2013b), Australia (Hine et al. 2013; 2016; Morrison et al. 2013), Germany (Metag, Füchslin, and Schäfer 2017), Singapore (Detenber 2016), the Netherlands (Wonneberger, Meijers, and Schuck 2019) and New Zealand (Thaker 2021). Segmentation analyses have also been applied to other environmental issues, such as environmental protection (Hefner 2013) and worldviews (Bernstein

and Szuster 2018), energy-related behaviours (Sütterlin, Brunner, and Siegrist 2011), and recycling attitudes (Vicente and Reis 2007) and behaviours (Boivin, Gagné, and Champagne Saint-Arnaud 2017). Given the central role ideologies, values and worldviews play in shaping individuals' response to climate change information (Kunh and Lao 1996; Lord, Ross, and Lepper 1979; Kahan 2013) audience segments could act as important moderators of message framing effects. Such framing effects are thought to occur when presenting the same information in different ways (i.e. equivalency framing) or emphasizing particular aspects of an issue over others (i.e. emphasis framing) causes citizens to alter their preferences (Cacciatore, Scheufele, and Iyengar 2016; Chong and Druckman 2007; Druckman 2001; Entman 1993).

Despite the implicit and explicit goal of audience segmentation studies to better communicate with specific audiences with tailored messages, there are still relatively few studies that use audience segmentation to empirically assess how specific audience segments respond to different types of climate change communications and interventions. Among the exceptions, Myers et al. (2012) use the Six Americas segmentation model and demonstrate that framing climate change as a health issue elicited positive emotional reactions (e.g. hope) across a range of audiences, with such effects increasing in size when comparing the most dismissive to the most concerned audience segments. As a result, they suggest that a public health frame might bolster support for climate change policy. However, this study also found that a national security frame produced an unanticipated boomerang effect on the relatively less engaged audiences (i.e. Doubtful and Dismissive segments), highlighting the propensity of different audiences to react in a non-uniform manner to a given message. In another study conducted in Australia, Hine and colleagues (Hine et al. 2016) found that messages with strong negative emotive content increased adaptation intentions in all three of their segments (i.e. Dismissive, Uncertain and Alarmed), while messages focusing on local impacts were effective at increasing engagement among dismissive audiences only. While these studies underscore the importance of considering audiences in the process of climate change communication, the varying effects of message framing across audiences generally remain underexplored, especially in the Canadian context, where no study about climate change audience segments, to our knowledge, has been published to date. To the extent that public opinion on climate change varies across cultural, political and regional

environments (Scheufele 2013; 2014), patterns of climate change segmentation are likely to diverge across cultural contexts (Scheufele 2018). As a result, the Canadian public is unlikely to segment into the same sub-populations as the U.S., German or Australian public. Furthermore, as Metag and Schäfer point out (2018), existing segmentation studies differ considerably in the constructs, measures and analytical procedures used, which makes cross-study comparisons challenging. For instance, some segmentation studies are based on Latent Class Analysis (e.g. Thaker 2021; Metag and Schäfer 2018), while others are based on Cluster Analysis (e.g. Metag, Füchslin, and Schäfer 2017; Wonneberger 2019) or Latent Profile Analysis (e.g. Hine et al. 2016).

With these limitations in mind, the aim of this study is not to directly assess how Canadian segments compare to those found in the United-States or other countries, but rather to provide context-relevant audience insights to inform communication for specific audiences. Specifically, we extend findings from the audience segmentation literature to the case of Canada, and explore the reactivity of different segments to messages around carbon pricing. Communicating about carbon pricing

Carbon pricing is one of the most commonly discussed policy instruments in both political and academic circles. According to the World Bank Carbon Pricing Dashboard, no fewer than 45 national and 34 subnational jurisdictions representing one fifth of global GHG emissions are covered by some form of a carbon price as of November 2021 (World Bank 2021). Despite being supported by a broad coalition of actors including international organizations, high profile economists, as well as some of the largest environmental NGOs, however, this policy approach has proven to be politically controversial across a variety of contexts (Harrison 2010; Lachapelle 2017; Mildenberger 2019; Rabe 2018). One of the key reasons people dislike carbon taxes is because the costs they impose are highly visible and perceived to be high (Carattini, Carvalho, and Fankhauser 2018; Jagers 2009). In fact, experimental evidence suggests that support for carbon taxes decreases with rising tax levels (Beiser-McGrath and Bernauer 2019; Jagers, Martinsson, and Matti 2019; Jagers et al. 2021). To the extent that carbon prices will need to substantially increase in order to meet the goals of the Paris Agreement (World Bank 2020), this public opposition to higher carbon taxes remains an important political barrier, thus pointing to

the potentially heightened role of policy design and communication in a context of rising carbon prices.

In order to overcome public opposition, a burgeoning literature has pointed to the potential of revenue recycling as a means of building public support for carbon taxes and carbon pricing more generally (Beiser-McGrath and Bernauer 2019; Carattini, Carvalho, and Fankhauser 2018; Dolšak, Adolph, and Prakash 2020; Lachapelle 2017; Nowlin, Gupta, and Ripberger 2020; Raymond 2019). In particular, a number of scholars and policy actors have identified lump-sum transfers, or equal per capita dividends, as a promising strategy for building public support (Jagers et al. 2021; Klenert et al. 2018). However, other research suggests that earmarking revenues to invest in programs and policies that strengthen and further reduce emissions may be seen as preferable from the perspective of the public. Focus groups conducted in Denmark (Klok et al. 2006), Ireland (Clinch and Dunne 2006), and the United Kingdom (Dresner, Jackson, and Gilbert 2006) all showed that respondents preferred earmarking revenues over other forms of revenue recycling to support additional emissions reductions. Consistent with this, a survey conducted on a large probabilistic sample of the Canadian population revealed a clear preference for earmarking carbon price revenues to fund investments in renewable energy (51%) over tax rebates (15%), and cuts to other taxes (7%) (Lachapelle, Borick, and Rabe 2012). Thus, while the literature provides suggestive evidence regarding a potential role for policy design in building public support, we know considerably less about the most effective way of communicating information about carbon taxes, as well as how different climate change audiences might react to specific features of their design.

To be sure, there is substantial evidence to suggest that information provision on the benefits of certain carbon tax designs can enhance support (Dolšak, Adolph, and Prakash 2020; Carattini, Carvalho, and Fankhauser 2018; Carattini, Kallbekken, and Orlov 2019). However, other research has questioned the extent to which information deficits are part of the problem, suggesting that a better strategy may be to avoid the complex task of communicating policy details altogether (Rhodes, Axsen, and Jaccard 2014). In fact, rather than communicating around policy design, some researchers point to informing the public of the relative costs of alternative policy measures as a means of building support for otherwise unpopular carbon taxes that are perceived as overly

costly (Jagers and Hammar 2009). In a similar vein, if regular citizens can't be relied on to fully understand the intricate details of policy design, they may instead be motivated to support a carbon tax based on its specific consequences for the relative prices of essential goods (like energy).

This is in line with existing research on framing effects, which suggests that the way issues are communicated – that is, the words used, the issue dimensions that are emphasized or made salient in a communicative context – can also have a meaningful and significant impact on the public's support for policies (e.g. Gollust, Niederdeppe, and Barry 2013; Hurwitz and Peffley 2005). These kinds of efforts at communicating certain aspects of carbon tax designs or highlighting the relative costs of alternative policy measures on public support for carbon pricing can be thought of as emphasis frames. In contrast to equivalency frames, which present an issue or political choice in different but logically identical ways, emphasis frames emphasize a subset of potentially relevant features of an issue over others (Chong and Druckman 2007; Druckman 2001), thus varying how the information is presented *and* its content (Cacciatore, Scheufele, and Iyengar 2016; Leeper and Slothuus 2020). While some scholars have argued for a narrower definition of framing that would exclude emphasis frames (Cacciatore, Scheufele, and Iyengar 2016) – notably because these effects are difficult to distinguish from other communication effects – the literature suggests that the two types of influences are important in shaping citizens' political preferences, similarly wielding on average medium-sized effects on political attitudes and emotions across studies and contexts (Amsalem and Zoizner 2020).

In light of the insights provided by the literature on audience segmentation for climate change communication, we designed a survey instrument intended to help identify specific climate change audiences that exist in the Canadian population. Informed by the literature on communicating around carbon taxes, we also embedded an experiment in the same survey to assess the reactivity of climate change audiences in Canada to messages (i.e. emphasis frames) intended to build support for carbon taxes.

Methods

In order to examine the public's reactivity to alternative ways of communicating around carbon taxes, we analyze data drawn from a random probability sample of 1207 adult residents of Canada. This survey was approved by the University of Montreal's Ethics Review Board (certificate CERAS-2017-18-105-D) and consent to participate was informed. The data were collected using a random digit dialing (RDD) telephone survey with a disproportionate stratified sample of adult Canadians aged 18 years and older. An overlapping dual-frame (landline and cell phone) sample was used. Interviews were conducted between 6 and 29 October 2017 in English and French. Using the American Association of Public Opinion Research method of calculating response rates (AAPOR RR3), we obtain a combined response rate of 9%, which is typical for this method of data collection and has been shown to provide valid estimates with limited bias from unit nonresponse (Keeter et al. 2006).

Audience segmentation

To segment the data into distinct audiences, we followed the approach of Maibach and colleagues (2011) and used three categories of variables as criteria for the segmentation: motivations, behaviours and preferred societal responses. However, we did not measure the full 36 variables that were used in the Global Warming's Six Americas, as research has demonstrated that valid audience segmentation models can be obtained using a subset of 15 (Maibach et al. 2011) or even 4 (Chryst et al. 2018) items. The questions available in our survey allowed us to measure motivations, behaviours and preferred societal responses with 13 variables, 11 of which were very similar to those used in the Six Americas (see Table 1). As shown in Table 1, three of these items were slightly adapted to the Canadian context and two others were added because they considerably improved the predictive power of our models (i.e. attitude toward the environmental movement and importance of climate change for electoral decisions).

We conducted a Latent Class Analysis (LCA) using Latent Gold 5.1, and used these 13 variables to submit four, five and six segment solutions to the analysis. To guard against local maximum solutions when conducting LCA, one efficient technique is to run the estimation algorithm several times with different parameter start values (Maibach et al. 2011). To address this issue and to

ensure the validity and stability of our findings, we conducted the analyses using 5 000 random sets of start values and replicated each solution ten times. All three models (4-,5-, and 6-segments) replicated exactly.

Variables used to create the segmentation	Global Warming's Six Americas (Maibach et al. 2011)
Motivations • Certainty global warming is occurring Human causation (% agree global warming is occurring and is mostly caused by human activities) • Personal risk perception • Timing of harm to Canadians • Knowledge • Climate change discussion frequency • Attitude toward the environmental movement* • Importance of climate change for electoral decisions*	*Motivations* • Certainty global warming is occurring • Human causation (% agree) • Scientific consensus • Personal risk perception • Future generation risk perception • Risk on animals and species • Timing of harm to Americans • Ability of humans to successfully mitigate climate change • Actions of individuals can make a difference • Technological optimism • Perceived impact of own mitigation actions • Impact of own actions if widely adopted in the U.S. • Impact of own actions if widely adopted in modern industrialized countries • Rating of Global warming (1=good to 6=bad) • Level of worry • Thought given to global warming • Need for information (4=low need) • Personal importance of issue • Unwilling to change opinion • Personally experienced global warming • Global warming discussion frequency • Friends share views on global warming

Behaviours	Behaviours
• Contacted government officials about mitigation • Rewarded/punished companies that are/are not reducing emissions • Reduced household's use of energy[+]	• Contacted government officials about mitigation • Rewarded companies that reduced emissions • Intend to reward companies that reduce emissions • Punished companies that are not reducing emissions • Intend to punish companies that are not reducing emissions • Stage of change for lowering thermostat in winter • Stage of change for using public transportation or car pool • Stage of change for walking-biking instead of driving • Stage of change for CFL use
Preferred societal responses • Primary responsibility for paying the financial costs of climate change[+] • Support for holding companies accountable[+]	*Preferred societal responses* • Priority of global warming for president and Congress • Corporations should do more-less to reduce warming • Citizens should do more-less to reduce warming • Desired US effort to reduce warming, given associated costs • Contingent int'l conditions for US mitigation action (% regardless of actions in other countries)
Total : 13 variables [+] Adapted [*] Added	Total : 36 variables

Table 1. – Audience segmentation variables

Several measures can be used to identify the correct number of classes and help choose the model that best fits the data (Table 2). Classical fit indices – including the Bayesian information

criterion (BIC), sample-size adjusted Bayesian information criterion (SABIC) and the consistent Akaike information criterion (CAIC) – where lower values indicate superior fit – did not converge on a single solution, which is often the case in LCA (Nylund-Gibson and Choi 2018). We thus performed bootstrapped likelihood ratio tests (BLRT) which provided p-values to assess whether moving from 4- to 5- and 6-segments lead to a statistically significant improvement in model fit. P-values for both the 5- and 6-class solutions were significant at p<0.001. Finally, we calculated the Bayes factor (BF) to compare the 5- and 6-class solutions. A BF of greater than 10 provides strong support for the model with fewer classes (Wasserman 1999), pointing in our case to the selection of the 5-class model. As is recommended when fit indices provide reasonable support for one or two candidate models (Nylund-Gibson and Choi 2018), we also looked at how the models compare to each other in terms of face validity. From this point of view, the 5-class model clearly offered the most informative and practical results. On the one hand, the four-segment model omitted the distinction between the Doubtful and the Dismissive groups, which masks some nuance, as results from our five-segment model (described below) make evident. On the other hand, the additional group created in the six-segment model is very similar to the Concerned segment we already have in the five-segment model and thus generated confusion while not substantially contributing to a better understanding of how motivations, behaviours and preferred societal responses differ across groups.

Model	LL	BIC(LL)	SABIC	CAIC	BLRT p	BF
4 classes	-15721	**32939**	32268	**33149**	-	**>15.000**
5 classes	-15570	33014	**32175**	33277	**0,000**	**>15.000**
6 classes	**-15482**	33212	32205	33529	**0,000**	-

Note. LL = log-likelihood; BIC = Bayesian information criterion; SABIC = Sample-size adjusted BIC; CAIC = Consistent Akaike information criterion; BLRT = Bootstrapped likelihood ratio test; BG = Bayes factor. Bolded values indicate "best fit" for each statistic.

Table 2. – Model fit statistics

Survey experiment

We embedded a vignette experiment in the survey, using a 2 X 4 factorial design, in which the first factor manipulated the price level of the policy, while the second manipulated different options for revenue use and messaging. Both levels in this experiment represent emphasis framing. The first factor had two levels – informing respondents that a carbon tax would result in 2 cents per litre (low cost) and 11 cents per litre (high cost) increase in the price at the gasoline pump. These prices correspond to the equivalent price per litre of gasoline resulting from a $10 carbon tax, and a $50 carbon tax, respectively, which align with the price schedule outlined by the Pan Canadian Framework on Clean Growth and Climate Change proposed by the Trudeau government in Canada at the time the survey was conducted. The second factor involved testing a number of potential options for revenue use and messaging around such policy design, as outlined in Table 3.

	2 cents/litre (low)	11 cents/litre (high)
No message	(1) At 10$ per tonne, this policy will increase the price of fossil fuels, adding about 2 cents per litre at the pump.	(2) At 50$ per tonne, this policy will increase the price of fossil fuels, adding about 11 cents per litre at the pump.
Invest in solutions	(3) At 10$ per tonne, this policy will increase the price of fossil fuels, adding about 2 cents per litre at the pump. **For each dollar increase it receives from this policy, the government will invest 1 dollar in solutions to address climate change: such as in clean energy, transit, and energy efficiency.**	(4) At 50$ per tonne, this policy will increase the price of fossil fuels, adding about 11 cents per litre at the pump. **For each dollar increase it receives from this policy, the government will invest 1 dollar in solutions to address climate change: such as in clean energy, transit, and energy efficiency.**
Equal dividend	(5) At 10$ per tonne, this policy will increase the price of fossil fuels, adding about 2 cents per litre at the pump. **The atmosphere belongs to everyone, and a carbon price gives a signal to everybody – business and households – to reduce their carbon pollution. The government plans to equally distribute all of the revenue in the form of equal per capita dividends for every citizen.**	(6) At 50$ per tonne, this policy will increase the price of fossil fuels, adding about 11 cents per litre at the pump. **The atmosphere belongs to everyone, and a carbon price gives a signal to everybody – business and households – to reduce their carbon pollution. The government plans to equally distribute all of the revenue in the form of equal per capita dividends for every citizen.**
Relative price	(7) At 10$ per tonne, this policy will increase the price of fossil fuels, adding about 2 cents per litre at the pump. **Although a carbon price makes polluting more expensive, it also makes things like clean energy and electric vehicles more affordable.**	(8) At 50$ per tonne, this policy will increase the price of fossil fuels, adding about 11 cents per litre at the pump. **Although a carbon price makes polluting more expensive, it also makes things like clean energy and electric vehicles more affordable.**

Table 3. – Summary of experimental treatments and question wording

Our dependent variable is an additive index of three questions assessing respondents' overall attitudes toward carbon taxes. The first and second items constituting the index include measures of the perceived fairness and efficacy of the experimentally manipulated carbon tax description, measured with the question: "On a scale from 0 to 10, where 0 represents very unfair and 10 very fair, how fair do you think this federal carbon price is?" and "On a scale from 0 to 10 where 0 represents very ineffective and 10 very effective, how effective or ineffective do you think this federal carbon price will be at reducing emissions?" The third item measured people's willingness to pay the carbon tax: "All things considered, would you be very willing, fairly willing, not very willing, or not at all willing to pay higher taxes in order to reduce greenhouse gas and address climate change?" Results from exploratory factor analysis suggested that these three items were not distinct enough to be discussed separately. In fact, the three items loaded onto a single factor that accounted for 71% of the variance (see Table 16 in Appendix A). All three questions (i.e. perceived fairness, perceived effectiveness and willingness to pay for carbon pricing) were converted on a 0-1 scale, summed and divided by three to form an index ranging from 0 ("highly unsupportive of carbon pricing") to 1 ("highly supportive of carbon pricing"). The index had a Cronbach's alpha of 0.79, indicating good internal consistency.

We measured several demographics, including age, gender, education, language, region, interest in politics and party identification. We also included a measure of political ideology as a covariate for this study, measured with the question "Generally speaking, do you usually consider yourself as being at the left, the right or the centre of the political spectrum?" Including a small number of covariates in the analysis of an experiment can increase the precision of estimates by reducing noise, especially when the number of observations is small, as long as covariates are selected in advance and good theoretical reasons suggest that these covariates will influence the dependent variable significantly (Mutz 2011). In line with this – and considering the abundance of research suggesting that people identifying with the ideological left are more likely to support climate policies (Drews and van den Bergh 2016; Dunlap, Xiao, and McCright 2001; Krosnick et al. 2006) – political ideology was included as a covariate in our models. All measures with exact wording and descriptive statistics can be found in the S1 File.

We ran one-way ANOVAs to determine if there were any significant imbalances across groups in terms of observed variables including age, education and gender, and found no significant differences, confirming experimental balance across groups on these observed characteristics (Table 17 in Appendix A).

Finally, we conducted a sensitivity analysis using G*Power (Faul et al. 2007) to estimate the effect sizes that could be detected with a power of 80% given the size of our sample and an alpha level of 0.05. Following Cohen's guidelines (Cohen 1988), the analysis revealed that our design was sufficiently powered to detect small framing effects ($f^2 > 0.01$) across the sample as whole, small to medium effects among the Alarmed, Concerned and Doubtful segments ($f^2 > 0.04$, $f^2 > 0.02$ and $f^2 > 0.06$ respectively) and large effects among Disengaged and Dismissive groups ($f^2 > 0.45$ and $f^2 > 0.12$ respectively). A recent meta-analysis (Amsalem and Zoizner 2020) reporting on 237 framing effects (N = 64,083) indicated that overall framing exerted on average medium-sized effects on citizens' political attitudes across contexts (d=0.41, which is equivalent to an f^2 of 0.04). While our analysis is sufficiently powered to detect similar medium-sized effects among the Alarmed, Concerned and Doubtful, our sample is too small to detect such effects among the Disengaged and Dismissive. We take this into account when interpreting our results.

Results

The Five Canadas of Climate Change

We begin with results from the audience segmentation. Our analysis identified five unique audiences within the Canadian population, each of which understands and engages with the climate change issue in their own way: the Alarmed (25%), Concerned (45%), Disengaged (5%), Doubtful (17%) and Dismissive (8%). This distribution provides a good sense of the relative size of different climate change segments in Canada, their socio-demographic makeup, as well as their key motivations, behaviours and policy preferences (Tables 20-23 in Appendix A).

The Alarmed represent about a quarter of the Canadian population. Individuals in this group are fully convinced that climate change is happening and already harming people living in Canada, believe it requires significant changes in government policy and are already taking some personal

action to reduce the threat. Of all groups, the Alarmed segment is made up of the largest proportion of respondents who are very confident in their belief that Earth is warming (87%) and that such warming is mostly the result of human activities (86%). Most of them feel very (42%) or somewhat (54%) well-informed about climate change and the majority discusses climate change very (56%) or somewhat (39%) often with family and friends.

A plurality of Canadians (about 2 in 5) falls into the Concerned category. Like the Alarmed, the Concerned believe human-caused climate change is real and support climate policy, but they are substantially less certain and engaged on the issue relative to the Alarmed. For instance, while most believe that human activity is behind rising temperature on Earth (68%) and that climate change is already harming people living in Canada (64%), fewer are very (54%) confident in their climate change beliefs. The Concerned are also distinct in their level of involvement regarding the issue. As compared to the Alarmed, very few say they feel very informed about the issue of climate change (8% vs 42%) or say they discuss the issue very often (6% vs 56%). Perhaps in part because they appear to be less informed about the issue, the Concerned differ from the Alarmed in their propensity to engage in climate-friendly actions.

Meanwhile, the Disengaged are less certain of their beliefs about climate change. Relative to all other segments, they are the most likely to indicate they are unsure as to whether or not Earth is warming (23%), or to refuse to pronounce themselves on whether they are confident that climate change is happening (28%). This propensity to indicate being "not sure" is also evident on a number of other key variables, such as the timing of impacts and personal risk perceptions. Another important distinction between the Disengaged and the two most engaged segments is that they are more than two (three) times less likely than the Concerned (Alarmed) to believe that climate change is mostly caused by human activities (26%). They are also less likely than the Concerned and Alarmed to report taking action themselves to help address climate change.

In terms of more skeptical audiences, relatively few of the Doubtful are very (12%) or somewhat (56%) confident that the average temperature on Earth is rising, and they are less likely than the national average (58%) to attribute this warming to human activities (25%). In line with their

skepticism regarding the existence of anthropogenic climate change, they are also less likely than the Alarmed, Concerned, and Disengaged segments to engage in actions to address the issue.

Finally, the Dismissive audience is the most convinced that climate change is not occurring with a plurality being somewhat or very confident that the phenomenon is not happening (48%). Consequently, all of them reject the fact that climate change is happening and that these changes are caused by human activities. No less than half of the Dismissive believe that climate change will never harm people living in Canada. This group is similar to the Alarmed in their feeling of being informed about the issue. When asked how informed they believe themselves to be about climate change and global warming, about 40% of them say they feel very informed. Of all groups, they are the least likely to report any form of behavioural engagement with respect to climate change.

Examining the socio-demographic makeup of the five segments provides additional information to better understand how each audience differs from another. Compared to national averages, our results show that the Alarmed are more likely to be left-wing (28% vs. 17%) women (57% vs. 51%) with a graduate or professional degree (42% vs. 31%). The Alarmed are also more likely than average to express vote intentions for the Liberal Party of Canada (36% vs 31%) or the Green Party of Canada (11% vs. 6%), and less likely to indicate support for the Conservative Party of Canada (12% vs. 26%). Alarmed are also much more likely than the national average to report being "very interested" in politics (50% vs. 32%).

At the other end of the spectrum, we find that socio-demographic distinctions are stark when looking at the Dismissive group. Compared to national averages, the Dismissive are more likely to live in Alberta (24% vs. 11%) and less likely to live in Ontario (30% vs. 38%) or Quebec (12% vs. 24%). Relative to the full sample, the Dismissive are more likely to be English-speaking (76% vs. 63%) men (84% vs. 49%), with a plurality on the right side of the political spectrum (39% vs. 11%). Similar to the Alarmed (51%), a majority of the Dismissive (57%) say they are very interested in politics. However, unlike the other audiences, they are relatively uniform in their electoral choice, with a strong majority expressing a preference for the Conservative Party of Canada (77%).

Comparing across segments, we find fewer socio-demographic features that distinguish the Concerned from the Doubtful. Not surprisingly, these two groups – which are more moderate in their positions – are more likely to be found at the center of the political spectrum (42% in both cases). A plurality of the remaining Concerned are either at the center-left (13%) or at the left (17%), while the remaining Doubtful self-identify at the center-right (13%) or right (17%). Compared to the Alarmed (42%), Concerned (32%) and Dismissive (31%), the Doubtful are less likely to have a graduate or professional degree (19%). We also found some differences in terms of the regional distribution of these audiences. Relative to the Concerned, the Doubtful are more likely to live in Alberta (19% vs. 8%), and less likely to live in Ontario (33% vs. 41%) or Quebec (21% vs. 27%).

Communicating around carbon taxes

Next, we review results from the analysis of messaging effects with respect to carbon tax support. Before proceeding to our core empirical analysis using Ordinary Least Squares (OLS) regression modeling, we present descriptive statistics with mean value comparisons of attitudes toward the policy for each of the eight treatment groups (Table 4). Because of the highly heterogeneous distribution of the audiences – with the Concerned accounting for as much as 45% of the respondents, and the Disengaged and Dismissive making up for only 5% and 8% of the sample – the number of observations per treatment is relatively low for some segments, especially the Disengaged and Dismissive (with 0 to 16 respondents per treatment). This is consistent with the results of our post hoc sensitivity analysis – which indicated that our design was sufficiently powered to detect small to medium effects among the Alarmed, Concerned and Doubtful segments, but not among the Disengaged and Dismissive. Given this, we focus on the Alarmed, Concerned and Doubtful when looking at between-segment differences in message responses.

		National average	**Alarmed**	**Concerned**	**Disengaged**	**Doubtful**	**Dismissive**
2 cents/litre (low)	No message	.48/.25 (131)	.64/.19 (34)	.52/.19 (58)	.40/.35 (4)	.30/.21 (21)	.16/.22 (14)
	Equal dividend	.46/.27 (133)	.65/.24 (32)	.51/.20 (57)	.49/.33 (6)	.33/.22 (26)	.05/.07 (12)
	Invest in solutions	.44/.28 (137)	.56/.27 (37)	.52/.22 (53)	.27/.18 (5)	.32/.26 (31)	.09/.11 (11)
	Relative price	.48/.25 (131)	.59/.25 (36)	.52/.22 (58)	.60/.13 (3)	.37/.23 (26)	.12/.2 (8)
11 cents/litre (high)	No message	.42/.27 (141)	.56/.27 (29)	.44/.26 (72)	. (0)	.32/.22 (28)	.15/.2 (12)
	Equal dividend	.46/.27 (137)	.57/.22 (22)	.53/.23 (68)	.33 /.30 (7)	.39/.27 (24)	.21/.25 (16)
	Invest in solutions	.48/.27 (138)	.55/.22 (36)	.58/.23 (69)	.57/.08 (2)	.23/.16 (20)	.09/.11 (11)
	Relative price	.53/.24 (136)	.66/.19 (36)	.54/.19 (79)	.39/.39 (2)	.45/.21 (19)	.09/.23 (9)

Table 4. – Mean level of attitudes toward carbon taxes, by audience segmentation and experimental treatment (mean/standard deviation, N in parentheses)

Causal effects between experimental conditions were assessed using OLS regressions on our dependent variable. To make interpretation more straightforward, we also estimated the marginal effects of each treatment on attitudes toward carbon taxes. We began by examining how the level of policy stringency affected attitudes toward carbon taxes and whether the Five Canadas of Climate Change moderate this effect. First, we considered the effect of an 11-cent price increase on attitudes toward carbon taxes (as compared to 2 cents). As shown in Appendix A (Model 1 of Table 18), the effect of policy stringency was very small (0.001) and non-significant. Next, we included the Five Canadas of Climate Change in our model and examined the extent to which audience segments helped predict overall attitudes. As model 2 of Table 18 demonstrates, the Five Canadas were significant predictors of attitudes toward the policy, with positive

coefficients indicating that the model predicted more supportive attitudes in each given group as compared to the reference category (i.e. the Dismissive). Belonging to the Doubtful increased the level of supportive attitudes by about 18% compared to the Dismissive segment, while belonging to the Alarmed increased the level of supportive attitudes by 42% relative to the Dismissive. In comparison, moving from the far right to the far left on the ideological scale had a 14-percentage point effect on our dependent variable. The effect of the Five Canadas of Climate Change on attitudes toward carbon taxes is thus three times greater than that of political ideology. Adding the Five Canadas to the base model significantly improved model fit, with an adjusted r-squared increasing from 0.12 in the base model to 0.30 in the fully specified model, $F_{(4, 922)} = 64.10$, $p < 0.001$.

To test the potential of policy stringency to affect audiences in different ways, we added interaction terms, multiplying segments by price levels (Model 3 of Table 18 in Appendix A). Interaction terms between segments and price levels were very close to zero and failed to reach statistical significance, suggesting that moving stringency from a low (2 cents) to a relatively higher (11 cents) increase in the gasoline price at the pump left attitudes unchanged across segments.

Next, we examined whether emphasizing different options for revenue use and messaging affected attitudes toward the policy and whether the Five Canadas of Climate Change responded differently to these treatments, both at low and higher levels of policy stringency (Table 5). Our results suggest that overall messaging effects only occurred when policy stringency was relatively higher. As Model 1 (Table 5) shows, none of the experimentally manipulated messages reached statistical significance when policy stringency was low. However, when the policy was said to increase the gasoline price by a higher amount (i.e. 11 cents), both the "Invest in solutions" and the "Relative price" messages significantly affected the dependent variable, respectively increasing the level of supportive attitudes by 9% and 11%. The "Equal dividend" message had no effect on attitudes at either level of policy stringency.

	Model 1		Model 2		Model 3	
	2 cents	11 cents	2 cents	11 cents	2 cents	11 cents
Invest in solutions	-.054	.088**	-.044	.07*	-.09	-.092
	(.032)	(.032)	(.027)	(.03)	(.088)	(.101)
Equal dividend	-.015	.058	-.011	.057	-.129	.023
	(.032)	(.033)	(.028)	(.03)	(.088)	(.095)
Relative price	-.021	.106**	-.024	.095**	-.034	-.1
	(.032)	(.033)	(.028)	(.03)	(.098)	(.107)
Doubtful			.195***	.169***	.095	.089
			(.041)	(.045)	(.077)	(.086)
Disengaged			.372***	.251*	.286*	.152
			(.075)	(.11)	(.134)	(.129)
Concerned			.375***	.337***	.315***	.21**
			(.038)	(.041)	(.067)	(.078)
Alarmed			.442***	.401***	.428***	.353***
			(.04)	(.045)	(.07)	(.086)
Invest*Doubtful					.093	.031
					(.109)	(.122)
Invest*Concerned					.098	.271*
					(.098)	(.109)
Invest*Alarmed					-.017	.072
					(.102)	(.118)
Equal*Doubtful					.175	.063
					(.11)	(.118)
Equal*Concerned					.105	.062
					(.097)	(.103)
Equal*Alarmed					.125	-.05
					(.103)	(.117)
Relative*Doubtful					.112	.262*
					(.119)	(.129)
Relative*Concerned					.022	.201
					(.107)	(.114)
Relative*Alarmed					-.07	.184
					(.111)	(.122)
Ideology	.083***	.066***	.045***	.028**	.048***	.031***
	(.009)	(.009)	(.009)	(.009)	(.009)	(.009)
Constant	.325***	.278***	.075*	.074	.115	.16*
	(.029)	(.031)	(.038)	(.041)	(.06)	(.072)
Obs.	458	471	458	471	458	471
Adjusted R-squared	0.141	0.111	0.348	0.265	0.374	0.292

*** p<.001, ** p<.01, * p<.05

Note: values are unstandardized regression coefficients with standard errors in parentheses. Constant represents intercepts of price level at 2 cents and Dismissive segment when segments are included. Attitudes toward carbon taxes range from 0 (highly unsupportive) to 1(highly supportive). Ideology is coded 0 (right), 1 (center right), 2 (center), 3 (center left) and 4 (left).

Table 5. – Effect of emphasis framing on attitudes toward carbon taxes, conditional on the Five Canadas

To examine how each segment responded to these messages, we again included interaction terms, this time multiplying the second factor (i.e. options for revenue use and messaging) by the five audiences. While results from Table 5 suggested that none of the messages had a main effect on attitudes when stringency was low (2 cents), Figure 1 shows that the "Invest in solutions" and the "Relative price" messages had an influence on attitudes at a lower level of policy stringency, but only among the Alarmed. Rather than increasing support for the policy, however, these messages decreased support by about 11 percentage points among this relatively more engaged segment.
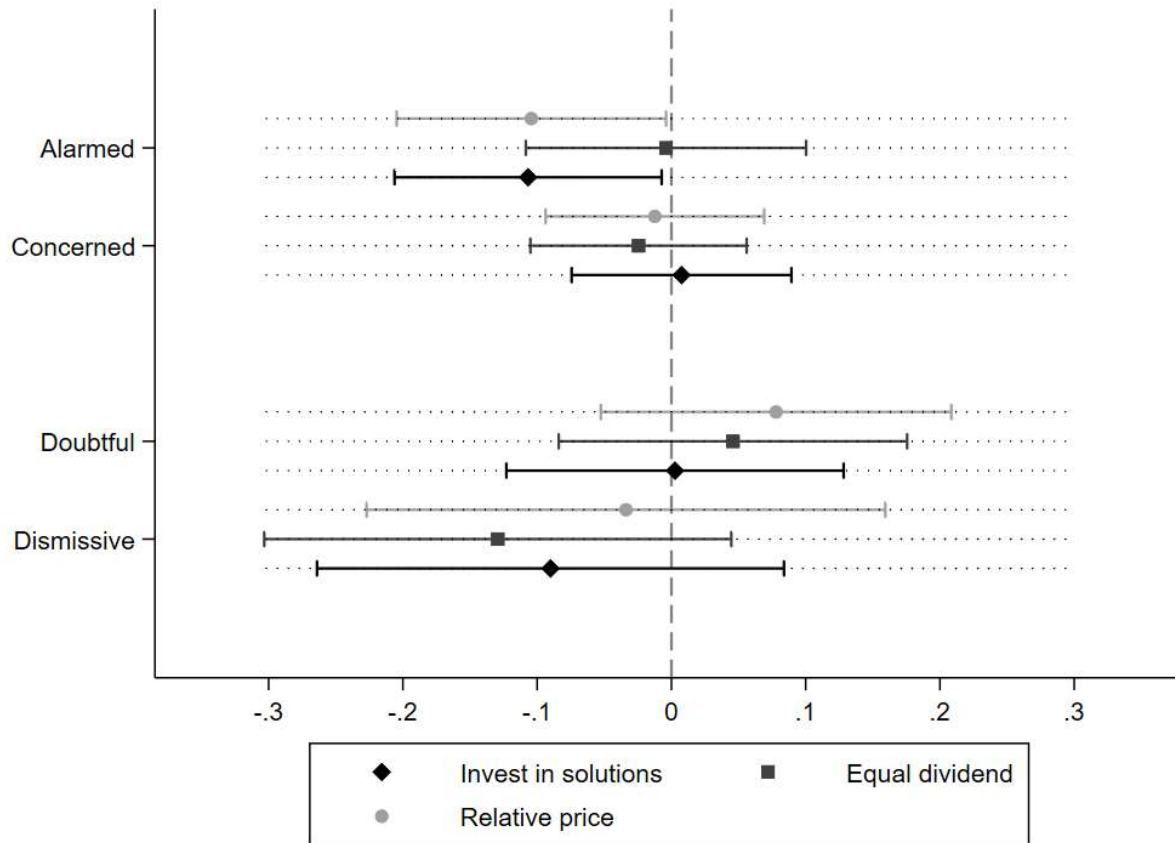
Figure 1. – Marginal effect of emphasis framing on attitudes toward carbon pricing under low price specification, conditional on the Five Canadas (95% Cis)

Turning to the analysis of messaging effects under the higher price (11 cents per litre) condition, the "Invest in solutions" message increased carbon tax support among the Concerned, though it had no effect on the other segments (Figure 2). Despite this, the green reinvestment message was very impactful among the Concerned: the Concerned exposed to the "Invest in solutions" message scored 18% higher on the attitude index relative to the Concerned in the "no message" group. The "Equal dividend" and the "Relative price" messages were also effective with the Concerned under the moderate price treatment, increasing the level of supportive attitudes by about 9% and 10% respectively. Finally, exposure to the "Relative price" message also led to a 16% increase in positive attitudes toward carbon taxes among Doubtful.
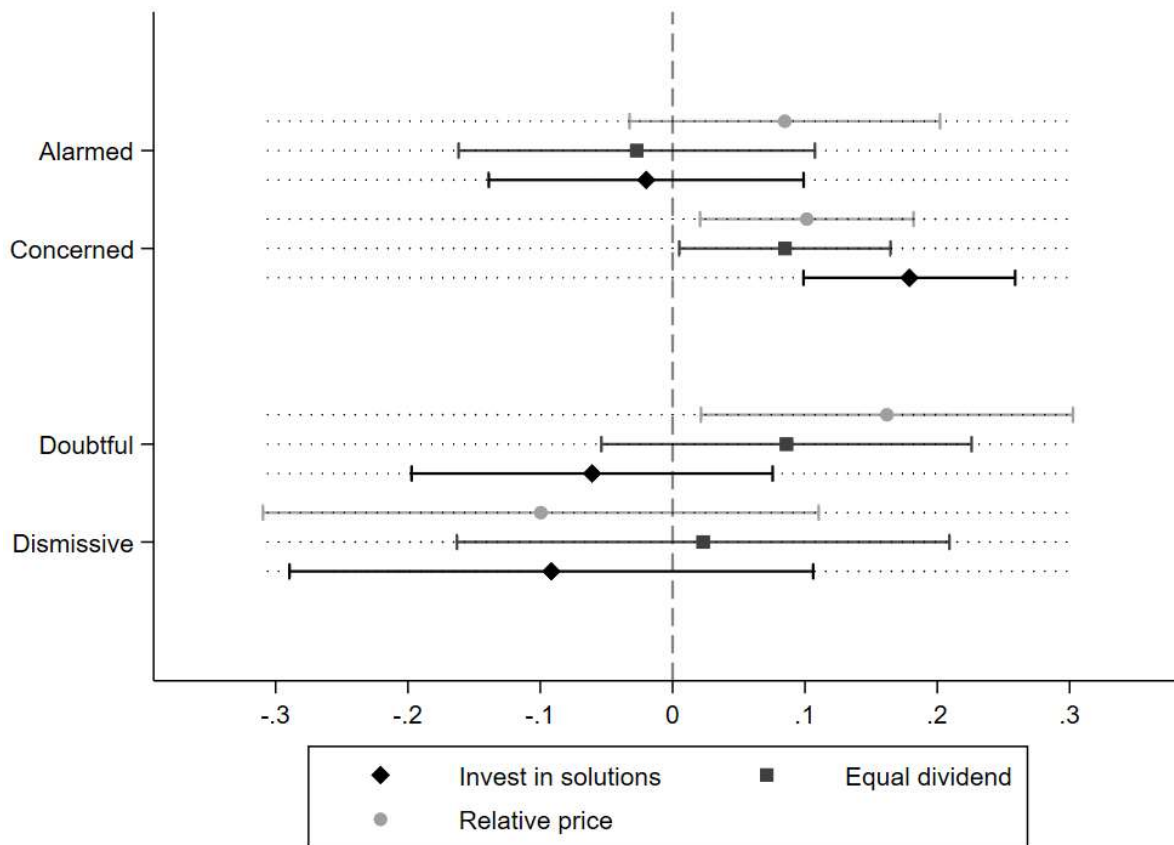
Figure 2. – Marginal effect of emphasis framing on attitudes toward carbon pricing under high price specification, conditional on the Five Canadas (95% Cis)

Discussion

Our analysis of the data measuring how Canadians think and act toward climate change revealed that the Canadian population can be divided into five distinct segments: the Alarmed (25%), Concerned (45%), Disengaged (5%), Doubtful (17%) and Dismissive (8%). These results are broadly consistent with Global Warming's Six Americas (Maibach et al. 2011) and akin to typologies identified in Australia (Hine et al. 2014; 2016) and Germany (Metag, Füchslin, and Schäfer 2017), though we did not find a Cautious segment in Canada. The Cautious – who believe in climate change but view it as a distant problem – comprised between a quarter and a fifth of the American, Australian and German populations at the time these studies were conducted. The most recent segmentation in Australia (Hine et al. 2016), however, found three groups rather than six: the Alarmed, the Uncommitted and the Dismissive. While a Dismissive group was found

in the U.S, Australia and Canada (as our data showed), this group was notably absent in the segmentation analysis conducted in Germany, reflecting differences in climate change audiences across countries.

To be sure, the potential for cross-national comparisons remains limited, as different variables were used to create the segmentations and some studies draw on data collected several years apart (e.g. the German segmentation draws on data collected in 2011, whereas our data were collected in 2017). Although caution should be exercised in comparing segments across studies, the fact that we did not find a Cautious segment similar to that identified in the United States is broadly consistent with previously reported differences in attitudes toward climate change across Canada and the United States (e.g. Lachapelle, Borick, and Rabe 2012). With respect to the Cautious, Maibach and colleagues (2011) describe this segment as individuals who believe in climate change but who tend see it as a distant problem, hence not feeling the urgency to take action.   In the spring of 2015, the Pew Research Center reported that, while Canadians and Americans expressed relatively high levels of concern about climate change (64% vs. 59%), the latter were considerably less likely than the former to believe that climate change is harming people around the world now (41% vs. 56%) (Pew Research Center 2015). To some extent, the absence of a Cautious segment in Canada reflects these differences in risk perceptions.

These differences notwithstanding, our results are similar to existing studies using climate change audience segmentation techniques, which demonstrate the predictive power of audience segments relative to demographics and other political variables found to be important correlates of climate policy support in the literature (Drews and van den Bergh 2016). Explaining 26% of the variance in attitudes toward carbon pricing, the predictive power of our segmentation is consistent with previous studies (Hine et al. 2014; Maibach et al. 2011) where audience membership explained between 14% and 55% of the variance in responses to climate change.

In terms of the overall impact of messages on climate policy attitudes, we found that both the "Invest in solutions" and "Relative price" messages had, across the sample as a whole, a positive impact on carbon pricing attitudes when policy stringency was higher. This result echoes previous experimental evidence of framing effects found in other studies. For instance, Beiser-McGrath

and Bernauer (2019) employed a conjoint design and found that information provision about revenue use significantly increased public support for a carbon tax in the United States and Germany, but similar to our study, these framing effects were most pronounced at relatively higher levels of policy stringency. This finding may suggest that communication of carbon tax benefits is especially important as carbon prices become more substantial, or as concerns about the cost of living rise. Moreover, it is worth noting that of the three options for revenue use and messaging tested, only the "Equal dividend" message had no overall effect on attitudes. This is at odds with research highlighting the role of equal per capita dividends in building support for carbon taxes (Jagers, Martinsson, and Matti 2019; Klenert et al. 2018) though it is in line with evidence suggesting that the public generally likes the idea of earmarking revenues to support additional emissions reductions (Clinch 2006; Dresner, Jackson, and Gilbert 2006; Lachapelle, Borick, and Rabe 2012; Klok et al. 2006). It is also possible that this frame was less effective because of the additional information that was introduced to accompany the treatment (i.e. "The atmosphere belongs to everyone, and a carbon price gives a signal to everyone—business and households—to reduce their carbon pollution"). While we included this information in an attempt to make the treatment stronger, we acknowledge it could also have weakened the treatment if respondents reacted negatively to the additional text.

Beyond these aggregate effects, we also found that emphasis framing affected the Five Canadas in very different – and sometimes unintended – ways. The "Invest in solutions" and the "Relative price" messages had a negative impact on attitudes toward carbon taxes among the Alarmed when policy stringency was low, and a positive impact on attitudes among the Concerned when policy stringency was higher. While all messages were effective with the Concerned, the "Relative price" was the only message positively affecting both the Concerned and the Doubtful. These findings echo recent research looking at the role of political variables in moderating the effect of carbon tax design on levels of policy support, which found heterogenous sub-group effects across individuals with different political ideologies (Jagers et al. 2021) and partisan identities (Nowlin, Gupta, and Ripberger 2020; Mildenberger et al. 2022). However, these studies focused specifically on revenue recycling options (e.g. tax rebates, deficit reduction, support for renewable energy technology) and used unidimensional segmentation criteria.

In contrast, we examined information provision and relative price effects using broader segmentation criteria, and showed that communicating around the specific consequences of carbon taxes for the price of essential goods (like energy) may be more effective than communicating around policy design, especially among less engaged audiences (i.e. the Concerned and Doubtful segments). That these framing effects were mostly found among moderately engaged groups echoes Zaller's (1992) two-moderator model of persuasion, and is in line with research by Chong and Druckman (2013) highlighting the role of strongly held prior attitudes in moderating framing effects. Both of these studies suggest that framing effects are most likely to be found among audiences with relatively weaker opinions.

A negative effect of the "Invest in solutions" and "Relative price" messages among the Alarmed is also broadly consistent with previous studies documenting "boomerang effects", occurring when exposure to a given message moves beliefs in a direction opposed to the original intent (Myers et al. 2012; Zhou 2016). However, in contrast to these studies – which typically found boomerang effects among groups that were more skeptical of climate change - our results demonstrate that boomerang effects may also occur among the most Alarmed segments of the population.

This result among the Alarmed could be explained by the relative sophistication of this audience. Recall that of all segments, the Alarmed are most engaged with climate change and are much more likely than national averages to report being both knowledgeable about the climate change issue, and very interested in politics. As a result, the Alarmed may be more motivated by accuracy goals and to scrutinize the credibility of messages, thus making them less inclined to believe that such a low (2 cents per litre) carbon price can have any real impact on green infrastructure or the relative price of different energy technologies (c.f. Druckman and McGrath 2019). To test this explanation, we created a dummy variable equal to 1 for respondents who received the "Invest in solutions" or the "Relative price" treatment (i.e. those with a negatively signed coefficient at a low price stringency) and 0 for those who received the "Equal dividend" treatment. We then examined whether these treatments had a different effect on perceptions of policy effectiveness, and whether policy stringency moderated this effect. As shown in Appendix A (Table 19), we found a negative interaction effect between the "Invest in solutions" and the "Relative price"

messages and the level of policy stringency. Consistent with the idea that the Alarmed are more sophisticated and therefore more likely to scrutinize the coherence of carbon pricing messages, we found that messages alluding to substantial earmarking or leveling the playing field for alternative energy sources decreased perceptions of policy effectiveness among the Alarmed, but only under the lower price treatment.

Overall, our results suggest that attempts at devising uniform, one-size-fits-all communication strategies around climate policy are likely to face important challenges. For instance, our findings suggest that governments and communicators should be careful when communicating with more sophisticated and engaged climate change audiences (like the Alarmed), who may be more motivated by accuracy goals when processing messages around climate change. As a result, careful consideration ought to be given to the credibility of messages, so as not to alienate more engaged audiences as they seek to win the support of less engaged groups. More broadly, the different framing effects found at different levels of policy stringency further suggest that the overall cost structure is important when crafting messages about climate policy. As the costs of climate policy and concerns with cost of living evolve over time, communications may need to be adapted so they better fit the context in which messages are received, while meeting the informational needs and motivations of different audiences.

Conclusion

Analyzing data from a random probability survey of adult Canadians collected in October 2017, this study examined how unique audience segments within the Canadian population think and act toward climate change and explored whether and how the level of audience engagement moderates the effect of various messages on support for climate policy. We found that the Canadian population can be divided into five distinct segments, offering potential targets for climate change communication: the Alarmed (25%), Concerned (45%), Disengaged (5%), Doubtful (17%) and Dismissive (8%). These audiences reacted to emphasis framing in very different - and sometimes unintended - ways. In particular, "Invest in solutions" and "Relative price" messages had a negative impact on attitudes toward carbon taxes among more engaged audiences (i.e. the Alarmed) when policy stringency was low, and a positive impact on attitudes among the

Concerned when policy stringency was higher. The "Relative price" was the only message positively affecting both the Concerned and the Doubtful, suggesting that communicating around the specific consequences of carbon taxes for the prices of essential goods (like energy) may be a fruitful way to broaden support for carbon pricing among moderately engaged audiences. This may particularly be important as the costs of climate policy rise as well as in contexts where cost of living considerations are top of mind.

In extending findings from the audience segmentation literature to the Canadian case, and by exploring how each segment responds to different messages about carbon taxes, our study helps better understand heterogeneity in Canadian attitudes toward climate change as well as the potential promise and pitfalls involved when attempting to communicate about a controversial policy across a broad range of differently engaged audience segments. In this sense, our study contributes to the literature on climate change policy and communication by highlighting the importance of audience-based data in supporting climate research, policy and communication and offering a starting point for further work aimed at developing messages that speak to different climate change audiences.

While exploratory in nature, our analysis is limited in a number of important respects. First, our findings are based on a relatively small sample of the five audience groups. In analyzing how these audiences respond to the treatments tested in our experiment, we had to rely on a small number of observations. Caution should be exercised when interpreting these results, notably for segments for which we have the smallest samples (i.e. Disengaged and Dismissive audiences). The null results reported in this analysis might reflect a lack of statistical power, particularly for these smaller audiences. In order to detect medium-sized effects with a power of 80% and an alpha level of 0.05, it would require a sample of 179 respondents in each audience segment. Given that this is the first segmentation study of its kind for Canada, it was difficult to anticipate the size of the audiences a priori. While we were able to meet this threshold for three segments (i.e. the Alarmed, Concerned and Doubtful), more research with larger samples would be required to determine the effectiveness of different frames across all audiences. For instance, future research could use data available from social media platforms as an exciting (and less costly) research possibility to classify climate change audiences from larger samples.

Second, our analysis provided a high-resolution portrait of attitudes toward climate change at one specific point in time, offering little insight into the evolution of climate opinions and audiences, as well as limited information on the durability of the observed framing effects. Many things have changed since 2017 in terms of national and international discourses on climate change, likely bringing about changes in the composition of the segments. For instance, the Six America's studies in the United States documented a clear trend toward rising Alarm in the United States (Goldberg et al. 2020). Although we can only speculate as to whether Canada followed a similar trend, our study provides a baseline against which future research can be compared. Other studies could replicate this segmentation using longitudinal data to provide a more dynamic picture of Canadian attitudes toward climate change. Finally, there are other important messages, and other factors that may condition messaging effects that were not included in this analysis, such as the source of the message and the availability of competing frames or arguments, which we leave for future work.

Building on this work, future analyses might go further and examine patterns of information behaviours and media use across audiences. Our study also calls for more research on climate change audiences using different types of research designs, including longitudinal analyses. Future research might also examine whether and how the source of the message influences messaging effects among different audiences and explore how the latter respond to frames as they compete with each other. These kinds of extensions will help to further our collective understanding of how messages interact with different audience characteristics, providing more insight into what to consider when attempting to communicate about controversial policies with a heterogeneous public.

Chapter 3 – Code red for humanity or time for broad collective action? Exploring the role of positive and negative messaging in (de)motivating climate action[2]

Introduction

Fear appeals, or communications that emphasize the dire consequences or threat of climate change, are often the default strategy when attempting to communicate with and engage the public on climate change (Moser 2010; Nisbet 2009; Hart and Feldman 2014). With each successive report authored by the UN's Intergovernmental Panel on Climate Change (IPCC), which evaluates the state of scientific knowledge on the topic, such messages are now common, as the scientific community feels compelled to highlight the rapidly closing window for securing a livable future in the face of continually rising global greenhouse gas (GHG) emissions. Indeed, after sounding a "code red for humanity" in its report released in August 2021, the IPCC further went on to describe "an atlas of human suffering and a damning indictment of failed climate leadership" (IPCC 2021; 2022). While such negative emotional messaging is common in both research and practice, relatively little emphasis has been given to efficacy-relevant information in IPCC reports and climate change communication more generally. Perhaps owing to the IPCC's claim to policy neutrality, research has found that threat information occurred nearly twice more frequently than efficacy-relevant information in the Summary for Policymakers (SPM) of the IPCC Fifth Assessment Report (Poortvliet et al. 2020). Extending well beyond the IPCC, this tendency to emphasize the consequences of inaction characterizes much of climate change communication, from economic assessments (Stern, 2007), media coverage (e.g. *Time's* 2017 "The Uninhabitable Earth") to popular culture, including films and documentaries (e.g. *The Day*

After Tomorrow [2004], *An Inconvenient Truth* [2006], *Years of Living Dangerously* [2014], and *Don't look up* [2021]). Although alarmist and fear-inducing narratives have long been used to describe climate change (Ereaut and Segnit 2006), this framing of the climate change problem took a qualitatively new form in 2019, with "climate emergency" emerging as a new global phenomenon (McHugh, Lemos, and Morrison 2021). Declared Word of the Year by the Oxford Dictionary in 2019, the phrase "climate emergency" was more than 100 times more common in September 2019 than it had been the previous year (Oxford Dictionaries 2019).

As the "climate emergency" frame gains momentum, negative and fear-based appeals continue to be debated within the climate change communication field (Ettinger et al. 2021), with several studies suggesting that fear-based messages can be effective (e.g. Meijnders, Midden, and Wilke 2001; van Zomeren, Spears, and Leach 2010; Michelson and DeMora 2021; Hartmann et al. 2014) and others suggesting the opposite (e.g. Feinberg and Willer 2011; O'Neill and Nicholson-Cole 2009; Chen 2016). This ongoing debate sheds light on three important and intertwined aspects of emotional appeals in communication: the message's content, the emotional arousal it induces, and the values and dispositions of the audiences receiving the message. However, most prior research has addressed questions related to one or two of these aspects, while overlooking the multiple and complex ways that all three are intertwined. This could help explain the mixed results commonly found in the literature on fear appeals, which has left several important questions unanswered. What is more effective (and when and how): scaring the public into climate action, or inspiring them to take action through optimistic and hopeful messages? Are negative emotional appeals leading to maladaptive fear and paralysis? Are optimistic and hopeful messages increasing complacency? What is the role of emotional responses in shaping the impact of negative and positive messaging on climate action? How do audiences with varying environmental values, worldviews and levels of engagement react towards communications that induce negative and positive emotions?

To address these questions, we examine the direct and indirect influence of negative and positive messaging on climate action across diverse supporters of Canada's environmental movement. Drawing on a two-wave panel survey of Canadian environmentalist NGO members (N=308) conducted in 2019 and 2021, we apply Latent Class Modelling to create a novel segmentation of

environmental activists in Canada. Using a survey experiment embedded in the second wave of this panel, we then examine how negative and positive messaging influence emotional arousal and climate action across audience segments. Overall, our results suggest that negative messages about climate change (e.g. sounding "code red for humanity") can be less mobilizing than positive messaging, even when the message is directed toward relatively engaged audiences and followed by the opportunity to take a concrete, doable and effective action. These findings help shed light on the potential limits of fear-based messaging in the context of a global public health pandemic, while further highlighting the importance of communicating in ways that inspire people through hopeful and optimistic messages.

The rest of the paper proceeds as follows. First, we briefly review the literature on the role of negative and positive messaging in (de)motivating climate action. We then examine the multiple ways that positive and negative messaging, emotions and audiences are intertwined and consider how these relationships help explain the mixed findings identified in the literature. After outlining our research design, we present the results of our audience segmentation and survey experiment. We conclude with a discussion of the implications of our findings and propose new avenues for further research.

Positive and negative messaging in climate change communication

While the consequences of climate change are admittedly frightening and distressing for many, it is unclear whether sounding "code red for humanity" will foster action or paralysis. Despite years of debate among scholars in the climate change communication field, there is no clear scientific consensus on whether fear-evoking communications are beneficial or detrimental for motivating action on climate change. This stands in contrast to research and theory exploring the conditions of fear appeal effectiveness in other fields (Janis and Feshbach 1953; Janis and Terwilliger 1962), which generally conclude that fear appeals can be effective, insofar as they also provide recipients with specific, actionable and effective steps to reduce the risk of a given threat (Witte and Allen 2000). While fear appeals have been widely studied in risk communication, fewer studies have examined these questions in the context of climate change (Reser and Bradley 2017; Brosch 2021).

Among the studies investigating the role of fear appeals in climate change communication, several have pointed to the positive effect of fear-based messages. Meijinders et al. (2001) found that eliciting fear about the risk of greenhouse gas emissions resulted in more favourable attitudes toward energy conservation, while van Zomeren et al. (2010) found that exposure to fear appeals about the impacts of climate change led to heightened environmental action intentions (signing petitions). Hartmann et al. (2014) found that high threat messages increased subjective fear and led to greater behavioural intentions (voting and green electricity purchasing). Moreover, this study found that fear predicted behavioural intentions and mediated the relationship between threat information and intentions.

Other studies, on the other hand, have found that messages and visuals emphasizing catastrophic and dire consequences of climate change can result in more skepticism and feelings of helplessness, leading to "apocalypse fatigue" and ultimately causing people to disengage from climate change (Feinberg and Willer 2011; O'Neill and Nicholson-Cole 2009; Chen 2016; Hart and Nisbet 2012). Through semi-structured interviews and focus groups, O'Neill and Nicholson-Cole (2009) found that fearful and shocking representations of climate change were associated with enhanced perceptions of climate change as a distant issue in both time and space. Using a survey experiment, Feinberg and Willer (2011) found that exposure to a dire message about the impacts of climate change increased skepticism in participants with just world beliefs (i.e. those who believe that people get what they deserve in life).

Building on previous work on fear appeals in risk communication (Witte and Allen 2000), a few studies have examined the interaction between fear and efficacy in the context of climate change (van Zomeren, Spears and Leach 2010; Chen 2016; Scharks 2016; Nabi, Gustafson and Jensen 2018). Some find support for the threat-with-efficacy structure (Nabi, Gustafson and Jensen 2018), while others suggest that efficacy information is more important than threatening information in predicting attitudes and intentions (Chen 2016; van Zomeren, Spears and Leach 2010). Given the potentially negative effect of fear-based messaging, and considering the importance of efficacy perceptions in predicting constructive responses to climate change (Bostrom, Hayes, and Crosman 2018; Jugert et al. 2016), scholars have more recently begun to investigate the effect of positive-only appeals in climate change communication, producing

similarly mixed findings. While some studies find that hope appeals, or messages designed to evoke hope, are effective for encouraging climate change engagement (e.g. Chadwick 2015), other studies find that optimistic messages increase complacency and reduce motivations to act on climate change (Hornsey and Fielding 2016). Although not explicitly appealing to fearful or hopeful emotions, two recent experimental studies compared the effectiveness of positive and negative messaging on real observable behaviours, again producing mixed results. In a series of three experimental studies testing the effectiveness of positively and negatively framed emails about the impact of clean energy policies, Levine and Kline (2019) found that respondents who received the positively framed email were more likely to sign the online petition or join the partner organization than those who received the negatively framed message. In another series of five experimental studies, Michelson and DeMora (2021) found that a negatively framed email sent by a local environmental advocacy organization in Washington was more likely to motivate supporters to sign an online petition relative to a positively framed email, an effect that remained consistent across the five experiments.

Messages, emotions and audiences

One possible explanation for the mixed findings identified above is that the effect of positive and negative messaging may be mediated by specific message-induced emotions, which are not accounted for in many of the studies examining the effectiveness of persuasive appeals. While message-induced emotions - particularly hope, fear and worry – have been found to play a mediating role in framing effects (Nabi, Gustafson, and Jensen 2018), many studies examining the effectiveness of fear appeals did not seek, find, nor report evidence that their messages were effective in actually evoking the intended emotional response (Reser and Bradley 2017). Importantly, measures of message-induced emotional arousal were included in most experimental studies yielding positive effects of fear appeals, either alone (Meijnders, Midden, and Wilke 2001; van Zomeren, Spears, and Leach 2010; Skurka et al. 2018) or in a threat-efficacy structure (Nabi, Gustafson, and Jensen 2018; Hartmann et al. 2014), whereas such measures were lacking in many studies reporting negative effects (e.g. Feinberg and Willer 2011; Chen 2016; Hart and Nisbet 2012).

While emotions play a central role in the conceptualization and operationalization of persuasive appeals in climate change communication, it should be noted that message-induced emotions differ from other pre-existing (i.e. message-unrelated) emotions about climate change. On the one hand, several studies have highlighted the constructive role of negative emotions in social movements in general (Jasper 2011; Castells 2015) and climate change more specifically (Ojala et al. 2021; Smith and Leiserowitz 2014). In their narrative review of the research on emotions and climate action, Ojala et al. (2021) find that negative emotions like worry, eco-anxiety and environmental grief generally led to adaptative responses in the context of climate change. On the other hand, these results are mainly correlational and do not imply that negative message-induced emotions will have effects similar to emotions experienced outside the context of communication. For example, negative emotions arising from personal experience with the consequences of climate change might have greater motivational power than negative emotions induced through communication. Along these lines, Demski et al. (2016) find that direct experience with flooding increase negative emotions, which in turn increase behavioural intentions to mitigate and adapt to climate change.

Another possible reason for these contradictory results is that studies differ substantially in terms of sample composition. In particular, many studies pointing to the effectiveness of fear appeals either included a much larger percentage of female participants (e.g. Meijnders, Midden, and Wilke 2001; van Zomeren, Spears, and Leach 2010) or sought to deepen engagement with individuals who were already engaged with climate change (e.g. Michelson and DeMora 2021).This is important, as regulatory fit theory (Kurman and Hui 2011) and the late effectiveness hypothesis (Cho and Salmon 2006) suggest that fear appeals should be more effective for women than men, and for late-stage rather than early-stage individuals (i.e. those who have already enacted change). According to the late effectiveness hypothesis, more engaged audiences should process fear through their high self-efficacy - and thus have a greater capacity to act out of fear (or other negative emotions). This suggests that targeting specific emotional reactions to motivate climate action is unlikely to produce consistent and predictable effects in individuals with varying levels of engagement with climate change.

To the extent that values, ideologies and worldviews have repeatedly been found to moderate how information about climate change is received, responded to, and acted upon (Kuhn and Lao 1996; Lord, Ross, and Lepper 1979; Kahan et al. 2012), it is likely that different segments of the population will react differently to emotion-based appeals. This is why scholars have emphasized the importance of knowing one's audience and tailoring communication to meet different audiences' emotional and informational dispositions and needs (Boykoff 2019; Chapman, Lickel, and Markowitz 2017; Markowitz and Guckian 2018; Scheufele 2018). An increasingly common approach used to identify specific audiences is audience segmentation, which aims to identify subgroups that share similar characteristics in terms of values, motivations, beliefs and behaviours within a population (Hine et al. 2014; 2017). While use of audience segmentation in the context of climate change is growing (e.g. Hine et al. 2016; Maibach et al. 2011; Metag and Schäfer 2018), we know relatively less about the diversity within environmentally engaged citizens. Yet, research suggests that the environmental movement is far from homogeneous, and that environmentalists diverge not only in their levels of engagement with climate change, but also - and perhaps most importantly - in terms of views about nature, technology, economic growth and social change (Brulle and Norgaard 2019; Bernstein and Szuster 2019; Tindall et al. 2022). While some authors argue that the environmental movement can be best understood as divided into two groups – those engaged in conventional advocacy, considered as "reformists", and those supporting a more contentious climate-justice perspective, considered "radicals" (e.g. Hadden 2015; Brulle and Norgaard 2019) – several others have suggested that the classical division between "reformists" and "radicals" might be further subdivided and refined (e.g. Perron, Vaillancourt, and Durand 2001; Bernstein and Szuster 2019). Overall, the literature suggests that the effectiveness of emotional appeals for climate action may depend not only on the level of engagement with climate change (Cho and Salmond 2006), but also on pre-existing values, ideologies and worldviews (Kuhn and Lao 1996; Lord, Ross, and Lepper 1979; Kahan et al. 2012), and that these predispositions are likely to vary, even among environmentally engaged citizens (Brulle and Norgaard 2019; Bernstein and Szuster 2019; Tindall et al. 2022).

In sum, existing research suggests that negative messaging should be most effective under certain conditions. First, negative messaging should be most effective when the message induces the

intended negative emotional arousal among the receiver, and when the mediating role of emotions is taken into account. Second, negative messaging should be most effective when the threatening information is followed by concrete, effective and attainable steps to reduce the threat of a given risk. Finally, negative messages should be most effective with audiences in later-stages of environmental engagement (e.g. environmental activists) and with more radical values and beliefs about climate change (e.g. radical activists).

Hypotheses and conceptual model

Building on this literature, we leverage data drawn from a sample of active supporters of environmental non-governmental organizations (ENGOs) to test five hypotheses (Figure 3). First, to the extent that previous research conducted on similarly engaged (e.g. Michelson and DeMora 2021) and less engaged (e.g. Levine and Kline 2019) samples lend credence to the late effectiveness hypothesis, we expect that negative messaging will lead to greater climate action than positive messaging among our sample of active ENGO supporters.

H1: Exposure to negative messaging (relative to positive messaging) increases the likelihood of taking climate action.

The literature is quite clear that negative frames should evoke greater negative and less positive emotions than positive frames, and vice-versa (Lecheler, Bos, and Vliegenthart 2015; Spence and Pidgeon 2010b; Nabi, Gustafson, and Jensen 2018). As such, we hypothesize that:

H2: Exposure to negative messaging generates more negative and less positive emotions than exposure to positive messaging.

To the extent that fear was found to mediate the positive relationship between threatening information and behavioural intentions (Hartmann et al. 2014), and that higher levels of hope reduced mitigation motivations (Hornsey and Fielding 2016), we further expect that:

H3: Negative (positive) emotional arousal is positively (negatively) associated with climate action.

H4: Negative messaging has a positive indirect effect on climate action by way of increased negative emotions and decreased positive emotions.

Finally, in light of the late effectiveness hypothesis and research on the role values, ideologies and worldviews play in moderating how individuals' respond to climate change information, we further hypothesize that the relationship between emotional arousal and climate action will be more positive for audiences in later-stages of environmental engagement and with more radical values and beliefs about climate change.

H5: the relationship between emotional arousal and climate action will be moderated by the level of engagement and radicalism of the audience receiving the message.
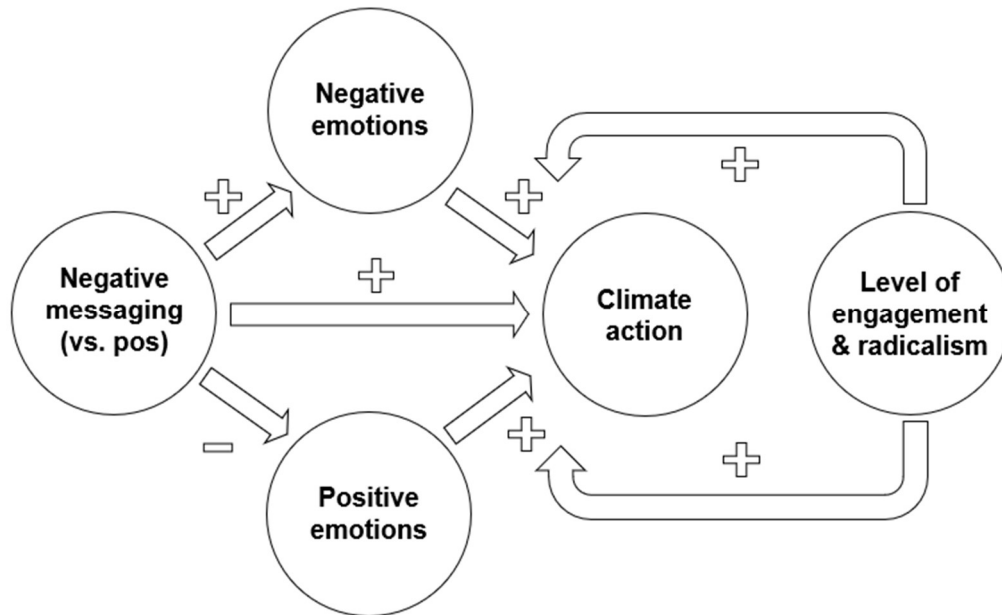
Note: model tests the effectiveness of negative (vs. positive) messaging on climate action (H1), through negative and positive emotional arousal (H2, H3 & H4) moderated by the level of engagement & radicalism of the audiences (H5).

Figure 3. – Conceptual model testing the effect of negative vs positive messaging on climate action

Data and Methods

To examine the direct and indirect influence of negative (vs. positive) messaging on climate action across audience segments, we analyze data drawn from a two-wave panel survey administered online to members and supporters of Canadian environmental organizations in 2019 and 2021. A total of eight environmental organizations (i.e. Greenpeace, David Suzuki Foundation, Conservation Council of New Brunswick, Ecology Action Centre, Canadian Parks and Wilderness Society, Nature Canada, West Coast Environmental Law and Canadian Environmental Law Association) participated in both waves of the study. These organizations provided a list of their email contacts including a full spectrum of environmental group supporters, from newsletter subscribers to active donors. The first wave of data was collected online between April 25th and July 18th, 2019 (n=2,651). A professional firm was hired to administer an online survey and develop unique web links that were provided to the participating environmental organizations, who then sent out a standardized invitation to their lists. The response rate for this portion of the field work was 9%. Based on the information provided by environmental organizations regarding the demographic make-up of their lists, we estimate that the sample is representative of the population of ENGO supporters in terms of age and gender. Of those who completed the first survey, 1,163 were invited to participate in the second wave of the research (i.e. excluding those who had unsubscribed since 2019) and 29% completed the second survey (n=335). This second wave was administered online between November 12th and December 31st, 2021. Retention for the second wave of the survey differed slightly by gender ($\chi^2(1)$=7.78, $p<0$=.05) such that males were slightly more likely to complete the two waves of the survey (15%) than females (11%). Older generations (i.e. Gen Xers and above) were also slightly more likely (13%) than younger cohorts (8%) to complete both surveys ($\chi^2(1)$=7.22, $p<0$=.05). No substantial differences in terms of education, income, or partisanship were detected between the initial sample and those who completed the second wave. To ensure data quality, we checked for any discordances between self-reported birth year in 2019 and 2021 and excluded 27 respondents from the analysis due to inconsistent responses (N=308).

Audience segmentation

To segment the data into relatively homogenous subgroups, we followed the approach of Maibach and colleagues (2011) and conducted a Latent Class Analysis using Latent Gold 5.1. Based on several selection criteria (e.g. R^2, bivariate residuals, improvement in model fit statistics), the following nine variables were used to create the segmentation on the initial sample (Table 6).

Attitude towards solutions (which statement best describes your attitude regarding solutions to environmental problems in our society?
• Environmental problems can be solved within our present political-economic system if enough people change their lifestyle/environmental problems can be solved only if significant changes are made in our present political-economic system/environmental problems can be solved only if our present political-economic system is replaced by a radically different system
Economic growth (how much do you agree or disagree with the following statements)
• Economic growth is necessary to finance environmental protection • We need to set strict limits on production, consumption and economic growth • Economic growth is the best indicator of prosperity • A "good life" without economic growth is impossible • Technology can solve all environmental problems associated with economic growth
New environmental paradigm (how much do you agree or disagree with the following)
• The balance of nature is very delicate and easily upset
Behaviours (have you ever…)
• Taken part in a protest or public march regarding environmental protection and/or environmental issues
• Voted for a political candidate primarily because of their progressive stance on the environment
Total: 9 variables

Table 6. – Selection of segmentation criteria

These variables were used to submit three, four and five segment solutions to the analysis. To guard against local maximum solutions when conducting LCA, we ran the estimation algorithm several times with different parameter start values (Maibach et al. 2011). To further ensure the validity and stability of our findings, we conducted the analyses using 5 000 random sets of start values and replicated each solution ten times. All three models (3-,4-, and 5-segments) replicated exactly.

Several measures can be used to identify the number of classes and choose the model that best fits the data (Table 7). Generally, the best fitting model is indicated by the model with the lowest value of the Bayesian information criterion (BIC) generated among the set of models (Nylund-Gibson and Choi 2018), pointing in our case to the selection of the 4-class model. Additionally, we performed bootstrapped likelihood ratio tests to assess whether moving from 3- to 4- and 5-segments significantly improved model fit. P-values for both the 4- and 5- segments were significant at $p<.001$. We thus calculated the Bayes factor (BF) to further compare the 4- and 5-class solutions. A BF greater than 10 provides strong evidence for the model with fewer classes (Wasserman 2000), indicating that the 4-class model provided the best model fit. The 4-class model was hence used to segment the data into distinct audiences. This model was used to replicate the audience segmentation on the 2021 data.

Model	BIC(LL)	NPAR	BLRT p	BF
3 classes	37083	86	-	<15
4 classes	36910	115	0.040	>15
5 classes	36975	144	0.016	-

Note: BIC = Bayesian information criterion; NPAR = number of parameters; LL = log-likelihood; BLRT = bootstrapped likelihood ratio test; BF = Bayes factor.

Table 7. – Summary of model fit statistics

Survey experiment

A survey experiment was embedded in the second wave of data collected in 2021. Respondents were randomly assigned to either a control group or to one of two treatment conditions as outlined in Table 8. The negative and positive messaging treatments were presented alongside visuals aimed at strengthening the experimental treatment (see Appendix B for exact visuals and wording).

		Question wording
Experimental treatments	Control	(1) No message
	Negative messaging (aimed at inducing negative emotions)	(2) This last summer, the United Nations Intergovernmental Panel on climate change issued its latest report, sounding a "code red for humanity". Wildfires and deadly heatwaves, as we saw this last summer, are just examples of how serious climate change is in Canada. As the UN chief said: "greenhouse-gas emissions from fossil fuels burning and deforestations are choking our planet and putting billions of people at immediate risk.
	Positive messaging (aimed at inducing positive emotions)	(3) The COVID-19 pandemic has shown how strong society is when we all work together. As the latest round of global climate talks will take place from 31 October to 12 November 2021 in Glasgow, United Kingdom, thousands of people will gather to advance climate action. Now is the time to take bold collective action to reduce emissions, build resilience and reduce the impacts of climate change.

Table 8. – Summary of experimental treatments

Participants in the negative and positive messaging conditions were then asked to rate how they felt while reading the paragraph using a battery of 10 emotions on a scale ranging from 0 (not at all) to 5 (extremely). Results of an exploratory factor analysis pointed to three emotional

dimensions. The first factor, worry, emerged as a separate dimension with only one item. The second, which we labelled "other negative emotions" comprised anger, sadness, upset, and fear. These items all loaded on the same dimension with high reliability (Cronbach's alpha > .81). Finally, hope and optimism loaded on the same factor (Cronbach's alpha >.89) which we labelled as hope. Skepticism, helplessness and empowerment were excluded because of high cross-loadings. Because we did not measure message-induced emotions for the control group, and given that we are interested in the mediating role of emotions in framing effects, we base our analysis on negative and positive messaging only.

We employed two separate measures of climate action: activism intention, and observable activism. Activism intention was measured using the self-reported intention to contact one's Member of Parliament (MP). Specifically, respondents were asked "would you take a minute to email your federal Member of Parliament demanding a green and just recovery from COVID-19? By answering yes, you will be directed to a letter we have prepared. If you would like us to send the letter on your behalf, please enter your information below the letter." Responses were coded 0 (no) and 1 (yes). The second measure of observed climate activism was coded as 1 if the respondent provided their contact information and sent the letter to their MP, and 0 otherwise.[3].Data collected in the first wave of the survey (2019) suggests that contacting one's MP is perceived as particularly effective among ENGO supporters. In the first wave of the survey, respondents were asked how effective they believed different actions to be in terms of bringing about changes to help protect the environment, on a scale ranging from 1 (not at all effective) to 5 (very effective). The question involved a randomized list of 13 different actions, including protests and marches, acts of civil disobedience, petitions, voting, lobbying elected officials, consumer boycotts and buycotts, advocating for stronger laws and policies for environmental protection, working collaboratively with government, working collaboratively with business, working collaboratively with Indigenous communities, public education campaigns, litigation through the courts and establishing teams of local volunteers to raise funds or deliver on-the-

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[3] Action pages may be assessed using the following links: https://act.newmode.net/action/ecoanalytics/tell-federal-government-we-need-green-and-just-recovery-covid-19 (in English) and https://act.newmode.net/action/ecoanalytics/dites-au-gouvernement-f%C3%A9d%C3%A9ral-nous-avons-besoin-dune-relance-verte-et-juste (in French).

ground projects. Advocating for stronger laws and policies for environmental protection was considered the second most effective action, with 80% of respondents ranking it as moderately or very effective, just behind working collaboratively with Indigenous communities (81%). Lobbying elected officials came 6th, with 63% of respondents finding it moderately or very effective. Overall, 87% of respondents said they would like to contact their MP and 54% actually sent the letter. Of those who showed activism intention, 68% sent the letter and 32% left the action page without actually sending the letter.

To test the effect of negative and positive messaging on emotions and climate action across different levels of audience engagement and radicalism, we used Hayes' PROCESS (Hayes 2022) modelling software (Model 4 and 14) with 5,000 bootstrapped resamples and 95% confidence intervals. Continuous variables were centered at their means prior to all analyses.

Results

We begin with results from the audience segmentation. Drawing on the first wave of the survey, our analysis identified four unique audiences within our sample of respondents who support Canada's environmental movement. These environmental group supporters varied in their levels of engagement and radicalism: the active radicals (26%), the active reformers (43%), the moderate reformers (25%) and the passive pragmatists (6%).

The active radicals represented about a quarter (26%) of the sample of environmental group supporters in Canada. Individuals in this segment were very engaged with climate change. A large majority (81%) said they had at some point taken part in a protest or public march regarding environmental issues and nearly all of them (96%) said they had at some point voted for a political candidate primarily because of their progressive stance on the environment. Of all groups, they were the most likely to think that environmental problems can be solved only if radical changes are made to the present political-economic system (54%). Most strongly disagreed with the economic growth paradigm: 94% strongly disagreed that economic growth is the best indicator of prosperity and 71% strongly agreed that we need to set strict limits on production, consumption and economic growth.

A plurality of environmental group supporters in the sample fell into the Active reformers category (about 2 in 5). Individuals in this group were engaged in climate change but were more active in traditional rather than radical forms of participation. Nearly all (92%) had at some point voted for a political candidate because of their progressive stance on the environment, while 60% had taken part in a protest or public march regarding environmental issues. The active reformers differed from their radical counterparts in that they were less likely to think that environmental problems can be solved only if radical changes are made to the present political-economic system (29%). Instead, most of the active reformers expressed a view that to protect the environment, significant changes should be made within the present system (64%). Although less strongly than their radical counterparts, most individuals in this group were willing to question the economic growth paradigm. For instance, when asked if strict limits were needed on production, consumption and economic growth, the active reformers were somewhat split between those who strongly agreed (32%), those who agreed somewhat (47%) and those who neither agreed nor disagreed (15%).

Meanwhile, the moderate reformers (about 25% of the sample) were less active and more ambivalent in their views. A majority (71%) had voted for a political candidate because of their stance on the environment and about one third (31%) reported having participated in a protest or public march. Similar to the active reformers, most of the moderate reformers endorsed the institutional view of solving environmental problems (63%). However, they were considerably more ambivalent than the active reformers when it came to agreeing or disagreeing with the economic growth paradigm. On questions related to economic growth, moderate reformers were more likely than any other group to say that they neither agreed nor disagreed (e.g. 42% of them said they neither agreed nor disagreed that economic growth is the best indicator of prosperity). Finally, the passive pragmatists (about 6% of the sample) were the least active of all groups, with 17% of them having taken part in a protest or public march and 39% having at some point voted for a political candidate primarily because of their stance on the environment. Of all groups, passive pragmatists were the most likely to believe that environmental problems can be solved within the present political-economic system if enough people change their lifestyle (36%). Yet,

almost half of the passive pragmatists believed that significant institutional changes should be made to solve environmental problems (46%). Individuals in this category tended to agree with the economic growth paradigm. Most of them either agreed (44%) or strongly agreed (28%) that economic growth is the best indicator of prosperity and about half either disagreed (28%) or strongly disagreed (27%) that we need to set strict limits on economic growth.

Replicating the segmentation using the 2021 data revealed slight changes in the distribution of audiences. Compared to the initial segmentation, the 2021 distribution revealed an increase in the proportion of active radicals (from 26% to 34%), a decrease in the proportion of moderate reformers (from 25% to 17%) and about the same proportion of active reformers (43% to 44%) and passive pragmatists (6% and 5% respectively). The 2021 distribution was used to test the moderated mediation model, as presented below.

Next, we tested whether negative (vs. positive) messaging had a direct or indirect effect on activism intention (i.e. would you take a minute to email your federal Member of Parliament) and observed activism (i.e. send a letter to their Member of Parliament). To test our first four hypotheses, we begin by examining a simple mediation model (PROCESS model 4). Results showed no direct nor indirect effect on activism intention (results not shown here). However, while respondents were equally likely to say that they would contact their MP regardless of the condition to which they were assigned, results showed that those who received the negatively framed message were significantly less likely to *actually* send the letter to their MP (Model 4 of Table 9). Contrary to our first hypothesis, negative messaging significantly *decreased* the likelihood of taking climate action (b [unstandardized]=-.621, p <.05). Overall, 59% of those who were assigned to the positive treatment sent the letter, while 46% did the same in the negative treatment condition. Holding worry, hope and other negative emotions constant, and converting the negative messaging coefficient in Model 4 of Table 9 from log-odds to odds, we find that the negative messaging condition decreased the odds of sending the letter by 54%. In line with our second hypothesis, negative messaging generated more worry (b [unstandardized]=.412, p <.05) and less hope (b [unstandardized]=-.415, p <.01) than positive messaging. However, our

treatment had no effect on the index of other negative emotions (fear, upset, anger and sadness). We further examined the impact of our experimental treatment on fear, upset, anger and sadness separately and found that our treatment significantly increased fear, though it had no impact on upset, anger and sadness (see Table 25 in Appendix B). Our results did not support the simple mediation hypotheses (H3 and H4), as indicated by the non-significant coefficients of worry and hope in Model 4 below.

	Model 1 DV: worry	Model 2 DV: neg. emotions	Model 3 DV: hope	Model 4 DV: observed activism
Constant	-.200*	-.111	.198*	.442*
Neg. messaging	.412**	.110	-.415**	-.621*
Worry			.	.156
Neg. emotions				-.171
Hope				.226

*p<0.05; **p<0.01; ***p<0.001

Table 9. – Summary of direct and indirect effect of negative and positive messaging on observed activism (PROCESS model 4)

Finally, we expected that the relationship between emotional arousal and climate action would be moderated by the level of engagement and radicalism of the audience receiving the message. We used PROCESS model 14 to test this moderated mediation hypothesis, with the negative (vs. positive) message as predictor (X), audience segments as moderator (W), worry and hope as mediators (M1 and M2) and observed climate activism as the outcome variable (Y). A model was tested for each of the four audiences (see Table 26 in Appendix B). However, given that active radicals were the only segment to process emotional arousal distinctively, we compare the results

for active radicals and less engaged groups, using the dummy variable "active radicals" (coded 1 if the respondent is an active radical and 0 otherwise).

Consistent with our fifth hypothesis, the interaction between worry and the most engaged and radical segment was positive and significant (b [unstandardized]=.8230 p <.05, Model 4 of Table 10). The difference between conditional indirect effects was also significant, as indicated by the index of moderated mediation (b [index]=.3421, bootSE=.1863, 95% BootCIS [.0486, .6553]). Overall, the negative messaging condition had a negative direct effect on observed activism among the sample as a whole, decreasing the odds of sending the letter by about 54%, and a positive indirect effect through worry among active radicals only, increasing the odds of sending the letter by 31% among this more engaged and radical audience segment. However, we found no moderated mediation between hope and the level of audience engagement and radicalism (b [index]=.1768, bootSE=.1853, 95% BootCIS [-.6152, .1072].

	Model 1 DV: worry	Model 2 DV: hope	Model 3 DV: observed activism
Constant	-.207*	.206*	.217
Neg. messaging	.416*	-.415**	-.620*
Worry			-.171
Hope			.0543
Active rad			.806*
Worry X act			.823*
Hope X act			.427

*p<0.05; **p<0.01; ***p<0.001

Table 10. – Summary of direct and indirect effect of negative and positive messaging on observed activism (PROCESS model 14)

Discussion and conclusion

Our analysis identified four unique audiences within our sample of active environmental group supporters in Canada, with varying levels of engagement and radicalism: the active radicals (26% in 2019; 34% in 2021), the active reformers (43% in 2019; 44% in 2021), the moderate reformers (25% in 2019; 17% in 2021) and the passive pragmatists (6% in 2019; 5% in 2021). Overall, these results are broadly consistent with previous research exploring the heterogeneity of views within the environmental movement (Brulle and Norgaard 2019; Bernstein and Szuster 2019; Tindall et al. 2022). Our findings differ from past research suggesting that the environmental movement might be understood as divided between only two groups (i.e. "reformists" and "radicals"; e.g. Brulle and Norgaard 2019), though they are in line with previous studies suggesting that pro-environmental worldviews vary along a more complex range of views (e.g. Bernstein and Szuster 2019).

Our survey experiment showed that negative messaging can be less mobilizing than positive messaging, even when the message is directed toward relatively engaged audiences and followed by the opportunity to take a specific, actionable and effective action. To be sure, this is at odds with previous work in risk communication suggesting that fear appeals can be effective insofar as they also provide recipients with the opportunity to take a clear, concrete and doable action (Witte and Allen 2000). However, it is consistent with the idea that negative messaging effectiveness may vary across time and contexts. As Patterson et al. (2021) recently pointed out, repeated, consistently negative messages may lead to public fatigue over time. While the literature has yet to investigate the effects of overlapping emergency frames (such as climate change and COVID-19), an alternative hypothesis that might help explain our findings is that the cascade of crises the world has faced in the last two years might have contributed to generating "apocalypse fatigue" (Patterson et al. 2021). To the extent that the use of the "climate emergency" frame has increased substantively since 2019 (McHugh, Lemos, and Morrison 2021), and that even recently published studies tend to draw on data collected in 2019 or before (e.g. Michelson and DeMora 2021), the contrast between our results and those found previously may suggest that alarmist and fear-inducing messages might be effective in the short-term, but might become less so as the context changes. Conversely, optimistic messages may become relatively

more effective as "apocalypse fatigue" sets in, especially in the context of a global public health pandemic. The extent to which such contextual factors shape responses to positive and negative framing is thus an important topic for future research. Our findings did not support our hypotheses regarding the simple mediating role of emotions. This is at odds with previous research pointing to the mediating role of emotions in framing effects (Nabi, Gustafson, and Jensen 2018; Hornsey and Fielding 2016). However, previous efforts differ from our study in terms of research design and outcome variables. Contrary to Nabi et al. (2018), who explored the mediating role of fear and hope in a threat-efficacy, emotion sequencing structure (i.e. exploring the effect of threat-induced fear on subsequent emotional responses to a loss- and gain-framed efficacy message), our negative message did not include any efficacy component, nor did our positive message include any threatening information. In testing the value of emotional sequencing, Nabi et al.'s (2018) model included two separate measures of fear: the first in response to a threatening vs. non-threatening message, and the second in response to a gain- vs. loss-framed efficacy message. Whereas their research design helped better understand how emotions can be intensified and climate action enhanced through emotional sequencing, our study offered a relatively more conservative test of the mediating role of emotions in framing effects. Overall, emotions were not found to mediate framing effects at the aggregate level. However, we do find some support for our moderated mediation hypothesis. The relationship between emotional arousal and climate action was moderated by the level of engagement and radicalism of the audience receiving the message, such that worry was positively associated with observed climate activism among active radicals, but not among less engaged/radical groups. This is in line with previous research suggesting that more engaged audiences will process fear or other negative emotions through high self-efficacy and thus be able to act out of (rather than avoid) these emotions (Cho and Salmon 2006).

Theoretically, this study contributes to the literature on effective climate change communication by demonstrating that negative messaging can be less mobilizing than positive messaging, even when meeting the conditions under which the literature suggests that fear appeals ought to be most effective. Although we included measures of message-induced emotions, drew on a sample of already engaged audiences, and offered the opportunity to act in a concrete and effective way,

the negative message was less mobilizing than the positive one. These results highlight the need to revisit existing theories in climate change communication in light of the potential "apocalypse fatigue" that may result from the repeated use of overlapping emergency frames. To the extent that severe climate change impacts are still unevenly spread geographically, such sounding of the alarm may resonate less with many who have not yet experienced serious impacts from climate change personally.   Furthermore, in identifying audience segments that vary in their levels of engagement and radicalism and testing a moderated mediation model that incorporates both mediation and moderation effects, this analysis further sheds light on the complex ways in which message frames and emotions interact with the audiences' preexisting values and dispositions. In so doing, we show that the relationship between emotions and climate action differ across audiences varying in their level of engagement and radicalism, hence highlighting the importance of taking audiences into account when developing persuasive appeals in the context of climate change communications. Methodologically, this study extends previous research by allowing for a comparison of persuasion effects on both self-reported intention to act, and on observed climate activism. Finally, these results have suggestive implications for environmental organizations seeking to engage and communicate with their supporters, as well as climate change communicators more generally.

However, our analysis is limited in a number of respects. First, our findings are based on a relatively small sample of environmental group supporters, and taken at a particular moment in time (in the shadow of a global public health pandemic). We thus had to rely on a small number of observations, especially when testing our moderated mediation hypothesis (i.e. including the four audience segments used in the analysis). While we have no way of knowing exactly how representative our sample is given the lack of true demographic data on Canada's environmental movement, we are confident that our random probability sample of eight of Canada's largest environmental groups provides a reasonably good representation of this population. Our sample is in fact similar to that used in other published research of Canadian environmental group supporters (e.g. Tindall and Piggot 2015), notably in terms of the greater proportion of older and female respondents. Moreover, to the extent that our experimental design establishes internally

valid results, ultimately, the generalizability of our findings is a point we must leave for future research.

Future research might examine how message frames, emotions and audiences interact in the process of climate change communication using larger samples of respondents, including both environmentally engaged citizens and the general public. The heightened prominence of online environments provides researchers and practitioners with new opportunities to connect with audiences that are less motivated and attentive to the issue of climate change. For instance, climate change communication researchers may consider running online field experiments on Facebook to test the impact of negative and positive messaging on several measures of engagement among the general public (for an example, see Orazi and Johnston 2020).

Second, although our study moves beyond previous work by offering an audience-focused approach to studying emotions in climate change communication, our manipulation was limited to a single message, and was followed by a limited number of post-treatment questions, making it difficult to know what specifically about each treatment triggered certain emotional and behavioural reactions. For example, in addition to reducing hope and increasing worry, "code red messaging" may have lowered efficacy beliefs about the action page itself. Having no post-treatment action-efficacy measures, we are unable to test for this possibility in the current research. Future studies would benefit from testing the potential interaction between messaging and emotions, on the one hand, and efficacy beliefs across a range of different types of climate action, on the other.

Third, our results may have been affected by the fact that the positive message explicitly primed efficacy (i.e. now is the time to take broad collective action), while the negative message did not. This imbalance could have increased efficacy perceptions in the positive treatment relative to the negative one, in turn affecting its relative effectiveness in motivating climate action. However, previous research has pointed to potentially more complex and less intuitive relationships between exposure to threatening/efficacy information and perceptions of efficacy. In fact, some studies have found that exposure to highly threatening information increased perceptions of efficacy (relative to a moderate threat) and suggested that the positive link between threat and

efficacy occurred as a result of "motivated control" – a coping mechanism leading people to adjust their efficacy beliefs in order to match their perception of the threat (Hornsey 2015). Other research has found that under exposure to threatening information, providing coping information actually lowered efficacy perceptions (i.e. perceived efficacy was higher in the threat only group) (Hartmann et al. 2014). Having no post-treatment measure of efficacy perceptions, we have no way of knowing exactly how each treatment affected efficacy beliefs.

To be sure, these results should not be interpretated as implying that negative messages can never be an effective communication strategy, nor that optimistic messages will always be more effective than negative messaging. Although many studies have shown that negative messaging increased pro-environmental intentions even in the absence of an efficacy statement (e.g. van Zomeren, Spears, and Leach 2010; Hartmann et al. 2014, Michelson and DeMora 2021), we cannot rule out the possibility that the negative treatment would have been more effective had it also included an efficacy statement (e.g. "the problem is so dire that we must urgently speak up and push governments to act"). Furthermore, different optimistic messages may tap into different components of efficacy (i.e. internal, external and response efficacy), affecting perceptions of efficacy and climate action differently. Future research could test a wider array of climate change messages, while manipulating both the valence of the message (i.e. positive versus negative) and the type of efficacy information (i.e. internal, external and response efficacy).

While our moderated mediation model accounted for the simultaneous effects of different emotions (i.e. worry and hope), much remains to be understood about how and under what conditions a different mix of emotions evoked in climate change communication can promote climate action. To the extent that emotional experiences are part of a complex interconnected system involving a wide range of emotions and cognitive appraisals that cannot be easily disentangled (Chapman, Lickel and Markowitz 2017), future studies should treat emotions as part of a more integrated learning system and investigate their potentially broader and longer-term impacts on behaviours. For instance, building on the results of this study, future analyses might go further and use longitudinal data to examine the interindividual and contextual conditions under which different emotion-laden messages should be most effective. While our results

provide suggestive evidence of potential "apocalypse fatigue", more research is needed to examine the (un)sustainability of emergency messages and threat-induced emotions about climate change over time, especially as they compete and overlap with other emergency frames or arguments.

Chapter 4 – Mobilizing for system change: integrating notions of audiences and group goals into existing social identity models of collective action

Introduction

As the world grapples with the severe consequences of climate change, it becomes increasingly clear that individual efforts will not be sufficient to limit global emissions and keep temperature increases within a safe range (Tollefson 2022). Achieving the Paris summit goal of limiting global warming to 1.5°C requires nothing short of deep structural changes in the way we produce and consume. To achieve these changes, key societal domains such as transportation, housing, and energy production must be transformed, and this requires the cooperation of all relevant actors – governments, businesses, and individuals (Bamberg et al. 2018). As the Intergovernmental Panel on Climate Change underscores, limiting global warming to 1.5°C will require "rapid and far-reaching" transitions in land, energy, industry, buildings, transport and cities (IPCC 2018). Such transformations will require more than just changes at the individual level; they will require a fundamental shift in the way societies operate. With climate tipping points approaching, pressing collective, system-level changes are essential for both mitigating greenhouse gas emissions and preparing communities to cope with the impacts of climate change (Tollefson 2022).

This evolving context raises questions about the role environmental psychology can play in fostering the necessary momentum for system-level change. Several researchers (Bamberg et al. 2018; Barth et al. 2021; Schulte et al. 2020) have argued that environmental psychology should shift its focus from focusing mainly on explaining individual behaviour toward emphasizing the collective dimension of climate action. As Barth et al. (2021) pointed out in a special issue published in the *Journal of Environmental Psychology*, there are at least two important ways in which environmental psychology can contribute to the resolution of the global climate crisis. The first is to focus on collective behaviours that change the system fundamentally, and the second is

to examine why and under what conditions individuals come to believe that they are part of a broader group for which they are willing to act collectively in support of the environment (Fielding et al. 2008; Tajfel and Turner 1979). However, despite the valuable insights offered in this special issue, the environmental psychology field still faces two important gaps that hinder its ability to fully reveal the collective dimension of climate action.

The first gap relates to the inconsistent understanding of social identity's predictive power across contexts and audiences. According to the social identity theory (Tajfel and Turner 1979), social identification or the degree to which people identify with a group is among the strongest predictors of collective action (Drury and Reicher 2009; Stürmer and Simon 2004; van Zomeren, Postmes, and Spears 2008). Despite its long history in the study of social movements, however, social identity has only recently begun to receive consistent scholarly attention in the context of climate change (Masson and Fritsche 2021). Among the important findings emerging from this research is that social identity can play a greater role in predicting collective pro-environmental action than individual-level action, as recent meta-analyses have suggested (Schulte et al. 2020). A recent study also found that in addition to varying across types of action, social identity's predictive power varied across audiences, which explained a greater share of intentions to participate in system-challenging collective action among non-activists than activists (Pozzi et al. 2022). While these results are consistent with research conducted outside the climate change context, which has shown that identities often act as cybernetic control systems (Powers 1975; Burke 1980; 1989; 1991; Hogg et al. 1995) – making social identification more important when engaging individuals in action that challenges their values or solution orientations – existing research in environmental psychology offers limited insight as to why the predictive power of social identity varies across contexts and audiences.

The second gap concerns the lack of understanding about how social identity can mobilize groups with the goal of challenging the system. Identifying the drivers of system-level change is an important step toward developing a more systems-based approach to environmental protection in Canada – a practice still relatively uncommon among environmental organizations (Beer 2022). In light of the potential of social identity to bridge individual and societal aspects of social

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transformations, scholars have suggested that social identity can serve an important role in mobilizing groups "with the goal to change a system fundamentally" (Barth et al. 2021, 4). However, given that most studies investigating social identity as a predictor of collective action tend to focus on relatively moderate objectives (Schulte et al. 2020), the extent to which social identity can predict the intention to engage in system-challenging collective action remains unclear.

This study offers an empirical test for the role of social identity in predicting system-challenging collective action across diverse audiences of activists and non-activists in Canada. The results provide empirical evidence that social identity can play a role in predicting the intention to participate in system-challenging collective action and emphasizes the importance of integrating notions of audiences and group goals into existing social identity models of collective action. Specifically, this study proposes that the role of social identity in explaining participation in the environmental movement depends on the extent to which the audience's preexisting values and beliefs align or not with the goal of collective action.

Social identity in predicting collective action

In their well-known social identity model of collective action (SIMCA), Van Zomeren and his colleagues suggested that social identity is not only a strong direct predictor of collective action but is also indirectly motivating climate action by feeding into efficacy beliefs (rational pathway) and moral outrage (emotional pathway) (van Zomeren 2013; van Zomeren et al. 2011; van Zomeren, Postmes, and Spears 2008). A few years later, an alternative model emerged, known as the encapsulation model of social identity in collective action (EMSICA) (Thomas et al. 2009). This model also acknowledges the importance of social identity, efficacy and emotions in collective action but asserts that rather than facilitating or giving rise to moral outrage and perceptions of efficacy, social identity actually encapsulates these experiences. Hence, the EMSICA model suggests that emotions and efficacy can shape perceptions of being part of a group, which, in turn, can motivate people to act on behalf of that group.

Both SIMCA and EMSICA have been found to have high levels of explanatory power across various contexts (e.g. Klavina and van Zomeren 2020; Thomas et al. 2016). However, recent research comparing the two models in real-life settings indicated that EMSICA may be more powerful than SIMCA in the context of bottom-up identity formation (Bamberg et al. 2015; Chayinska et al. 2019; Uysal and Akfırat 2022). In addition to showing that collective action can be motivated by both group-based emotions and efficacy beliefs, a number of researchers suggest that some people may be more motivated by emotional motivations, while others may be more efficacy-driven (e.g. Tausch et al. 2011; van Zomeren et al. 2004).

Predicting participation among activists and non-activists

Environmental activists are generally seen as the driving force behind the environmental movement. The success of this social movement, however, is largely determined by the extent to which activists are able to mobilize others within the broader ingroup (Kutlaca, van Zomeren, and Epstude 2020). While non-activists can be valuable allies in social change processes, research suggests that their motivations differ from activists'. For instance, as opposed to activists whose engagement tends to be driven by collective and moral concerns (Sabucedo et al. 2018; Turner-Zwinkels et al. 2016; van Zomeren 2013), non-activists are more likely to act based on personal concerns and "rational calculations" of the costs and benefits of action or inaction (Olson 1968; van Zomeren and Spears 2009). Unsurprisingly, research also suggests that activists associate more strongly with their group (van Zomeren, Postmes, and Spears 2008; van Zomeren and Spears 2009) than non-activists. Examining the social-psychological drivers of collective action during the "Chile awakenó" protests of 2019–2020, Pozzi et al. (2022) found that EMSICA had a stronger explanatory power among non-activists than activists. These authors found that a slightly modified EMSICA model, which included prosocial disobedience attitudes in addition to emotions, efficacy and social identification, explained 58% of the variance in non-activists' collective action intentions and 44% among activists. In addition, they showed that non-activists had a more emotion-focused approach to collective action, while activists were more efficacy-driven. Their findings contrasted with previous work suggesting that non-activists are more motivated by rational calculations and activists by moral concerns. However, this study measured

collective action intentions in a relatively radical and system-challenging context, setting it apart from previous work generally looking at within-system collective action. As these results illustrate, relationships between social identification, emotions and efficacy may vary across contexts and audiences.

Collective action goals

Based on three recent meta-analyses, Schulte et al. (2020) provided evidence demonstrating that opinion-group-based social identities are more strongly associated with the intention to engage in pro-environmental *collective* action than *individual-level* action. Summarizing the empirical evidence for the proposed strong association between pro-environmental social identity and pro-environmental action, the authors found that on average, social identity explained between 31% (first meta-analysis: nine samples) and 40% (second meta-analysis: 15 samples) of the variance in intentions to participate or actual participation in collective action for the environment, relative to only 12% for individual behaviours (third meta-analysis: eight samples). As social identities account for a greater proportion of pro-environmental *collective* action than *individual-level* action, scholars have proposed that social identities can play a central role in mobilizing groups with the "goal to change a system fundamentally" (Barth et al. 2021, 4). However, the social-psychological processes leading different individuals to participate in system-challenging collective action have yet to be examined empirically, and little is known about whether the predictive power of social identity approaches varies as a function of collective action goals. The majority of the studies included in Schulte et al.'s (2020) meta-analyses focused on achieving broad environmental goals (e.g. how often do you get involved with any groups whose main aim is to preserve or protect the environment), and none explicitly referred to collective action as a way of transforming a system fundamentally. Considering that environmental organizations rarely mobilize around system change (Beer 2022), and meta-analyses examining social identity's role in predicting collective action tend to focus on relatively moderate objectives (Schulte et al. 2020), it is unclear to what extent social identity predicts the intention to engage in system-challenging collective action.

EMSICA, audiences and collective action goals

While much remains to be understood as to why the predictive power of social identity as well as the pathways involved in EMISCA differ across audiences and contexts, these findings are consistent with research conducted outside the climate change context, which has shown that identities often act as cybernetic control systems (Burke 1980; 1989; 1991; Hogg et al. 1995; Powers 1975). In Burke's (1991) words: "identity processes, viewed from a cybernetic control perspective, may be regarded as acting like a thermostat […] individuals use their identities as thermostats to assess the identity implications of interactions and to initiate behaviours that maintain or restore congruency between the identity and the reflected appraisals" (p. 242). If social identity influences behaviour mainly through reducing dissonance, it may have little influence on behaviour when the preexisting values of the audience are already broadly aligned with the actions or goals of the group (i.e. when group-based dissonance is low; Glasford et al. 2008). Hence, the greater the level of group-based dissonance, the greater the role of social identity in predicting collective action intentions. To the extent that social identity's predictive power depends upon the degree of (in)consistency between one's personal values and beliefs and the goals of collective action, it may be beneficial to incorporate notions of group goals and audiences into existing collective action models.

Many studies have shown that the values, ideologies and worldviews of individuals can shape their interpreting and acting upon new information regarding climate change (Kahan 2012; Kunh and Lao 1996; Lord et al. 1979). Accordingly, scholars have emphasized the importance of knowing one's target audience (Scheufele 2018) as well as adapting communication strategies to fit preexisting values and beliefs (Boykoff 2019; Markowitz and Guckian 2018). Perhaps the most common way of achieving these goals is by segmenting audiences based on their values, motivations, beliefs or behaviours (Hine et al. 2014, 2017). While several studies have shown that audience segmentation can be useful in climate change communication (e.g. Hine et al. 2016; Maibach et al. 2011; Martel-Morin and Lachapelle 2022; Metag and Schäfer 2018), few have attempted to connect audience segmentation with other influential theories in environmental psychology. As social identity approaches focus mostly on collective drivers of climate action, we

know little as to how the pathways involved in EMSICA may interact with the preexisting values and beliefs of different audiences and the extent to which they align or not with different collective action goals.

The current study

This study examines the role of EMSICA in predicting the intention to participate in system-challenging collective action among diverse audiences of activists and non-activists in Canada. Specifically, it asks two questions. First, what role does EMSICA play in predicting the intention to mobilize for system change? And second, to what extent does the predictive power of EMSICA depend upon the extent to which the audience's values and beliefs align (or not) with the goal of collective action (i.e. level of group-based dissonance)?

Since past studies have shown that social identity plays a large role in predicting collective pro-environmental action, social identity should also play a role when mobilizing for system change. Hence, the first hypothesis is that EMSICA will play an important role in predicting the intention to engage in system-challenging collective action (explaining between 30% and 40% of the variation in collective action intentions). The fact that EMSICA had greater explanatory power among non-activists than activists further suggests that the encapsulation role of social identity may be more important when the preexisting values and beliefs of the audience are at odds with the goal of collective action. In line with this, the second hypothesis is that social identity will play a greater role the larger the gap between the audience's preexisting values and beliefs and the goal of collective action (i.e. the greater the level of group-based dissonance).

To test these hypotheses, this study draws on two online surveys conducted in 2021 and 2022 with samples of Greenpeace Canada supporters (N = 1,394) and the Canadian public (N = 1,514), each containing an experiment varying the goal of collective action. The University of Montreal's Ethics Review Board approved both surveys (certificate CERAH-2022-3920) and participants provided informed consent to participate. A multigroup structural equation modelling approach is used to examine the role of EMSICA in predicting intentions to mobilize for system change (versus other group goals) across various audiences of activists and non-activists in Canada.

Methods

This study analyzed data obtained from an online survey administered to a sample of Greenpeace Canada supporters (N = 1,394) and a representative sample of the Canadian population (N = 1,514). The Canadian sample was representative in terms of age, gender, education, ethnicity and region. The first questionnaire was administered to Greenpeace supporters from 20 July to 30 August 2021, while the second was administered to the Canadian population from 20 December 2021 to 14 February 2022.

Measures

Among the measures used in the analysis were emotions, efficacy beliefs, moral convictions, post-materialist values, views about environmental solutions, social identification and collective action intention. Unless otherwise specified, all questions were scored using a five-point Likert scale (1 = strongly agree to 5 = strongly disagree).

Four items were used to measure emotions (all reverse-coded). Perceived *injustice* regarding climate change was adapted from Barth et al. (2015) ("When I think about the current state of the planet, I feel an overwhelming sense of injustice"). *Fear* was adapted from Furlong and Vignoles (2021) ("I feel scared when I think about the future of the planet"). *Shame* was measured with one item from Rees and Bamberg (2014) ("I feel ashamed when I realize what we are leaving behind for future generations"). Finally, one item was adapted from van Zomeren et al. (2019) to measure anger ("I feel angry about how people have treated the environment").

Efficacy beliefs were measured with two separate questions adapted from van Zomeren et al. (2019). Collective efficacy was measured with the statement "I feel hopeful that Greenpeace can help protect us from climate change" (reverse-coded). Participative efficacy was measured with the statement "I believe that I, as an individual, can make a significant contribution to Greenpeace achieving its aims" (reverse-coded). Moral convictions were measured with two items also adapted from Van Zomeren et al. (2019): "My opinion on the climate emergency is part of my core moral norms and values" (reverse-coded) and "I believe that the issue of climate change is a moral issue" (reverse-coded).

Social identification was measured with four items adapted from Koc (2017): "I feel solidarity with Greenpeace" (reverse-coded), "I feel committed to Greenpeace" (reverse-coded), "I feel a distance between myself and Greenpeace" and "I have nothing in common with Greenpeace".

Post-materialist values were measured using Inglehart and Abramson's (1999) 12-item index, which was based on three sets of respondent rankings of social priorities in which the respondents were asked to identify their highest and second-highest priorities among four choices (two materialist and two post-materialist choices).[4] The measure ranged from zero (materialist) to six (post-materialist).

Views about environmental solutions were measured with one self-developed question asking the respondents what would be most impactful in solving environmental problems. From the following options, the respondents were asked to rank the most important as 1, followed by 2 and then 3: more people doing their part to live a sustainable lifestyle; more people protesting, marching and demanding change from our political leaders; more people disrupting the global capitalist system through activism; the free market driving society toward efficiency and improvement; and our government taking appropriate actions to protect society.

To operationalize the gap between beliefs and goals, three dummy variables were created (i.e. individual change orientation, political change orientation, and system change orientation). Individual change orientation was coded 1 if "more people living a sustainable lifestyle" was selected as either first, second, or third most impactful solution and 0 otherwise. Political change orientation was coded 1 if "our governments taking appropriate actions to protect society" was selected among the three most impactful solutions and 0 otherwise. System change orientation was coded 1 if "more people disrupting the global capitalist system through activism" was selected and 0 otherwise. To examine the predictive power of EMSICA in the control group, where

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[4] The first set included 1) a high level of economic growth, 2) making sure the country has a strong national defence, 3) seeing that people have more say in how things get decided at work and in their community and 4) trying to make our cities and countryside more beautiful. The second set included 1) maintaining order in the nation, 2) giving people more say in government decisions, 3) fighting rising prices and 4) protecting freedom of speech. The third set included 1) maintaining a stable economy; 2) progress toward a less impersonal, more human society; 3) the fight against crime and 4) progress toward a society in which ideas count more than money.

respondents were simply asked to rate how likely they were to participate in collective action aimed at addressing environmental issues, a dummy variable was created to account for personal environmental norms. This variable was coded 1 if the respondent agreed or strongly agreed with the statement "my opinion on the climate emergency is part of my core moral norms and values" and 0 otherwise.

Finally, collective action intention was measured with two questions embedded in a survey experiment, as detailed below.

Analytical procedure

Survey experiment

As part of the survey experiment, the respondents were randomly assigned to one of four groups with different collective action goals (Table 11). The first message contained no justification (control). The second message focused on the importance of reducing our own greenhouse gas emissions (individual change). The third message emphasized political mobilization as a means to reduce greenhouse gas emissions (political change). Finally, the fourth message highlighted the importance of changing the systems on which our country is built (system change).

		Question wording
Experimental treatments	Control	(1) No message
	Individual change	(2) In addressing issues like climate change, it is important for us to find ways to reduce our own greenhouse gas emissions, for instance by consuming less meat and avoiding air travel.
	Political change	(3) In addressing issues like climate change, it is important for us to mobilize politically to pressure our governments to adopt policies that reduce greenhouse gas emissions, for example, policies that promote renewable energy development.

System change	(4) In addressing issues like climate change, it is important for us to change the systems our country is built on from the ground up, by rethinking economic development and growth, and addressing systemic inequalities.	

Table 11. – Summary of experimental treatments

Respondents were then asked two questions in a randomized order. First, they were asked to rate how likely or unlikely they were, this coming year, to take one of the following actions (the action depended on the experimental group they were assigned to): attend protests or marches aimed at: addressing environmental issues (control); pressuring individuals to do more to address environmental issues (individual change); pressuring governments and corporations to do more to address environmental issues (political change); or disrupting the status quo and pushing for systems change to address environmental issues (system change). The second question asked respondents to rate how likely or unlikely they were to take another action (again, the specific action questioned depended on treatment assignment): join or maintain support for any organization committed to addressing environmental issues (control); pressure individuals to do more to address environmental issues (individual change); pressure governments and corporations to do more to address environmental issues (political change); or disrupt the status quo and push for systems change to address environmental issues (system change).

Testing EMSICA across audiences

To strengthen the analysis, three distinct tests were conducted. The first test was conducted on samples of activists and non-activists. The second test was conducted across several sub-samples of activists and non-activists, segmented based on their values and beliefs using LCA (Latent Gold 6.0). The details on how the audiences were created are provided in the Appendix (Tables 30 and 31 of Appendix C).

Multigroup analysis was conducted in the first two tests to assess the power of EMSICA in predicting the intention to mobilize for system change (versus individual change). The comparison with the individual change condition was used as a baseline to assess the extent to

which the predictive power of the model varies as a function of group goals. The analysis in the first two steps was conducted in two main stages. First, the measurement model was assessed by carrying out confirmatory factor analysis in each sample. Second, structural equation modelling was used to test the model on each sample, and multigroup analysis was performed to assess differences across collective action goals in each sample. Due to the many steps involved in multigroup analysis, the system change condition was compared against the individual change condition only at this stage, leaving further comparisons across treatments for the third test. In the third test, the predictive power of EMSICA was examined and compared across respondents whose views were aligned with the goal of collective action versus not in each of the four experimental groups, this time without performing multigroup analysis across treatments.

Results

First test: testing EMSICA among activists and non-activists

As a first step in this initial test, checks were performed to assess the measurement model by conducting CFA on each sample (i.e. activists and non-activists). As Tables 32 and 33 in Appendix C show, the four-factor measurement model was partially validated. All standardized item loadings (λCFA) loaded significantly (p < .001) on their constructs, and the composite reliability threshold of .60 was met for all factors (ranging from .61 to .91) except for the measure of collective action intention in the activist sample (.57). All Cronbach's alphas (α) were also greater than .70 except for the measure of social identification (α = .68) and collective action intention (α = .59) in the activist sample. Because Cronbach's alpha for collective action intention was substantially lower than the commonly accepted threshold, the two items were treated separately (i.e. attend and join). In anticipation that personal and collective efficacy may play out differently across the experimental treatments, the two efficacy items were also included separately in the analysis (although both loaded on the same factor). The correlations between the study variables are presented in Appendix C (Tables 34–35). The correlations range from .04 to .62 in the sample of activists, and from .25 to .73 in the sample of non-activists. Table 12 below presents the descriptive statistics across the samples and experimental treatments.

Constructs and items	Individual change (n = 595)				System change (n = 599)			
	Non-activists (n = 295)		Activists (n = 300)		Non-activists (n = 301)		Activists (n = 298)	
	Mean/SD	α	Mean/SD	α	Mean/SD	α	Mean/SD	α
Emotions		.91		.78		.91		.77
Injustice	3.74/1.10		4.60/.78		3.78/1.11		4.55/.83	
Scared	3.89/1.17		4.49/.92		3.92/1.09		4.45/.85	
Angry	3.93/1.13		4.56/.81		4.00/1.06		4.62/.74	
Ashamed	3.84/1.15		4.46/.84		3.84/1.11		4.50/.82	
Efficacy		.81		.70		.81		.77
Personal	3.52/1.14		3.74/.91		3.51/1.11		3.85/.93	
Collective	3.64/1.19		4.13/.85		3.70/1.14		4.18/.90	
Group ID		.82		.69		.83		.68
Committed	3.04/1.08		3.73/.93		3.05/1.08		3.61/.96	
Solidarity	3.38/1.12		4.17/.96		3.34/1.11		4.17/.94	
No distance	2.89/1.05		3.54/1.05		2.93/1.09		3.41/1.12	
Common	3.33/1.16		4.46/.77		3.38/1.11		4.43/.81	
Intentions		.80		.61		.84		.57
Attend	2.2/1.23		3.18/1.46		2.3/1.25		3.22/1.39	
Join/maintain support	2.82/1.13		4.23/1.09		2.74/1.3		4.12/1.12	

Table 12. – Descriptive statistics

As a second step, an analysis of the full structural model for each sample was performed using the maximum likelihood method in SPSS Amos 28. The original EMSICA model (Thomas et al. 2009) was first tested on the non-activist sample. In both treatments, the initial model was not satisfactory (system change: $\chi2_{53} = 659.2$, $p < .001$, $\chi2$/df ratio = 12.44, RMSEA = .195 and NNFI(TLI) = .655; individual change: $\chi2_{53} = 559.0$, $p < .001$, $\chi2$/df ratio = 10.55, RMSEA = .180 and NNFI(TLI) = .686). The modification indices suggested adding four paths: three connecting emotions to personal efficacy, collective efficacy and social identification, and one linking attend to join. The modification indices also recommended allowing the covariance between no distance and common to vary. This slightly modified model provided a very good fit in both conditions (system change: $\chi2_{48} = 64.78$, $p > .05$, $\chi2$/df ratio = 1.35, RMSEA = .034 and NNFI(TLI) = .99; individual change: $\chi2_{48} = 70.30$, $p < .05$, $\chi2$/df ratio = 1.47, RMSEA = .04 and NNFI(TLI) = .99). The same analysis was then replicated for the sample of activists. The initial EMSICA model was once again unsatisfactory for either treatment (system change: $\chi2_{53} = 315.6$, $p < .001$, $\chi2$/df ratio = 5.95,

RMSEA = .129 and NNFI(TLI) = .618; individual change: χ^2_{53} = 265.7, p < .001, χ^2/df ratio = 5.01, RMSEA = .116 and NNFI(TLI) = .688). However, the model was satisfactory in both conditions when the paths added in the non-activist sample were also included in the activist sample (system change: χ^2_{48} = 59.7, p > .05, χ^2/df ratio = 1.24, RMSEA = .029 and NNFI(TLI) = .981; individual change: χ^2_{48} = 85.33, p <. 001, χ^2/df ratio = 1.78, RMSEA = .051 and NNFI(TLI) = .940). Figure 4 depicts the results for the hypothesized paths across each sample's individual and system change conditions. There are two numbers in each path: the first shows the results for the individual change condition, and the second is for system change.
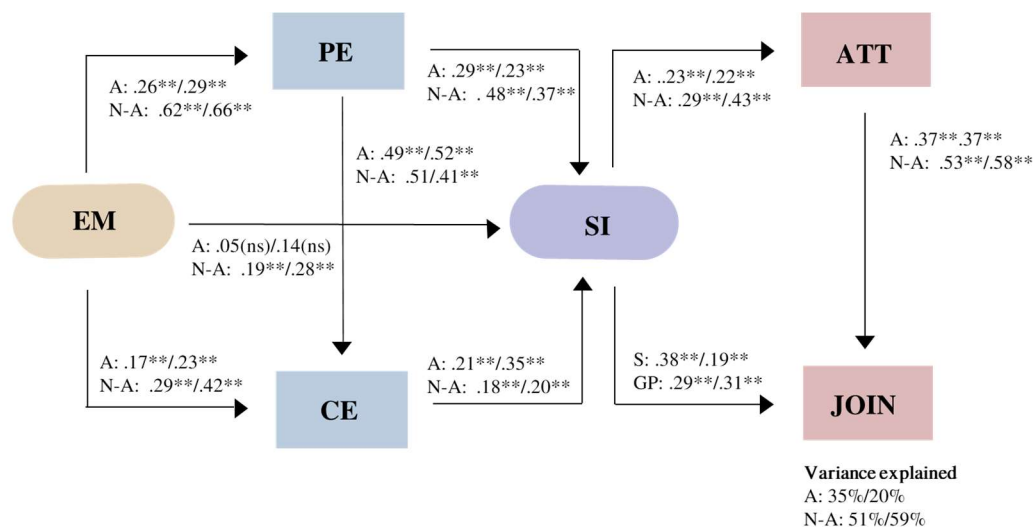
Note: ** = p < .05. A = activists, N-A = non-activists, EM = emotions, PE = personal efficacy, CE = collective efficacy, SI = social identification, ATT = attend protests and JOIN = join or maintain support for any organization aimed at pressuring individuals to do more/pushing for system change and disrupting the status quo.

Figure 4. – Structural paths and multigroup analysis, activists and non-activists (individual change/system change)

As seen in Figure 4, the EMSICA model had a greater impact on predicting the intention to mobilize for system change than individual change among the sample of non-activists (59% versus 51%). However, among the sample of activists, EMSICA actually had lower predictive power in the system change condition relative to the individual one (20% versus 35%). In terms of potential differences in the structural pathways across the conditions, Figure 4 suggests that among the

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activists, the difference in predictive power across the conditions may be due to the roles of emotions and social identification being more important in the system change condition relative to the individual one. Among the non-activists, the difference in predictive power may be due to the direct effect of social identification on collective action intention being less important when mobilizing for system change relative to individual change.

In order to assess the statistical significance of these results, a multigroup analysis was performed on the samples of activists and non-activists. For the purpose of ensuring that the models were comparable across the two experimental treatments in both samples, the equivalence of the factorial measurement was verified across the treatments (i.e. individual and system change). This was achieved by performing configural and metric invariance tests on the full sample of activists (n = 598) and non-activists (n = 595) (see Tables 36–37 in Appendix C). Configural invariance, which assessed whether the patterns of fixed and free parameters were the same in both treatments, was observed in both samples (activists: $\chi2_{96}$ = 145.06, p < .001, χ2/df ratio = 1.51, RMSEA = .029 and NNFI(TLI) = .96; non-activists: $\chi2_{96}$ = 135.10, p < .01, χ2/df ratio = 1.41, RMSEA = .026 and NNFI(TLI) = .99). Metric invariance was also observed, confirming the statistical invariance of the factor structure among the two treatments (activists: $\Delta X^2(6) = 10.51$ and p > .10; non-activists: $\Delta X^2(6) = 5.45$ and p > .10). These preliminary analyses confirmed that the model could be meaningfully compared across the two experimental treatments in both samples.

Next, structural invariance tests were conducted to evaluate the equivalence of the structure model (i.e. whether the structural paths were the same across the conditions). Constraining the paths of both treatments at the same time did not result in a significant delta chi-squared in either sample (activists: $\Delta X^2(9) = 14.20$ and p > .05; non-activists: $\Delta X^2(9) = 6.02$ and p > .05). The regression weights for each structural path were statistically invariant across the treatments, indicating that none of the differences in the structural paths between the individual and system change conditions shown in Figure 4 was statistically significant (Table 13).

	Individual change	System change	ΔX^2	Δdf	p
Activists					
EM → PE	.26**	.29**	04	1	>.05
EM → CE	.17**	.33**	.32	1	>.05
EM → SI	.05(ns)	.12(ns)	.33	1	>.05
PE → SI	.29**	.23**	.49	1	>.05
CE → SI	.22**	.36**	.87	1	>.05
PE → CE	.49**	.52**	.46	1	>.05
SI → ATT	.24**	.22**	.04	1	>.05
SI → JOIN	.38**	.19**	3.45	1	>.05
ATT → JOIN	.37**	.37**	.14	1	>.05
Non-activists					
EM → PE	.62**	.66**	.77	1	>.05
EM → CE	.29**	.42**	3.08	1	>.05
EM → SI	.19**	.27**	1.00	1	>.05
PE → SI	.48**	.38**	.98	1	>.05
CE → SI	.19**	.20**	.08	1	>.05
PE → CE	.51**	.41**	1.92	1	>.05
SI → ATT	.44**	.43**	.01	1	>.05
SI → JOIN	.29**	.32**	.12	1	>.05
ATT → JOIN	.53**	.58**	.41	1	>.05

***p < .001, **p < .01 and *p < .05.

Table 13. – Structural paths, multigroup analysis and structural invariance

Overall, these results only partially support the first hypothesis that EMSICA would play an important role in predicting the intention to engage in system-challenging collective action (explaining between 30% and 40% of the variation in collective action intention). The EMSICA model explained an important share of the variance in the intention to participate in system-challenging collective action among non-activists (59%), but considerably less among activists (20%). As the comparison with the individual change condition shows, the lower power of EMSICA among activists does not seem to be solely driven by the audience itself, but also by the specific collective action goal. The model explained nearly two times more variance in the intention to mobilize for individual change than system change among activists (35% vs 20%).

A possible explanation for the low predictive power of social identity in the system change condition among activists may be that activists' values and beliefs are generally aligned with system change (e.g. they have strong post-materialist values, believe that system change is impactful), which might render the 'encapsulation' role of social identity less important, as predicted by the second hypothesis. The results of the first test are consistent with this hypothesis. About half (49%) of the respondents in the activist sample selected system change as one of the most impactful solutions, whereas only a third selected it in the non-activist sample (30%). EMSICA played a greater role in the non-activist sample (explaining 59% of the variance in collective action), in which most were not aligned with the goal of system change (70%), and a smaller role in the activist sample (explaining 20% of the variance in collective action), in which fewer were not aligned with the goal (51%).

To further examine this hypothesis, the second test assesses the predictive power of EMSICA across diverse audiences of activists and non-activists segmented based on their values and beliefs.

Second test: testing EMSICA among diverse audiences of activists and non-activists

Before replicating the analysis across audiences with varying values and beliefs, the audience segmentation results are presented. Among Greenpeace's existing supporters, the analysis revealed three unique audiences: Optimistic environmentalists (35%), Realist climate advocates (38%) and Concerned supporters (27%). The Optimistic environmentalists represented about one-third (35%) of the Greenpeace supporters. The individuals in this segment experienced strong feelings of moral outrage about the consequences of climate change, had strong efficacy beliefs and were highly sympathetic toward Greenpeace. Of all the groups, they identified most strongly with Greenpeace. Nearly all of them felt a sense of solidarity with the organization (31% agreed and 61% strongly agreed), and most of them felt committed to it (50% strongly agreed and 26% somewhat agreed). The people in this group were very strongly oriented toward post-materialist values. A majority (64%) selected five or six items on the post-materialism scale, ranging from zero (materialist) to six (post-materialist), and nearly all of them (95%) said it was more important

to protect the environment than to promote economic growth even at the expense of jobs and the economy.

About over quarter of activists fell into the Realist climate advocates category (28%). The individuals in this segment had strong feelings about climate change but had considerably weaker efficacy beliefs compared with the Optimistic environmentalists. For instance, few Realist climate advocates strongly agreed that Greenpeace could help protect us from climate change (45% versus 65%) or that their own contributions could have an impact (21% versus 39%). The Realist climate advocates also differed from the Optimistic environmentalists in their level of identification with Greenpeace. Relatively fewer expressed solidarity with the organization (46% versus 61% strongly agreed) or said they felt committed to it (19% versus 26% strongly agreed). Like the Optimistic environmentalists, the Realist climate advocates were oriented toward post-materialism values, with more than two-thirds (67%) of them selecting more than four items on the post-materialism index, and almost all (97%) prioritizing environmental protection over economic growth.

Meanwhile, the Concerned supporters (27%) had less strong feelings about climate change, and most of them were unsure about the impact of their own contributions. They were also less likely to identify with Greenpeace compared with the Optimistic environmentalists and Realist climate advocates. Although a majority of the Concerned supporters expressed some level of solidarity with the organization (54% agreed and 10% strongly agreed), fewer of them felt committed to it (31% agreed and 5% strongly agreed). Similar to the two other activist audiences, most Concerned supporters expressed an affinity toward post-materialist values (59% selected more than four items), and almost nine out of 10 agreed that protecting the environment was more important than promoting economic growth (87%).

Using the same segmentation criteria, the analysis pointed to three audiences within the general population: Motivated (39%), Concerned (47%) and Doubtful (14%). The Motivated Canadians represented about a third of the Canadian population (39%). Out of all the segments identified within the sample of non-activists, the individuals in this segment experienced the strongest moral outrage about the consequences of climate change, had the strongest efficacy beliefs and

expressed the greatest level of identification with Greenpeace. While the Motivated Canadians felt less strongly about climate change than the Optimistic or Realist supporters, they were more likely to strongly agree that their contributions could have an impact (51%) compared with both the Optimistic environmentalists (39%) and Realist climate advocates (21%). Moreover, they were more likely than the Realist climate advocates (92% versus 87%) and nearly equally as likely as the Optimistic environmentalists (92% versus 97%) to feel hopeful that Greenpeace could help protect them from climate change. The Motivated Canadians, however, were significantly less inclined to embrace post-materialist values compared with the sample of activists in general, with only about one in five (19%) choosing more than four items from the post-materialist scale. Despite this tendency toward more materialist values, a large majority of the Motivated Canadians viewed protecting the environment as more important than promoting economic growth (81%).

The Concerned Canadians represented about one in two Canadians (47%). Compared with the Motivated Canadians, the individuals in this group experienced weaker moral outrage and efficacy beliefs about climate change. Like the Concerned supporters, most individuals in this segment believed that Greenpeace could help protect them from climate change, but a majority of them were unsure about the impact of their own contributions. Relatively few Concerned Canadians felt a sense of solidarity with Greenpeace (29% agreed and 3% strongly agreed), and very few of them felt committed (15% agreed and 2% strongly agreed). Only 10% of them selected five or six items on the post-materialism scale, and only half of them (54%) said it was more important to protect the environment than to promote economic growth.

Finally, Doubtful Canadians represented the smallest segment within the Canadian population (14%). The individuals in this segment were not very concerned about climate change, had very low efficacy beliefs and were mostly unsympathetic toward the organization. Barely any of them (2%) selected five or six items on the post-materialism scale. As opposed to all the other segments in which the majority favoured environmental protection over economic growth, most Doubtful Canadians (55%) said that promoting economic growth was more important than preserving the environment even if the environment suffers.

According to the audience segmentation analysis, among the non-activists, the gap between the preexisting values and beliefs of the audience and the collective action goal of system change should be wider among the Doubtful Canadians (77% not aligned), followed by the Concerned (71% not aligned) and Motivated Canadians (66% not aligned). Among the sample of activists, this gap should be wider for the Concerned supporters (54% not aligned), followed by the Optimistic environmentalists (51% not aligned) and Realist climate advocates (49% not aligned). Accordingly, to confirm the second hypothesis, EMSICA should have the greatest predictive power among the Doubtful Canadians and the lowest among the Realist climate advocates. Moreover, to the extent that the activists were less heterogenous than the non-activists in terms of post-materialist values and views about environmental protection and economic growth, the predictive power of EMSICA for the system change condition should vary more across the audiences of non-activists than activists.

To further test the second hypothesis, the multigroup analysis presented in the first test was replicated for each subsample of non-activists (i.e. Motivated, Concerned and Doubtful Canadians) and activists (i.e. Optimistic environmentalists, Realist climate advocates and Concerned supporters). Configural and metric invariance tests were replicated for each subsample (see Table 38 in Appendix C). The results confirmed that the model could be meaningfully compared across the six audiences. Figure 5 illustrates the hypothesized paths among the three audiences of non-activists. Each path consists of two numbers: the first for individual change and the second for system change. The bolded parameters indicate statistically significant differences between the structural paths across the individual and system change conditions. The details for each audience are provided in Appendix C (Table 39).

PE

M: **.02/.42****
C: .03/.24**
D: .05/.05

M: .30**/.39**
C: .30**/.15
D: .32**/.60**

M: .51**/.26**
C: .16/.32**
D: .39**/.74**

ATT

M: .51**/.53**
C: .64**/.70**
D: **.83******/.62****

M: **.39******/.26****
C: .19**/.30**
D: .18/.32**

EM

SI

M: .02/-.11
C: .14/.14
D: **-.34******/.47****

M: .02/.01
C: .03/.00
D: .05/.30

M: .12/.10
C: .14/.23**
D: -.29/-.27

M: .07/.29**
C: .12/.11
D: .06/.35**

CE

JOIN

Variance explained
M: 40%/44%
C: 45%/55%
D: 71%/82%
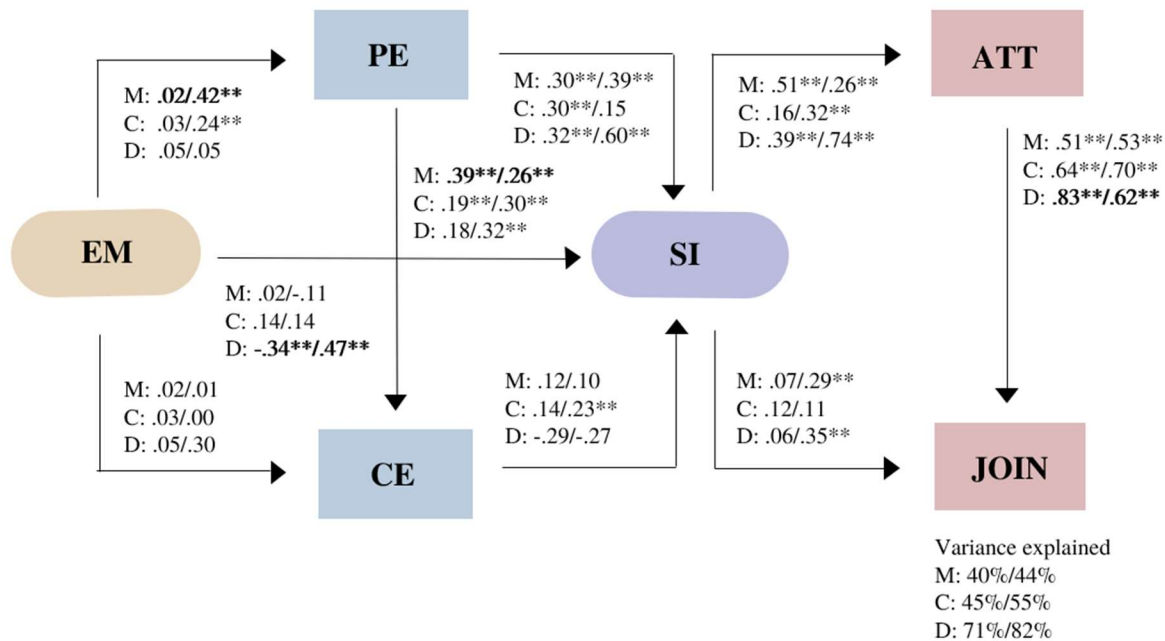
Note: ** = p < .05. The bolded parameters are significantly different from each other across the experimental treatments. A = activists, N-A = non-activists, EM = emotions, PE = personal efficacy, CE = collective efficacy, SI = social identification, ATT = attend protests and JOIN = join or maintain support for any organization aimed at pressuring individuals to do more/pushing for system change and disrupting the status quo.

Figure 5. – Structural paths and multigroup analysis, non-activist audiences (individual

change/system change)

As predicted by the second hypothesis, the EMSICA model performed significantly better when the audience's preexisting values and beliefs were *not* aligned with the goal of system change. The model explained 82% of the variance in the system-challenging collective action intentions among the Doubtful Canadians – those least aligned with system change. By contrast, the model explained 55% and 45% of the variance in collective action intentions among the Concerned and Motivated Canadians, respectively. In sum, the discrepancy between preexisting values and beliefs and system change was larger for the Doubtful group, followed by the Concerned and Motivated, and the EMSICA model accounted for the greatest share of variance in collective action intentions for the Doubtful (82%), followed by the Concerned (55%) and Motivated (45%).

Interestingly, aside from having a negative effect on social identification among the Doubtful Canadians, emotions played no role whatsoever in the individual change condition. In the system change condition, however, emotions had a positive indirect effect on collective action intentions among the Doubtful (through social identification, b = .47) and a positive indirect effect on social identification through personal efficacy among the Concerned and Motivated Canadians. Structural invariance tests (Table 39 in Appendix C) revealed four statistically different structural paths between the individual change and the system change conditions: among the Doubtful Canadians, the path from emotions to social identification (.47 versus –.34) and from attend to join (.62 versus .83), and among the Motivated Canadians, the path from emotions to personal efficacy (.42 versus –.02) and from personal to collective efficacy (.26 versus .39).

Figure 6 illustrates the hypothesized paths among the three audiences of activists. Providing additional support for the second hypothesis, the EMSICA model explained the greatest share of variance in system-challenging collective action intentions among the Concerned supporters (21%), followed by the Optimistic environmentalists (19%) and Realist climate advocates (12%). In line with the greater heterogeneity in views about environmental protection and post-materialist values among the non-activists than the activists, the variance across the audiences varied more among the non-activists (ranging from 44% to 82%) than among the activists (from 12% to 21%). The greater role of emotions in the system change condition among the non-activists was not observed among any of the three activist audiences. In fact, among the Optimistic environmentalists and Realist climate advocates, there was no link between emotions or efficacy beliefs and system-challenging collective action. Social identification increased the intention to attend protests or public marches, but this effect was not driven by either efficacy beliefs or emotions. In the system change condition, social identification predicted the intention to participate in protests or public marches – a radical type of action – but not the intention to join or maintain support for environmental organizations – a more conventional, less radical type of action. However, in the individual change condition, social identity predicted the intention to join or maintain support but not the intention to participate in protests or public marches.
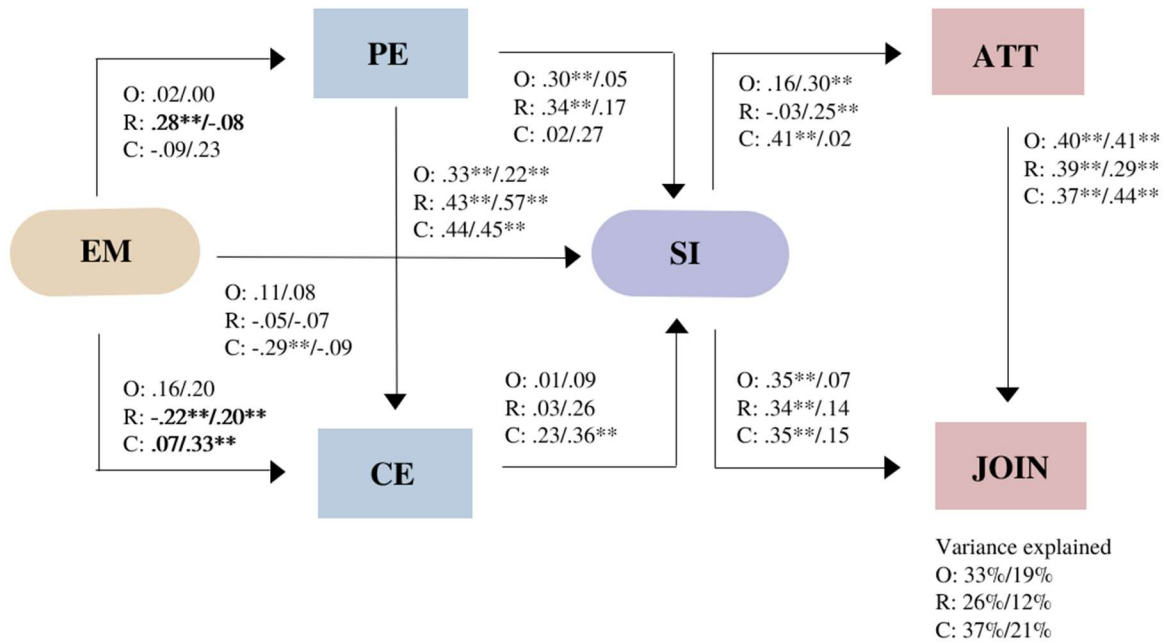
Note: ** = p < .05 and (ns) = not significant. The bolded parameters are significantly different from each other across the experimental treatments. A = activists, N-A = non-activists, EM = emotions, PE = personal efficacy, CE = collective efficacy, SI = social identification, ATT = attend protests and JOIN = join or maintain support for any organization aimed at pressuring individuals to do more/pushing for system change and disrupting the status quo.

Figure 6. – Structural paths and multigroup analysis, activist audiences (individual change/system change)

Third test: testing EMSICA among respondents whose views are aligned with the goal of collective action versus not aligned

As a final test, the predictive power of EMSICA was examined and compared across respondents whose views were aligned with the goal of collective action versus not, in each of the four experimental groups. Overall, this test involved 16 different models. The fit indices for each model can be found in Appendix C (Table 40).

As Table 14 shows, EMSICA systematically explained a greater share of variance in the intentions to mobilize for a specific goal among the respondents who were precisely *not* oriented to that

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goal. For instance, the EMSICA model explained 62% of the variance in the intentions to mobilize for individual change among the activists who did not select individual change among the three most impactful solutions relative to only 31% among those who did. Although the differences were smaller, similar patterns were observed for political change (22% versus 18%) and system change (24% versus 16%). Given the very few respondents who did not agree that climate change was part of their core moral norms and values among the sample of activists, the sample size was too small to assess the predictive power of EMSICA among those not aligned with the goal of environmental protection (i.e. control group). Among the sample of non-activists, EMSICA explained 80% of the variance in the intentions to mobilize for individual change among those who did not select lifestyle change as one of the most impactful solutions compared with 49% among those who did. Differences were also found between those who selected the corresponding goal as one of the most impactful solutions and those who did not in the political change condition (48% versus 78%) and the system change condition (41% versus 62%). In the control group, the model explained 38% of the variance in collective action among those who agreed that climate change was part of their core moral norms of values and 44% among those who did not.

	Not aligned with the goal	Aligned with the goal
Activists		
Environmental protection	-	15%
Individual change	62%	31%
Political change	22%	18%
System change	24%	16%
Non-activists		
Environmental protection	44%	38%
Individual change	80%	49%
Political change	78%	48%

Table 14. – Predictive power of EMSICA across the treatment conditions (aligned with the goal versus not aligned)

Discussion

Summary of results and implications

This study provides empirical evidence that social identity can play a role in predicting the intentions to participate in system-challenging collective action and emphasizes the importance of integrating notions of audiences and group goals into existing social identity models of collective action.

The results only partially supported the first hypothesis that EMSICA would play an important role in predicting the intention to engage in system challenging collective action (explaining between 30% and 40% of the variation in collective action intentions). The EMSICA model explained an important share of the variance in the intention to participate in system-challenging collective action among non-activists (59%), but considerably less among activists (20%).

Overall, the EMSICA model explained an important share of the variance in the intention to participate in system-challenging collective action among the non-activists (59%), but considerably less among the activists (20%). Though the difference was smaller, the model also explained a greater share of the variance in the intention to mobilize for individual change among the non-activists (51%) than the activists (35%). The power of EMSICA in predicting collective action intention in the individual change condition was broadly consistent with previous meta-analyses showing that social identity explains, on average, between 31% and 40% of the variance in intentions to participate in pro-environmental *collective* action (Schulte et al. 2020). However, to the extent that this study assessed the predictive power of EMSICA, which includes emotions, efficacy and social identification, and that Schulte et al.'s findings examined the link between pro-environmental social identity and pro-environmental action only, the findings of the present study were not directly comparable to those reported by Schulte et al. (2020).

In light of Schulte et al.'s (2020) finding that social identity is a better predictor of collective behaviours than individual behaviours, the first hypothesis posited that social identity would also be important when mobilizing for system change. The findings only partially supported this hypothesis. Although EMSICA was a powerful motivator for system change mobilization among

the non-activists, its low predictability in explaining the intention to mobilize for system change among the sample of activists brought potential nuance to Barth et al.'s assertion that social identity can play an important role in mobilizing with the "goal to change a system fundamentally" (2021, p. 4). On the one hand, it is true that large-scale, repeated, concerted collective action in support of the environment can fundamentally alter the system without being explicitly framed around that goal, and in this sense, all collective action can be perceived as inherently system-challenging. On the other hand, in the context of climate change, collective action can serve different goals, ranging from relatively moderate ones, like protecting the environment or pressing individuals and the government to take action to combat climate change, to more radical ones, like disrupting the status quo and explicitly pushing for system change. As the results from this study illustrate, integrating notions of group goals into existing collective action models can be important, as different group goals may entail different social-psychological processes, thus influencing collective action differently.

In fact, this study presents multiple pieces of evidence to suggest that social identity's predictive power increases as the gap between the preexisting values of the audience and the collective action goal widens. In line with the second hypothesis, the EMSICA model performed significantly better when the audience's preexisting values and beliefs were *not* aligned with the goal of collective action. For instance, among the non-activists, the level of group-based dissonance (i.e. the discrepancy between preexisting values and beliefs and system change) was larger for the Doubtful segment, followed by the Concerned and Motivated, and the EMSICA model accounted for the greatest share of variance in the collective action intentions of the Doubtful (82%), followed by the Concerned (55%) and Motivated (45%). This expectation was also met among the sample of activists, and it was further supported when comparing the predictive power of EMSICA among individuals with different views about environmental solutions (including all experimental treatments). These findings were in line with research conducted outside the climate change context, which has shown that social identity influences behaviour mostly through reducing dissonance (Powers 1975; Burke 1980; 1989; 1991; Hogg et al. 1995). They were also broadly consistent with previous research in psychology, which has long pointed to the role of values, ideologies and worldviews in shaping how different individuals interpret, react and act upon new

information (Kahan 2012; Kunh and Lao 1996; Lord et al. 1979). However, few studies have explored the connection between audience segmentation and other influential theories in environmental psychology. Aside from Pozzi et al.'s study (2022), which suggested that EMSICA could play a larger role in predicting collective action intentions among non-activists than activists, little research has compared the predictive power of social identity across diverse audiences. This study proposes that the role of social identity in explaining participation in the environmental movement depends on the extent to which the audience's preexisting values and beliefs align or not with the goal of collective action.

Contributions

This study moves beyond the previous works in three important ways. First, while scholars have pointed to the potentially important role of social identity in mobilizing groups with the "goal to change a system fundamentally" (Barth et al. 2021, 4), the social-psychological processes that lead individuals to take part in collective action explicitly aimed at changing the system had not yet been examined empirically. This study offers an empirical test for the role of social identity in predicting the intention to participate in system-challenging collective action.

Second, most previous studies comparing the role of social identity across contexts and audiences have tended to be correlational in nature (e.g. Pozzi et al. 2022; Schulte et al. 2020). By contrast, the present research offers an experimental test to assess the role of social identity in predicting the intention to mobilize in support of different group goals. In so doing, it provides new insights into the causal relationships between the key constructs of EMSICA and different collective action goals.

Finally, this study extends the previous research by examining how these relationships play out among diverse values-based audiences by presenting multiple pieces of evidence suggesting that the role of social identity depends on the extent to which the preexisting values and beliefs of the audience align (or not) with the goal of collective action. As Barth et al. pointed out (2021), to contribute to the major societal transformation required to address the global climate crisis, approaches in environmental psychology "will need both a perspective focused on individual

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factors and a perspective focused on the collective factors" (p. 74). This study contributes to this effort by offering a fresh perspective on how individual and social conditions can interact and work together to foster environmental mobilization.

Limitations and future directions

Although this study offers several important contributions, it is limited in a number of ways. First, the sample of activists (i.e. Greenpeace Canada supporters) in this study is not representative of the population of environmental activists in Canada; therefore, the low power of social identity in predicting the intention to mobilize for system change among the sample of activists should be interpreted with caution. Future studies should consider a wider range of environmental identities, since Greenpeace represents only one of many environmental organizations dedicated to fighting climate change in Canada.

Second, while the results suggest that social identity models of collective action may be limited in their ability to explain activists' engagement, the study provides little insight into what other factors can motivate activists to participate in collective action. Future research can examine a wider range of potentially important factors, such as organizational ties and interpersonal social networks (Tindall 2002, 2015) while simultaneously integrating notions of group goals and values-based audiences.

Finally, these findings suggest that emotions, efficacy and social identification can be powerful motivators of collective action under certain conditions by highlighting how emotions and efficacy can serve as foundations for shared identities, especially among audiences that are not particularly involved in environmental issues. However, the extent to which these perceptions can be effectively enhanced through tailored communication strategies remains unclear. Future research should test different messages aimed at increasing feelings of moral outrage, efficacy beliefs and social identification among non-activists, as this can be expected to translate into action.

Chapter 5 – Conclusion

This dissertation opened up with the puzzling realization that increasing public awareness and addressing knowledge gaps is not sufficient to spur broad climate change engagement and may even undermine it in some circumstances. Exploring creative social-psychological approaches to engaging Canadians on the issue of climate change, this thesis fused insights from three key findings in social psychology and tested their implications for climate change communication and interventions in Canada. The first examined biased assimilation theory and the importance of integrating consideration of audiences' preexisting values and beliefs into the communication process. The cultural and group-identity underpinnings of climate change disagreements and the potential role social identity may play in motivating climate action were then explored in a separate empirical chapter. Finally, a third insight from social psychology about the cognitive and emotional challenges to communicating climate change and the potential of message framing in overcoming these challenges was examined.

Taken together, the three empirical chapters in this dissertation demonstrated that leveraging insights from social psychology can significantly improve climate change communication and interventions in Canada. The first article highlighted the importance of audience-based data in supporting climate research, policy and communication. The first and second articles emphasized the important role message framing may play in (de)motivating support for climate policy (first article) and climate action (second article). The third article demonstrated that social identity can be a powerful predictor of collective action intention and emphasized the importance of integrating notions of audiences and group goals into existing social identity models of collective action.

Summary

First article

Understanding how different groups of people think, feel and act with respect to climate change is crucial for knowing one's audience – the first cardinal rule of communication. The first article, "The Five Canadas of Climate Change: using audience segmentation to inform communication on climate policy" (Chapter 2), examined how unique audience segments within the Canadian population think and act toward climate change and explored whether and how the level of audience engagement moderates the effect of various messages on support for climate policy. Based on a random probability sample of Canadian residents (N = 1207) conducted in October 2017, this study identified five distinct audiences with varying attitudes, perceptions and behaviours regarding climate change: Alarmed (25%), Concerned (45%), Disengaged (5%), Doubtful (17%) and Dismissive (8%). By exploring how each segment responded to different messages about carbon pricing in Canada, this study found that emphasis framing affected the Five Canadas in very different and sometimes unintended ways. The "invest in solutions" and "relative price" messages had negative impacts on attitudes toward carbon taxes among the Alarmed when policy stringency was low and a positive impact on attitudes among the Concerned when policy stringency was higher. While all the messages were effective with the Concerned, "relative price" was the only message positively affecting both the Concerned and the Doubtful.

This article advanced the previous works by offering context-relevant audience insights to inform communication for specific audiences in Canada while further laying the groundwork for future research aimed at tailoring messages to specific climate change audiences. These findings are important, as they show that one-size-fits-all communication strategies are likely to face important challenges and can mobilize some segments of the public while potentially alienating others. This further suggests that the government and communicators should consider the credibility of messages carefully so as not to alienate more sophisticated and engaged audiences as they attempt to secure the support of less engaged ones. Overall, this article contributed to the dissertation's overarching argument by highlighting the importance of audience-based data

in supporting climate research, policy and communication and illustrating the role message framing can play in motivating climate policy support.

Second article

Research in social psychology suggests that messages emphasizing climate change's dire consequences are likely to increase skepticism and feelings of helplessness, causing people to disengage further from the issue. In the climate change communication field, however, there is no clear scientific consensus as to whether fear-evoking communications are beneficial or detrimental to motivating climate action. The second article, "Code red for humanity or time for broad collective action? Exploring the role of positive and negative messaging in (de)motivating climate action" (Chapter 3), examined how negative and positive messaging influence emotional arousal and climate action across unique audiences within Canada's environmental movement. Leveraging data drawn from a sample of environmental group supporters in Canada (N = 308), this article identified four unique audiences within the supporters of Canada's environmental movement who vary in their levels of engagement and radicalism: active radicals (26% in 2019 and 34% in 2021), active reformers (43% in 2019 and 44% in 2021), moderate reformers (25% in 2019 and 17% in 2021) and passive pragmatists (6% in 2019 and 5% in 2021). Using an experiment embedded in the second wave of the survey, the study further tested whether negative (versus positive) messaging had a direct or indirect effect on activism intention (i.e. "would you take a minute to email your federal member of parliament?") and observed activism (i.e. send a letter to the member of parliament). Overall, the negative messaging condition had a negative direct effect on observed activism among the sample as a whole, which decreased the odds of sending the letter by about 54%, and a positive indirect effect through worry among the active radicals only, which increased the odds of sending the letter by 31% among this more engaged and radical audience segment.

This article contributes to the debate on fear appeal effectiveness in climate change communication by showing that negative messaging can be less mobilizing than positive messaging even when meeting the conditions under which the literature suggests that fear appeals will be most effective. In demonstrating that the relationship between emotions and

climate action differs across audiences with varying levels of engagement and radicalism, this study further highlights the importance of taking audiences into account when developing persuasive appeals in climate change communication. These findings have important theoretical and practical implications. They suggest that while fear-based messages may be effective in the short term, they can become less so over time. Consequently, they highlight the need to revisit existing theories in climate change communication in light of potential "apocalypse fatigue" that may result from the repeated use of overlapping emergency frames. Moreover, these findings contributed to the dissertation's argument by showing that message framing can play an important role in (de)motivating climate action and highlighting how communicating with people in a way that inspires them through optimistic messaging can help overcome the cognitive and emotional barriers associated with climate change communication.

Third article

Although the environmental psychology field has been arguing for better integration of the collective dimension of climate action (Bamberg et al. 2018; Barth et al. 2021; Schulte et al. 2020), notably highlighting the important role social identity may play in motivating collective action, little research has explored how individual and social factors interact and work together to foster collective environmental action. The third article, "Mobilizing for system change: integrating notions of audiences and group goals into existing social identity models of collective action" (Chapter 4), examined the role of social identity in predicting the intention to mobilize for system change across diverse audiences of activists and non-activists. Drawing on two online surveys conducted in 2021 and 2022 with samples of Greenpeace Canada supporters (N = 1,394) and the Canadian public (N = 1,514), this analysis revealed three unique audiences within the Greenpeace supporters – Optimistic environmentalists (35%), Realist climate advocates (38%) and Concerned supporters (27%) – and three audiences within the general population – Motivated (39%), Concerned (47%) and Doubtful (14%) Canadians. Overall, the EMSICA model explained an important share of the variance in the intention to participate in system-challenging collective action among the non-activists (59%), but considerably less among the activists (20%). This study presented multiple pieces of evidence to suggest that social identity's predictive power increases as the gap between the preexisting values of the audience and the collective action goal widens.

In line with the second hypothesis, the EMSICA model performed significantly better when the audience's preexisting values and beliefs were *not* aligned with the goal of collective action. Among the non-activists, the level of group-based dissonance (i.e., the discrepancy between preexisting values and beliefs and system change) was larger for the Doubtful segment, followed by the Concerned and Motivated, and the EMSICA model accounted for the greatest share of variance in the collective action intentions of the Doubtful (82%), followed by the Concerned (55%) and Motivated (45%). This expectation was also met among the sample of activists, and it was further supported when comparing the predictive power of EMSICA among respondents whose views were aligned with the goal of collective action versus not.

This study moved beyond the previous research by offering an empirical test for the role of social identity in predicting the intention to mobilize, specifically for system change, while providing new insights into the causal relationships between the key constructs of EMSICA and different collective action goals. These findings highlighted the potential and limitations of social identity in predicting collective action while pointing out the importance of integrating notions of audiences and group goals into existing social identity models of collective action. These findings are important, as they suggest that harnessing the motivational power of emotions, efficacy beliefs and social identification can be an effective strategy to engage non-activist audiences in collective climate action. This article contributed to the overall argument of the dissertation by showing that social identity can be a powerful predictor of collective action intention while emphasizing the importance of integrating notions of audiences and group goals into existing social identity models of collective action.

Overall dissertation

Taken together, this dissertation demonstrated that leveraging insights from social psychology can significantly improve climate change communication and interventions. In doing so, it contributes to filling two important gaps in the existing literature.

First, despite the implicit and explicit aims of audience segmentation studies to communicate with specific audiences more effectively through tailored messages, the effect of message framing across audiences has remained largely understudied to date, especially in the Canadian

context where no study had been published about climate change audience segments prior to the research presented in this dissertation. This dissertation can help better understand the heterogeneity in attitudes and views toward climate change in Canada and identify potential promises and pitfalls that may arise when communicating to a wide range of differently engaged audiences.

Second, although the environmental psychology field has been arguing for better integration of the collective dimension of climate action (Bamberg et al. 2018; Barth et al. 2021; Schulte et al. 2020), notably highlighting the important role social identities play in collective action, little research has explored how individual and social factors interact and work together to facilitate collective environmental action. By testing the role of EMSICA in predicting collective action among diverse audiences, this dissertation has provided insights into how audience segmentation can be integrated into other influential theories of social psychology. As Barth et al. (2021) pointed out, to contribute to the major societal transformation required to address the global climate crisis, approaches in environmental psychology "will need both a perspective focused on individual factors and a perspective focused on the collective factors" (p. 74). This dissertation contributes to this effort by offering a fresh perspective on how individual and social conditions can interact and work together to foster environmental mobilization.

These findings have important implications for climate research, policy and communication. Overall, they suggest that climate change communication and interventions are likely to fail in the absence of context-relevant, detailed, empirical, audience-based data. As this dissertation has demonstrated, leveraging insights from social psychology can help overcome many of the challenges associated with engaging the public on climate change.

The main findings, contributions and implications of the dissertation are summarized in Table 17 below.

	Findings	Contributions	Implications	Thesis arguments
First article	The Canadian population can be divided into five distinct audiences who may react to message framing in very different and sometimes unintended ways.	The first article offers context-relevant audience insights to inform communication for specific audiences and provides a starting point for future work aimed at developing tailored climate change messages.	One-size-fits-all communication and interventions are likely to face important challenges, as they can mobilize some segments of the public while potentially alienating others.	Audience-based data are important in supporting climate research, policy and communication. Message framing can play an important role in (de)motivating climate policy support.
Second article	Positive messages about climate change can be more mobilizing than negative messaging even when the message is directed toward relatively engaged audiences and followed by the opportunity to take specific, actionable and effective action.	The second article contributes to the debate on fear appeals in climate change communication by showing that negative appeals can be less mobilizing than positive ones even under conditions where the literature suggests that they should be most effective.	Fear-based messages may be effective in the short-term but can become less so as the context changes, highlighting the need to revisit the existing theories in climate change communication in light of potential "apocalypse fatigue."	Message framing can play an important role in (de)motivating climate action.

Third article	The encapsulation model of social identity in collective action can play a large role in predicting collective action, though the model performs better when the audience's preexisting values and beliefs are *not* aligned with the goal of collective action.	The third article offers an empirical test for the role of social identity in predicting the intention to participate in system-challenging collective action across contexts and audiences.	Harnessing the motivational power of emotions, efficacy beliefs and social identification can be an effective strategy to engage non-activists in collective climate action; however, it may have limited impact on activists.	Social identity can be a powerful predictor of collective action intention, though it may be important to integrate notions of audiences and group goals into existing social identity models of collective action
Overall dissertation	Audience-based data are important for supporting climate research, policy and communication. Framing can play an important role in motivating climate action and policy support. Social identity can be a powerful predictor of collective action.	The overall dissertation examines the effect of climate change communication and interventions on specific audience segments and shows how audience segmentation can be integrated into other influential theories in social psychology.	Climate change communication and interventions are likely to fail in the absence of context-relevant, detailed, empirical, audience-based data.	Leveraging insights from social psychology can significantly improve climate change communication and interventions in Canada.

Table 15. – Summary of findings, contributions and implications

Limitations and future research

Although this dissertation makes substantial theoretical and practical contributions, it has multiple limitations as well. Each empirical article has its own limitations, which are discussed in detail in each chapter. This section discusses the limitations that are most relevant to the thesis' core argument that leveraging insights from social psychology can improve climate change communication and interventions in Canada. This argument was based on three key findings, as

illustrated in Table 15. The limitations and future research directions that relate to each of these findings are discussed below.

First, this dissertation highlighted the importance of audience-based data in informing climate research, policy and communication. However, it shed limited light on the evolution of climate opinions and audiences and the duration of framing effects. The first article (Chapter 2) presented a high-resolution portrait of Canadian attitudes toward climate change. Nevertheless, much has changed in terms of national and international discourses on climate change since 2017, which has likely changed the composition of the segments. The second article (Chapter 2) provided a dynamic picture of the distribution of audiences within Canada's environmental movement by documenting an increase in active radicals, the most active and radical segment among ENGO supporters in Canada, from 26% in 2019 to 34% in 2021. Meanwhile, the share of moderate reformers decreased during the same period (25% in 2019 and 17% in 2021), while the share of active reformers (43% in 2019 and 44% in 2021) and passive pragmatists (6% in 2019 and 5% in 2021) remained fairly constant. Though the two segmentations were not based on the same segmentation criteria, comparing the general public segments presented in the first (Chapter 2) and third (Chapter 4) articles suggested insights into how Canadian attitudes may have changed over time. In 2017 (Chapter 2), the two most concerned audiences, Alarmed (25%) and Concerned (45%), represented seven in 10 Canadians. By contrast, the two most concerned audiences in 2022, Motivated (39%) and Concerned (47%), represented almost nine in 10 Canadians (Chapter 4). Since these two segmentations were based on different segmentation criteria, however, it was impossible to assess precisely how the Five Canadas of Climate Change presented in the first article have evolved since 2017 and, in particular, whether and how much the share of the Alarmed group has increased since then. While this limitation is important, the audience segmentation approach used in the dissertation, the first of its kind for Canada, provides a baseline against which future research can be compared. By using longitudinal data, other studies can replicate these segmentations in order to provide a more dynamic picture of Canadian attitudes toward climate change.

Second, this thesis illustrated the importance of message framing in overcoming the cognitive and emotional challenges associated with communicating climate change. However, many

different frames can be used to engage audiences with climate change, and only a few were tested in this dissertation. Although the first two chapters' findings provided empirical evidence of the importance of tailoring communications to specific audiences, more research is required to understand how these audiences respond to a wider array of climate change messages. Furthermore, caution should be exercised in interpreting the null results for some framing effects reported in the first article, especially for the smallest audiences (i.e. Disengaged and Doubtful). Though this limitation is discussed in greater detail in the first article (Chapter 2), it is important to reiterate that null results among the Disengaged and Doubtful audiences may not necessarily reflect a lack of framing effects but also possibly a lack of statistical power. Further research with larger samples is required to assess the effects of different message frames across the full range of audiences, including those representing a marginal portion of the population. By utilizing data from social media platforms, for instance, future research can classify climate change audiences from larger samples. Aside from the way climate change messages are framed, received and responded to by specific audiences, several other aspects of communication were not considered in this analysis, which may have affected some of the results presented in this dissertation, such as the source of the message and the availability of competing frames. Further research is required to determine whether and how the source of the message influences the framing effects across audiences as well as how different segments respond to frames as they compete with one another.

Third, this dissertation demonstrated that social identity can be a powerful predictor of collective action and highlighted the importance of incorporating conceptions of audiences and group goals into existing social identity models of collective action. While these findings pointed to the motivational power of social identity – as well as emotions and efficacy beliefs, which social identity encapsulates – whether and the extent to which the key components of EMSICA can be effectively enhanced through tailored communication remains an open question. Other studies can test different messages that aim to increase moral outrage, efficacy beliefs and social identification, especially among non-activists, as this dissertation demonstrated that these factors can play an important role in motivating collective action among the general population.

Finally, there are some more general limitations that pertain to the methodology employed throughout the whole thesis. Important in this respect is the inherent limitations associated with self-report surveys (Kormos and Gifford 2014), the primary data collection method utilized in this dissertation. Self-report surveys are susceptible to various sources of bias, including social desirability bias, response bias, and recall bias (Koller, Pankowska, and Brick 2023) Participants may tend to provide responses that align with societal expectations or what they perceive as socially desirable, potentially resulting in an inaccurate representation of their genuine beliefs or behaviours. Additionally, individual responses can be influenced by memory constraints or subjective interpretation of survey questions. Despite diligent efforts to design survey instruments that mitigate these biases and enhance response validity, it is important to acknowledge that some degree of bias may persist and impact the results. Another significant limitation lies in the exclusive reliance on quantitative methods. While quantitative approaches, including survey experiments, were well-suited to assess the relative effectiveness of various communication strategies among different segments of the Canadian population – a key objective in this dissertation – the development of research questions and hypotheses primarily drew from existing scientific literature and the insights of researchers and practitioners in the field. This approach may have inadvertently overlooked certain concerns or themes that are prevalent in the broader public discourse, and which qualitative methods such as focus groups and in-depth interviews could have captured more effectively. Thus, there exists the possibility that the dissertation may not have fully explored certain significant themes that are of importance to the wider population, warranting consideration in future research endeavours.

Concluding remarks

Considering Canada's high level of greenhouse gas emissions and relatively friendly climate policy environment, it has the potential to become a world leader in combating climate change. However, as raising public awareness and filling knowledge gaps on climate issues have not been enough to drive action and policy support, scholars and communicators must find new creative ways to engage the public on climate change. In this context, the lack of detailed empirical data to guide climate policy and communicate effectively with diverse audiences is a major concern.

To help fill this gap, this dissertation examined how unique audience segments of the Canadian population think and act toward environmental issues and explored the potential of different communication and intervention strategies to motivate policy support and climate action across various audiences. As demonstrated, leveraging social psychology insights can significantly enhance climate change communication and interventions in Canada. In light of these findings, meeting Canadians where they are on climate change appears a promising strategy moving forward. It is hoped that these findings will pave the way for future audience-based research in addition to being useful and relevant to policymakers, communicators, practitioners and others seeking to increase climate change engagement in Canada and abroad.

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Appendix A

Measures of overall attitudes toward carbon taxes ($\propto$=.79)	Factor loadings (one-factor solution)
Willingness to pay the carbon tax	.56
Perceived effectiveness	.57
Perceived fairness	.60

Table 16. – Factor loadings for overall attitudes toward carbon taxes

		No message	Equal dividend	Invest in solutions	Relative price	P-values
2 cents/litre	Gender	.51/.50 (146)	.54/.50 (149)	.55/.50 (148)	.47/.50 (146)	.4515
	Education	2.67/1.23 (150)	2.64/1.27 (151)	2.60/1.27 (151)	2.56/1.32 (151)	.8862
	Age	54/18 (150)	55/17 (151)	56/17 (151)	52/18 (151)	.3113
11 cents/litre	Gender	.50/.50 (149)	.49/.50 (142)	.48/.50 (147)	.53/.50 (147)	.8158
	Education	2.75/1.20 (151)	2.66/1.28 (153)	2.47/1.24 (150)	2.75/1.24 (150)	.1717
	Age	54/17 (151)	54/19 (153)	54/19 (150)	53/18 (150)	.9432

Table 17. – Analysis of variance: demographic characteristics by experimental treatment

(mean/standard deviation, N in parentheses)

	Model 1	Model 2	Model 3
High price	.001	.004	.055
	(.016)	(.015)	(.049)
Doubtful		.178***	.197***
		(.03)	(.043)
Disengaged		.33***	.383***
		(.062)	(.078)
Concerned		.355***	.386***
		(.028)	(.039)
Alarmed		.424***	.453***
		(.03)	(.041)
High price*Doubtful			-.037
			(.06)
High price*Disengaged			-.133
			(.13)
High price*Concerned			-.059
			(.054)
High price*Alarmed			-.06
			(.057)
Ideology	.073***	.035***	.036***
	(.007)	(.006)	(.006)
Constant	.322***	.092***	.066
	(.018)	(.026)	(.036)
Obs.	929	929	929
Adjusted R-squared	0.116	0.298	0.303

*** p<.001, ** p<.01, * p<.05

Note: values are unstandardized regression coefficients with standard errors in parentheses. Constant represents intercepts of price level at 2 cents and Dismissive segment when segments are included. Attitudes toward carbon taxes range from 0 (highly unsupportive) to 1(highly supportive). Ideology is coded 0 (right), 1 (center right), 2 (center), 3 (center left) and 4 (left).

Table 18. – Price effect on attitudes toward carbon taxes, by audience segment

	Coef.	St.Err.	T-val	P-val	[95%	Conf]	Sig
Invest solutions/Relative price vs. Equal dividend	.064	.060	1.06	.290	-.055	.184	
Low price	.114	.069	1.64	.102	-.023	.251	
Invest solutions/Relative price * low price	-.162	.081	-2.01	.046	-.322	-.003	*
Ideology	.059	.015	4.02	.000	.030	.089	***
Constant	.310	.065	4.77	.000	.182	.437	***

Mean dependent var	.512	SD dependent var		.255
R-squared	.097	Number of obs		191.000
F-test	.992	Prob > F		.001
Akaike crit. (AIC)	.980	Bayesian crit. (BIC)		26.241

*** p<.001, ** p<.01, * p<.05

Table 19. – Effect of emphasis framing on perceptions of effectiveness among the Alarmed

	Al.	Conc.	Dis.	Doub.	Dism	Avg.
How confident are you that the average temperature on Earth is/is not increasing?						
Very confident it is increasing	87	54	28	12	13	51
Fairly confident it is increasing	12	42	19	56	12	33
Not too confident it is increasing	1	2	8	11	6	4
Not confident at all it is increasing	0	0	7	0	4	1
Not sure/refused	0	2	28	8	4	4
Not confident at all it is not increasing	0	0	6	0	4	1
Not too confident it is not increasing	0	0	1	4	9	1
Fairly confident it is not increasing	0	0	0	9	22	3
Very confident it is not increasing	0	0	3	1	26	2
Is the earth getting warmer mostly because of human activity such as burning fossil fuels, or mostly because of natural patterns in the earth's environment?						
Mostly human activity	86	68	26	25	0	58
Mostly natural patterns/a combination/not sure/refused	14	32	74	75	100	42

When do you think climate change will start to harm people living in Canada?

Climate change is already harming people in Canada	84	64	29	22	3	55
In 10 years	8	16	24	12	1	13
25 years	2	12	5	16	6	9
50 years	4	7	0	25	5	9
100 years	0	1	0	17	20	5
Never	1	0	5	4	55	5
Not sure/refused	2	1	38	4	10	4

How well informed do you believe yourself to be on the issue of climate change?

Very well informed	42	8	17	9	40	20
Somewhat informed	54	69	30	44	52	58
Not too informed	3	20	25	43	3	18
Not informed at all	0	3	25	3	4	3
Not sure/refused	0	0	3	1	1	0

How much do you think climate change will harm you personally?

A great deal	37	13	23	2	1	17
A moderate amount	42	43	24	21	2	35
Only a little	18	36	20	42	10	30
Not at all	3	6	18	35	84	17
Not sure/refused	0	2	16	0	3	2

Table 20. – Motivations, by audience segment

	Al.	Conc.	Dis.	Doubt.	Dism.	Avg.
How often do you discuss climate change with your family and friends?						
Very often	56	6	11	7	29	21
Occasionally	39	66	10	30	28	47
Rarely	5	25	24	41	28	23
Never	0	3	50	22	15	9
Not sure/refused	0	0	5	0	0	0
In the past year, have you, yourself… Written a letter, emailed or phoned a government official to urge them to take action on climate change?						
Yes	24	3	5	0	5	8

	Al.	Conc.	Dis.	Doub.	Dism.	Avg.
No	76	97	88	100	95	91
Not sure/refused	0	0	8	0	0	0
In the past year, have you, yourself… Deliberately bought or boycotted certain products based on their environmental impact?						
Yes	84	54	13	30	20	53
No	14	44	74	70	80	45
Not sure/refused	2	2	13	0	0	2
How important a factor is climate change and or climate policy in deciding which party gets your vote?						
A deciding factor	34	7	9	5	7	14
Somewhat a deciding factor	51	62	10	20	13	46
Neutral	6	18	10	26	4	15
Somewhat not a deciding factor	2	9	9	27	15	11
Not a deciding factor at all	5	3	12	20	60	11
Not sure/refused	2	2	51	1	1	4
Thinking specifically about the environmental movement, do you think of yourself as…						
An active participant in the environmental movement	36	13	15	10	6	18
Sympathetic towards the movement, but not active	54	68	18	31	13	51
Neutral	8	18	41	46	29	22
Unsympathetic towards the environmental movement	2	1	7	12	52	7
Not sure/refused	0	0	18	2	0	1

Table 21. – Behaviours, by audience segment

	Al.	Conc.	Dis.	Doub.	Dism.	Avg.
Who or which group should be primarily responsible for paying the financial costs associated with climate change?						
Governments	22	35	32	49	23	33
Corporations	39	35	16	22	17	32
Individual citizens	11	7	12	10	12	9
All of the above/combination	28	21	14	16	16	21
Other	0	0	2	0	2	0

None/not happening	0	0	0	0	27	2
Not sure/refused	0	1	24	3	4	2
Thinking now about companies that produce and distribute fossil fuels, do you support or oppose holding these companies accountable for a share of the financial costs of climate change?						
Strongly support	64	46	31	10	10	41
Somewhat support	24	43	0	60	23	38
Somewhat oppose	5	6	15	23	11	9
Strongly oppose	5	4	7	5	48	8
Not sure/refused	2	1	47	2	9	4

Table 22. – Preferred societal responses, by audience segment

	Al.	Conc.	Dis.	Doub.	Dism.	Avg.
Gender						
Male	43	47	43	49	84	49
Female	57	53	57	51	16	51
What is your mother tongue?						
French	25	27	19	24	10	24
English	65	59	60	65	76	63
Other	10	14	21	11	14	13
In which province do you currently live?						
Alberta	8	8	6	19	24	11
British Columbia	13	14	13	10	16	13
Prairies	6	4	8	11	13	7
Atlantic	9	7	15	7	5	7
Ontario	39	41	30	33	30	38
Quebec	25	27	28	21	12	24
If a federal election were held today, for which party are you most likely to vote?						
Liberal Party of Canada	36	36	21	23	8	31
Conservative Party of Canada	12	19	25	43	77	26
The New Democratic Party	12	13	0	8	0	10
The Bloc Québécois	4	3	2	1	0	3
Green Party of Canada	11	5	0	3	1	6
Another party	1	0	2	0	1	1
I would not vote	2	4	8	5	6	4
Not sure/refused	23	19	43	16	7	20

How interested are you in politics generally?						
Very interested	50	24	8	21	57	32
Somewhat interested	36	51	36	44	34	44
Not to interested	9	17	30	21	7	15
Not interested at all	4	8	21	14	2	8
Not sure/refused	0	0	6	0	0	0
Do you usually consider yourself as being at the left, the right or the centre of the political spectrum?						
Right	6	6	9	17	39	11
Center right	7	6	4	13	14	8
Centre	32	42	17	42	27	37
Centre left	16	13	2	4	4	11
Left	28	17	9	9	2	17
Not sure/refused	12	15	58	16	14	16
What is the highest level of education you have attained?						
Less than high school	3	4	28	9	5	6
High school graduate	16	19	30	24	17	19
Some college or tech school	8	12	15	16	16	12
College graduate	32	34	19	32	31	32
Graduate or professional degree	42	32	8	19	31	31

Table 23. – Demographics, by audience segmentation

Appendix B

Figure 7. – Negative messaging treatment
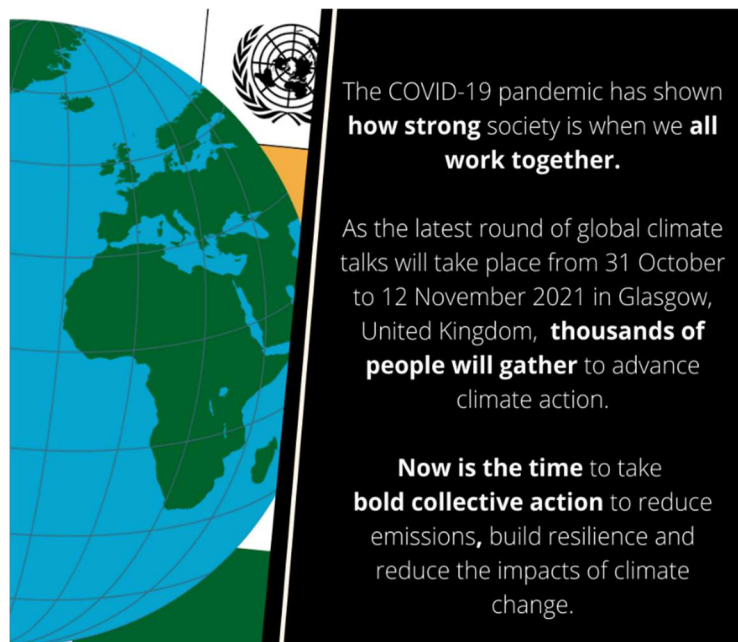
Figure 8. – Positive messaging treatment

Other negative emotions (∝=.81)	Factor loadings
Sadness	.41
Fear	.50
Upset	.57
Angry	.51

Hope (∝=.89)	Factor loadings
Hope	.71
Optimism	.71

Table 24. – Factor loadings (other negative emotions and hope)

	Model 1 DV: sadness	**Model 2** DV: upset	**Model 3** DV: fear	**Model 4** DV: anger	**Model 5** DV: observed activism
Constant	-.078	-.108*	-.321**	-.118	.118
Neg. mess.	-.015	.004	.619***	.118	-.638+
Sadness			.		-.067
Upset					-.161
Fear					-.019
Anger					-.451

*p<0.05; **p<0.01; ***p<0.001 + p=0.055

Table 25. – Summary of direct and indirect effect of negative and positive messaging on observed activism (PROCESS model 4 – discrete negative emotions)

	Model 1 DV: worry	**Model 2** DV: hope	**Model 3** DV: observed activism
Active radicals			
Constant	-.207*	.206*	.576*
Neg. messaging	.416*	-.415**	-.653*
Worry			.300
Hope			.287
Worry X act ref			-.415
Hope X act ref			-.223
Moderate reformers			
Constant	-.207*	.206*	.485*
Neg. messaging	.416*	-.415**	-.597+
Worry			.191
Hope			.170
Moderate ref			-.440
Worry X mod ref			-.272
Passive pragmatists			.
Constant	-.207*	.206*	.514*
Neg. messaging	.416*	-.415**	-.599
Worry			.206
Hope			.3157
Passive prag			-1.850
Worry X pass			-1.428
Hope X pass			-1.665

Table 26. – Summary of direct and indirect effect of negative and positive messaging on
observed activism, less engaged segments (PROCESS model 14)

	Model 1 DV: worry	**Model 2** DV: hope	**Model 3** DV: clicked yes but did not send the letter
Constant	-.246*	.248*	.605
Neg. messaging	.526**	-.531**	-1.717
Worry			.665
Hope			.688
Efficacy beliefs			-1.497

Neg. x eff	2.216*
Hope x eff	-.344
Worry x eff	-.326
Active rad	-1.684*
Neg. x act	1.548
Hope x act	-1.524**
Worry x act	-1.119*

*p<0.05; **p<0.01; ***p<0.001

Table 27. – Summary of direct and indirect effect of negative and positive messaging on the likelihood of showing activism intention but not observed activism

Efficacy beliefs	Active radicals	Effect	P-value
Low	No	-1.717	.078
Low	Yes	-.168	.849
High	No	.499	.327
High	Yes	2.048	.020

Table 28. – Conditional direct effects of negative messaging on the likelihood of showing activism intention but not observed activism at values of the moderators

Efficacy beliefs	Active radicals	Effect	BootLLCI	BootULCI
Low	No	-.365	-2.071	1.139
Low	Yes	.444	-.577	2.247
High	No	-.182	-.583	.119
High	Yes	.627	-.017	2.748

Note: Conditional indirect effects are significant is boot confidence intervals exclude 0.

Table 29. –   Conditional indirect effects of negative messaging on the likelihood of showing activism intention but not observed activism through decreasing hope at values of the moderators

Appendix C

Audience Segmentation

The audience segmentation analysis was conducted using LCA (Latent Gold 6.0). The activist sample was segmented first. As the segmentation criteria were intended to capture heterogeneity within a given population (Nylund-Gibson and Choi 2018), and the EMSICA variables were likely to capture a significant percentage of where divisions could exist within the two samples, the possibility of using these variables to segment the data was not ruled out.

As many of the variables that could contribute to capturing the heterogeneity within the two samples were therefore included in the analysis, the final set of segmentation variables was selected based on commonly used selection criteria (e.g. R2, bivariate residuals and improvement in model fit statistics). These segmentation criteria guided the selection of the nine variables used to create the initial audience segmentation of the activist sample (see Table 30 below).

Values and emotions
• "My opinion on the climate emergency is part of my core moral norms and values."
• "I believe that the issue of climate change is a moral issue."
• "When I think about the current state of the planet, I feel an overwhelming sense of injustice."
• "I feel ashamed when I realize what we are leaving behind for future generations."
• Post-materialism index score
Efficacy beliefs
• "I feel solidarity with Greenpeace."
• "I feel a distance between myself and Greenpeace."
Views about approaches to environmental protection (first and second most important)

• What will be most impactful in solving environmental problems [you may select up to three options and rank the most important as 1, followed by 2 and then 3]:

1. more people doing their part to live a sustainable lifestyle

2. more people protesting, marching and demanding change from our political leaders

3. more people disrupting the global capitalist system through activism

4. the free market driving society toward efficiency and improvement

5. our government taking appropriate actions to protect society

Total: nine variables

Table 30. – Selection of segmentation criteria

With these variables as the segmentation criteria, the three-, four- and five-segment solutions were analyzed. In order to avoid selecting a local maximum solution, as can occur with LCA, the estimation algorithm was replicated 10 times using 5,000 random sets of parameter start values (Maibach et al. 2011). All three models (with three, four and five segments) were replicated exactly. The BIC was used to compare the three models and determine the number of classes that best fit the data (Nylund-Gibson and Choi 2018), leading to the selection of the three-class model (see Table 13). The same steps were performed on the non-activist sample, which demonstrated similar model fit indices. As a result, both samples were segmented using the same criteria, and the three-class model was selected in both cases.

	BIC (LL)	AWE	NPAR	BLRT*p*	BF
Activists					
3 classes	31085	33019	140	-	>15
4 classes	31097	33572	187	.040	<15
5 classes	31173	34251	234	.016	-
Non-activists					
3 classes	36389	38134	140		<15
4 classes	36097	38493	187	<.001	<15
5 classes	36073	38943	234	<.001	-

Note: BIC = Bayesian information criterion, AWE = approximate weight of evidence criterion, NPAR = number of parameters, LL = log-likelihood, BLRT = bootstrapped likelihood ratio test and BF = Bayes factor.

Table 31. – Summary of model fit statistics

Constructs and items	Individual change (n=295)					System change (n=301)				
	λCFA	λSM	α	CR	AVE	λCFA	λSM	α	CR	AVE
Emotions (EM)			.91	.91	.71			.91	.91	.72
Injustice	.82	.82				.80	.80			
Scared	.86	.86				.88	.88			
Angry	.81	.81				.88	.89			
Ashamed	.87	.88				.82	.81			
Efficacy (EFF)			.81	.82	.69			.81	.82	.69
Personal	.87	.90				.83	.87			
Collective	.79	.76				.83	.79			
Group identification (GI)			.82	.82	.54			.83	.82	.54
Committed	.82	.80				.86	.83			
Solidarity	.84	.82				.84	.81			
Distance	.58	.55				.60	.55			
No common	.66	.63				.61	.57			
Collective action intentions (CAI)			.80	.80	.67			.84	.85	.75
Attend	.74	.74				.73	.72			
Join or maintain support	.89	.88				.98	.98			

Notes: λCFA = Factor loadings in confirmatory factor analysis; λSM = Factor loadings in structural model; α = Cronbach's alpha; CR = Composite reliability; AVE = Average variance extracted

Table 32. – Item list per construct, Cronbach's alpha, composite reliability, average variance

extracted, non-activist sample

Constructs and items	Individual change (n=295)					System change (n=301)				
	λCFA	λSM	α	CR	AVE	λCFA	λSM	α	CR	AVE
Emotions (EM)			.78	.78	.47			.77	.77	.46
Injustice	.57	.58				.62	.62			
Scared	.73	.72				.69	.70			
Angry	.77	.79				.65	.65			
Ashamed	.66	.65				.75	.73			
Efficacy (EFF)			.70	.70	.54			.77	.78	.65
Personal	.73	.76				.68	.74			
Collective	.74	.71				.91	.83			
Group identification (GI)			.69	.70	.38			.68	.70	.37
Committed	.72	.73	.69	.70	.38	.73	.73			
Solidarity	.71	.71				.68	.68			

	.52	.51				.48	.47			
Distance	.52	.51				.48	.47			
No common	.47	.46				.51	.50			
Collective action intentions (CAI)			.61	.72	.59			.57	.58	.41
Attend	.47	.48				.57	.57			
Join or maintain support	.98	.96				.72	.71			

Notes: λCFA = Factor loadings in confirmatory factor analysis; λSM = Factor loadings in structural model; α = Cronbach's alpha; CR = Composite reliability; AVE = Average variance extracted

Table 33. – Item list per construct, Cronbach's alpha, composite reliability, average variance

extracted, activist sample

	1	2	3	4	5	6
1. EM		.615	.419	.572	.251	.299
2. PE	.658		.682	.726	.318	.379
3. CE	.452	.687		.594	.260	.310
4. GI	.618	.704	.605		.438	.522
5. ATT	.258	.294	.253	.418		.662
6. JOIN	.345	.392	.337	.557	.716	

Note: Correlations above the diagonal are for the individual change condition; Correlations below the diagonal are for the system change condition.

Table 34. – Correlations between study variables, non-activist sample

	1	2	3	4	5	6
1. EM		.256	.138	.161	.038	.076
2. PE	.295		.539	.418	.099	.198
3. CE	.183	.620		.390	.092	.184
4. GI	.257	.497	.543		.236	.473
5. ATT	.055	.107	.117	.215		.458
6. JOIN	.069	.134	.146	.269	.406	

Note: Correlations above the diagonal are for the individual change condition; Correlations below the diagonal are for the system change condition.

Table 35. – Correlations between study variables, activist sample

	C.I.		M.I.	
	RMR	GFI	RMR	GFI
Activists				
Individual change (n=300)	.05	.96	.06	.94
System change (n=298)	.04	.97	.05	.96
Non-activists				
Individual change (n=295)	.05	.96	.09	.95
System change (n=301)	.04	.97	.10	.95

Notes: CI = Configural invariance; M.I. = Metric invariance; RMR = Standardized root mean square residual; GFI = Global fit index

Table 36. – Configural and metric invariance (activists and non-activists)

	X^2	df	RMSEA	NNFI	CFI	Δ CFI	Δ X2	Δ df	p
Activists									
C.I.	145.06	96	.03	.96	.97	-	-	-	-
M.I.	155.57	10	.03	.96	.97	.00	10.51	6	>.10
Non-activists									
C.I.	135.10	96	.03	.99	.99	-	-	-	-
M.I.	140.53	10	.03	.99	.99	.00	5.45	6	>.10

Notes: RMSEA = Root mean square error of approximation; NNFI = non-normed fit index; CFI = comparative fit index.

Table 37. – Full models: configural and metric invariance (activists and non-activists)

	X^2	df	RMSEA	NFI	CFI	Δ CFI	Δ X2	Δ df	p
Motivated Canadians									
C.I.	96.63	96	.000	.86	1.00	-	-	-	
M.I.	11.25	102	.02	.83	.98	.02	13.62	6	<.05
P.M.I.	99.76	101	.00	.85	1.00	.00	3.13	5	>.05
Concerned Canadians									
C.I.	121.08	96	.03	.84	.96	-	-	-	
M.I.	134.54	102	.03	.83	.95	.01	13.46	6	<.05
P.M.I.	124.12	101	.03	.84	.96	.00	3.04	5	>.05
Doubtful Canadians									
C.I.	144.77	96	.08	.77	.90	-	-	-	
M.I.	154.71	102	0.08	.77	.90	.00	9.94	6	>.05
Optimistic environmentalists									
C.I.	111.24	96	.03	.71	.94	-	-	-	
M.I.	115.91	102	.03	.70	.94	.00	4.67	6	>.05
Realist climate advocates									
C.I.	138.29	96	.04	.73	.89	-	-	-	
M.I.	142.06	102	.04	.72	.89	.00	3.77	6	>.05
Concerned supporters									
C.I.	108.23	96	.03	.80	.97	-	-	-	

M.I.	123.08	102	.04	.77	.95	.02	14.85	6	<.05
P.M.I.	116.31	101	.03	.80	.97	.00	8.08	5	>.05

Table 38. – Configural and metric invariance across audiences (both samples)

	Lifestyle change	System change	Δ X^2	Δ df	p
Motivated Canadians					
EM → PE	.02(ns)	.42**	7.69	1	<.05
EM → CE	-.12(ns)	.01(ns)	.91	1	>.05
EM → SI	.02(ns)	-.13(ns)	.79	1	>.05
PE → SI	.30**	.41**	.72	1	>.05
CE → SI	.12(ns)	.08(ns)	.00	1	>.05
PE → CE	.39**	.26**	3.74	1	>.05
SI → ATT	.51**	.28**	3.56	1	>.05
SI → JOIN	.07**	.25**	1.08	1	>.05
ATT → JOIN	.51**	.53**	.20	1	>.05
Concerned Canadians					
EM → PE	.02(ns)	.24**	3.41	1	>.05
EM → CE	.14(ns)	.00(ns)	.65	1	>.05
EM → SI	-.06(ns)	.14(ns)	1.67	1	>.05
PE → SI	.31**	.16(ns)	1.30	1	>.05
CE → SI	.14(ns)	.22**	.19	1	>.05
PE → CE	.20**	.30**	.79	1	>.05
SI → ATT	.16(ns)	.32**	1.27	1	>.05
SI → JOIN	.12(ns)	.12(ns)	.00	1	>.05
ATT → JOIN	.64**	.70**	.91	1	>.05
Doubtful Canadians					
EM → PE	.05(ns)	.05	.00	1	>.05
EM → CE	-.00(ns)	.30	1.02	1	>.05
EM → SI	-.34*	.47**	13.11	1	<.05
PE → SI	.30*	.60**	2.80	1	>.05
CE → SI	-.29(ns)	-.27*	.23	1	>.05
PE → CE	.18(ns)	.32*	.07	1	>.05
SI → ATT	.39*	.74**	3.62	1	>.05
SI → JOIN	.06(ns)	.35**	3.04	1	>.05
ATT → JOIN	.83**	.62**	8.29	1	<.05
Optimistic environmentalists					

EM → PE	**.28***	**-.09(ns)**	2.40	1	**<.05**
EM → CE	**-.23***	**.20****	1.38	1	**<.05**
EM → SI	-.04(ns)	-.04(ns)	.47	1	>.05
PE → SI	.33**	.14(ns)	1.03	1	>.05
CE → SI	.06(ns)	.29	.16	1	>.05
PE → CE	.43**	.57**	.18	1	>.05
SI → ATT	-.03(ns)	.18(ns)	2.62	1	>.05
SI → JOIN	.36**	.15(ns)	.52	1	>.05
ATT→ JOIN	.39**	.29**	6.86	1	>.05
Realist climate advocates					
EM → PE	-.07(ns)	-.01	.00	1	>.05
EM → CE	.14(ns)	.20	.01	1	>.05
EM → SI	.01(ns)	.07	.04	1	>.05
PE → SI	.30**	.06	2.34	1	>.05
CE → SI	.03(ns)	.07	.26	1	>.05
PE → CE	.34**	.22**	.75	1	>.05
SI → ATT	.13(ns)	.32**	.87	1	>.05
SI → JOIN	.34**	.08	1.87	1	>.05
ATT → JOIN	.41**	.41**	.38	1	>.05
Concerned supporters					
EM → PE	-.09(ns)	.24(ns)	3.67	1	>.05
EM → CE	**.07(ns)**	**.33****	4.20	1	**<.05**
EM → SI	-.29**	-.09(ns)	.89	1	>.05
PE → SI	.02(ns)	.28**	1.05	1	>.05
CE → SI	.25(ns)	.38**	.03	1	>.05
PE → CE	.44(ns)	.45**	.04	1	>.05
SI → ATT	.41**	.01(ns)	3.67	1	>.05
SI → JOIN	.33**	.13(ns)	.88	1	>.05

*** p<.001. ** p<.01. * p<.05*

Note: Bolded parameters are significantly different from each other across groups asdfas(Δ X^2 (1); $p < .05$

Table 39. – Structural paths, multigroup analysis and structural invariance across audiences (both samples)

	X^2	df	RMSEA	NFI	CFI	p
Activists						
Environmental prot. x not aligned	-	-	-	-	-	-
Environmental prot. x aligned	76.77	48	.04	.91	.96	<.05
Individual change x not aligned	87.29	48	.14	.71	.83	<.05
Individual change x aligned	87.65	48	.06	.88	.94	<.05
Political change x not aligned	53.01	48	.04	.74	.96	>.05
Political change x aligned	85.68	48	.06	.87	.94	<.05
System change x not aligned	59.34	48	.04	.89	.98	>.05
System change x aligned	65.79	48	.05	.88	.97	<.05
Non-activists						
Environmental prot. x not aligned	89.31	48	.09	.88	.94	<.05
Environmental prot. x aligned	79.64	48	.06	.93	.97	<.05
Individual change x not aligned	65.67	48	.04	.97	.99	<.05
Individual change x aligned	6.34	48	.10	.75	.93	>.05
Political change x not aligned	96.91	48	.14	.83	.90	<.05
Political change x aligned	78.65	48	.05	.96	.98	<.05
System change x not aligned	62.88	48	.04	.97	.99	>.05
System change x aligned	54.29	48	.04	.91	.99	>.05

Table 40. – Third test fit indices