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Affective Images of Climate Change: Analysis and Database Development

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ANALYSIS AND DATABASE DEVELOPMENT

By

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ABSTRACT

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Although climate change has become an increasingly popular topic in both research and the public-eye, there is little standardization of the images used to represent it. The differences in expert and non-expert climate imagery is also problematic. This study aims to resolve both of these issues: first by analyzing participants' ratings of 320 images on their relevance to climate change as well as emotional arousal and valence; then by compiling these images and their affective characteristics into a database for use in future climate-related research. Participants' environmental attitudes were surveyed to investigate the relationship between attitudes and image ratings. High-arousal, low-valence images tended to be rated as most relevant to climate change, and participants with higher environmental interest tended to rate all images as more relevant to climate change. We also found that image themes of climate-relevant images in this study were similar to those found in other climate imagery studies—e.g. ice floes, industrial smog, and natural disaster outcomes—implying that non-experts consistently find that this type of imagery best represents climate change.

To Mom and Dad, for understanding.

To my Marquette family, for support.

To Kedzie, for everything.

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INTRODUCTION

Climate change is a growing field of research, the subject of heated political debate, and an area of interest among the public. The Intergovernmental Panel on Climate Change (IPCC) has determined that the average surface temperature of the Earth has increased 0.85°C from 1880 to 2012 due to human causes, and predicts that from 2016 to 2035 the temperature will increase an additional 0.9°C—1.3°C (Burkett et al., 2014). For reference, during the previous warming period between glacial cycles 120,000 years ago, the Earth's surface temperature never rose more than 2°C higher than its more recent pre-industrial temperature (Burkett et al., 2014). This extreme increase over a short span of time is expected to have consequences. Globally, IPCC scientists are currently predicting that human health will be—and in many areas, already is—negatively impacted by the effects of climate change: for example, extreme heat waves, forest fires, and flooding greatly increase the risk of injury and illness, in addition to diminished crops caused by such disasters leading to an increase in malnutrition (Smith et al., 2014). In North America alone, IPCC scientists are reporting that anthropogenic changes in climate have led to an increase in severe hot weather and variable precipitation, based on which they are predicting ill effects on crops and water resources (Romero-Lankao, et al., 2014).

And yet, in August of 2017, the United States gave notice to the United Nations that it would begin the process of withdrawing "as soon as it is eligible to do so" from the Paris Agreement (C.N.464.2017.TREATIES-XXVII.7.d), an agreement through the United Nations Framework Convention on Climate Change for countries involved to limit their

greenhouse gas emissions and develop adaptations to the impacts of climate change while also attempting to limit the global average temperature from rising any more (United Nations, 2016). Clearly, there is disconnection between experts and non-experts of climate change and how they communicate with one another on the topic.

Using images is a useful way to explore this gap in communication, as visual imagery has commonly been used to supplement the communication of scientific ideas between experts and non-experts (Nicholson-Cole, 2005; Trumbo, 1999). Images have the ability to quickly impart complex, powerful messages into memorable visual content (Nicholson-Cole, 2005; Trumbo, 1999), making them more accessible to non-experts and more relatable to their own experiences and opinions than traditional methods of presenting scientific data, such as journal articles and statistics. Since these direct scientific sources are often limited in availability to the public, individuals' main source for knowledge on climate change appears to be mass media, particularly television and newspapers (Nicholson-Cole, 2005; Sundblad, Biel, & Gärling, 2009; Wilson, 2000).

As television and newspapers are visual in nature, the imagery accompanying stories on climate change is particularly important, as it can be powerfully emotional, as well as potentially altering viewers' interpretation of the information and its importance (DiFrancesco & Young, 2011). These images in the media also likely influences individuals' mental representations of climate change, from image themes to the general affective qualities of those images. These representations can then in turn influence individuals' opinions on climate change and their preferences on policies directly dealing with climate change. For example, Leiserowitz (2006) has found that negative emotional images predicted greater perception of global warming's risk, and that these negative climate images (such as

dried out landscapes) predicted greater support for American climate policies (such as nationally reducing greenhouse gas emissions and increased taxes on fuel-inefficient vehicles).

As these policies are voted on by the general, non-expert public, investigating what kind of imagery they find relevant to climate change and how that is related to their environmental views is greatly important to ensure that climate messages are being communicated efficiently between experts and non-experts and not misinterpreted, particularly in a culture where visual images are so prevalent in all forms of media and communication (e.g. Gamson, Croteau, & Hoynes, 1992). Because of this, we have chosen to assess non-experts' judgements on the emotional characteristics and relevance to climate change of potential climate imagery, as well as collecting participants' environmental views.

This study aims to develop a large database of affective images, free to be used in climate change research, all based on ratings done by non-experts. These images will have varying levels of relevance to climate change, arousal, and valence, which can be used for experimental stimuli of differing levels for any future studies. These variables will be determined through ratings done by individuals with varying levels of interest in the environment and ecological issues, in order to get the most objective measure of the images and be most effective in use with non-expert audiences.

Environmental Attitudes and the New Ecological Paradigm Scale

Environmental attitudes among the American public have fluctuated throughout the years (Chong, 2014). According to Gallup polls, opinions on prioritizing the environment over energy production have bounced from the majority to the minority to a recent high of 59%, with a similar trend in opinions on giving priority to protecting the environment at the risk of limiting economic growth (Newport, 2017). At the same time, the public's

environmental attitudes have been found to have a direct, positive relationship with states' adoption of environmental policy based on two nationwide samples (Brace, Butler, Arceneaux, & Johnson, 2002; Johnson, Brace, & Arceneaux, 2005) and predictive of other factors which have direct relationships to environmental policy support (Dietz, Dan, & Shwom, 2007). This support for policy is "a key resource for the environmental movement," (Dietz, Dan, & Shwom, 2007) so it is vital to understand individuals' environmental attitudes that shape and inform this support.

For example, individuals' environmental concern has been shown to be a significant positive predictor of self-reported pro-environmental behavior and participation among environmentalists and the general public (Olli, Grendstad, & Wollebaek; Steel, 1996), as well as being correlated with higher likelihood of participating in a "green" electricity program (Clark, Kotchen, & Moore, 2003) and purchasing environmentally friendly products (Kim & Choi, 2005). High environmental concern has also been found to drastically reduce time discounting in response to hypothetical environmental dilemmas, and to be positively correlated with cooperation through personal sacrifice of real-world rewards to benefit environmental causes (Kortenkamp & Moore, 2006).

Environmental concern and attitude was measured in all of the abovementioned studies using The New Ecological Paradigm Scale (Dunlap, Van Liere, Mertig, & Jones, 2000), through 15 items covering what the authors consider the five facets of an ecological worldview: "the reality of limits to growth, antianthropocentrism, the fragility of nature's balance, rejection of exemptionalism, and the possibility of an ecocrisis" (Dunlap et al., 2000). The questionnaire items prompt respondents to agree or disagree with statements that support "the dominant social paradigm"—the attitude that human beings should dominate the

environment, which has the ability to bounce back from abuse—or the "new ecological paradigm"—the attitude that the environment is delicate and that human industry is harming it (Dunlap et al., 2000).

The New Ecological Paradigm (NEP) Scale was chosen for use in this study due to its widespread use in environmental research, both within the United States and internationally (see Dunlap, 2008), and its recommendation as being a standardized measure of environmental attitudes (Hawcroft & Milfont, 2010). We also have chosen to measure individuals' environmental attitudes rather than belief in climate change directly, in anticipation of a wider variety in responses as environmental attitudes more broadly encompass specific environmental issues like climate change (Dietz, Dan, & Shwom, 2007).

Climate Change Communication

Current literature on the communication of climate change calls for these messages to be shaped according to the audience (Leiserowitz, 2006), appealing to what they find meaningful (Nerlich, Koteyko, & Brown, 2010). As the scientific view that recent climate change is anthropogenic has become more definite, the goal of communication has shifted from proving that the climate is changing to convincing the public to make behavioral changes that will lessen the impacts (Nerlich, Koteyko, & Brown, 2010). For example, studies in multiple locations have explored the perceived barriers to engaging in pro-climate behavior, such as feeling the government should "take the lead" or that the monetary cost of these behavior changes is too high (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007). Other recent studies have found success in increasing individuals' intentions to act in pro-climate ways by framing uncertain, negative consequences of climate change as avoidable (Morton, Rabinovich, & Marshall, 2011), and an increase in reported engagement with and interest in climate change when its risks and effects were specifically focused on individuals' localities

as opposed to globally (Scannell & Gifford, 2013). However, given the sizable population of individuals who do *not* find climate change important personally (33% of a nationally representative sample; Leiserowitz, Maibach, Roser-Renouf, Rosenthal, Cutler, & Kotcher, 2017), these suggestions for change may not be reaching a wider, non-expert audience.

Previous research on the communication of climate change has found that the language used can create confusion rather than state the facts—scientific language and colloquial language often use the same words with different meanings, leading to misinterpretations by the public (Nerlich, Koteyko, & Brown, 2010). For example, the word "enhance": scientifically it is used to mean increasing in intensity, while colloquially it means to improve—the phrase "enhanced greenhouse effect" can imply a negative consequence by experts, but be interpreted by non-experts as a success (Nerlich, Koteyko, & Brown, 2010).

Similarly, the fact that climate change is not immediately observable is an obstacle in fully understanding the risks and realities of climate change. Greenhouse gases, for example, are invisible, and the projected consequences of climate change are "not distributed evenly," with the chance to occur anywhere in the world (Weber & Stern, 2011). A review of perceived consequences of climate change has shown that in multiple studies, people believe the negative effects of climate change will be greatest "globally" and specifically in areas far from their own country (McDonald, Chai, & Newell, 2015). Given that the IPCC relays its impacts as "future projections" and "predictions" (Burket et al., 2014; Romero-Lankao et al., 2014; Smith et al., 2014) and the difficulty in "confidently" estimating the probability of climate-related disasters (Weber & Stern, 2011) the consequences of climate change can seem ambivalent or unsure to non-experts. Many people report feeling less concerned about

climate change recently and that its consequences may be exaggerated, or that the most severe consequences will not occur for another 40 years (McDonald, Chai, & Newell, 2015). This spatial, hypothetical, and temporal distance (McDonald, Chai, & Newell, 2015) may widen the gap in communication and thus the potential for climate action.

Due to these language concerns and the fact that there is no singular "smoking gun" causing climate change, individual opinions are more likely based on values and emotions than on scientific evidence and data (McKie & Galloway, 2007). Add in the confusion with other environmental issues (such as ozone depletion, see Leiserowitz, 2006), and it seems that climate change has turned "from a purely scientific phenomenon into a cultural one" (Nerlich, Koteyko, & Brown, 2010). Because of this, it is recommended that academics in the field explore non-expert perceptions of climate change in order to improve methods of engagement on an emotional level of the topic (Nerlich, Koteyko, & Brown, 2010). Instead of a "one-way" dialogue, climate change communication should be a two-way conversation between experts and non-experts, in order to understand both what experts are trying to convey and what non-experts are perceiving about climate change (Nerlich, Koteyko, & Brown, 2010). This "bottom-up" rather than "top-down" approach acknowledges that non-experts' opinions are not based solely on knowledge or lack of knowledge, but involve heuristics, experiences, and importantly, emotions (Ockwell, Whitmarsh, & O'Neill, 2009). In order to communicate the most effectively with an audience, engagement should be pursued in three factors: the audience's understanding, emotions, and behavior (Ockwell, Whitmarsh, & O'Neill, 2009).

We also aim to attend to this relationship between expert knowledge and "lay knowledge" (Nerlich, Koteyko, & Brown, 2010), particularly through the use of images

accompanying climate change messages. By having average individuals—especially with varying levels of interest in climate change and the environment—determine the relevance, arousal, and valence of the images used, our research will explore how non-experts view climate change and the images used to represent it. The variables chosen for this study attend to our participants' understanding by determining relevance to climate change of the images and participants' emotions by determining the arousal and valence of the images, while participants' behaviors are attended to by their surveyed attitudes toward the environment. In doing this, our results will be more suited for use in research with other non-experts, less prone to misinterpretation or confusion regarding why certain images are used in climate-related messages, and attend to individual differences in environmental attitudes.

Climate Change Images and Imagery

Previous studies on climate change imagery have produced primarily qualitative data based on participants' self-reports. Studies wherein participants were asked to spontaneously report their mental representations of climate change primarily elicited images of melting glaciers, polar bears, and destruction (Leiserowitz, 2006; Nicholson-Cole, 2005; O'Neill & Nicholson-Cole, 2009). For example, one individual responded that their mental image of climate change involved "ice bergs, and glaciers shrinking and snow disappearing" (O'Neill & Nicholson-Cole, 2009), while other individuals have reported visualizing "melting polar ice caps" and "upset ecological balance" (Leiserowitz, 2006). This seems to support the findings that climate change and its consequences are perceived to occur and be more severe in distant locations (McDonald, Chai, & Newell, 2015), as glaciers and polar bears are hardly common in the United States and United Kingdom where these interviews took place. Because these results are subjective, even when the imagery produced by participants can be categorized into common themes and subject matter (e.g., Leiserowitz, 2006; O'Neill &

Nicholson-Cole, 2009), the imagery was still not consistent across participants, making it difficult to directly compare the impact of different types of climate change imagery.

In Leiserowitz's (2006) study, participants were asked what they first imagined when hearing the phrase "global warming;" participants were also asked the valence of their individual imagery. So, while the average valence of each category of imagery was recorded (Leiserowitz, 2006), these ratings are coming only from one person per image, rather than every participant rating every potential image. There is, then, still an obstacle in comparing individuals' salient mental images of climate change, and the valence of those images, as they are both completely subjective to the individual participants with no relation to the other responses gathered in the study and there is no way to "re-use" those specific images again.

Participants in this study were also asked about the strength of their positive or negative feelings toward global warming as well as surveyed on their risk perception of climate change in many different facets, such as likelihood of local or global impacts and the severity of those impacts (Leiserowitz, 2006). Negative feelings toward global warming and skeptical imagery associated with global warming elicited from the interview were found to be the two most powerful predictors of global warming risk perception, as well as being the two most powerful predictors of national environmental policy preference (Leiserowitz, 2006). From this, it is obvious that individuals' attitudes toward global warming directly impact their reported support or opposition to proposed pro-environmental policies, although the impacts of these attitudes on the imagery individuals associated with global warming is less clear. Any relationships between participants' positive or negative feelings toward global warming and type of imagery generated were not reported, and the direction of "naysayers'" feelings toward global warming cannot easily be inferred due to the wording of the question,

"Do you have any negative/positive feelings about global warming?" (Leiserowitz, 2006) Naysayers may have associated negative feelings due to finding global warming "overblown" as a topic (Leiserowtiz, 2006) just as alarmists may have associated negative feelings due to fear.

Other studies have been conducted where all participants were given the same climate-related images by researchers in order to determine their salience and promotion of self-efficacy regarding climate change (e.g. O'Neill, Boykoff, Niemeyer, & Day, 2012; O'Neill & Hulme, 2009; O'Neill & Nicholson-Cole, 2009). In O'Neill and Nicholson-Cole's 2009 study, participants of various ages and social backgrounds were given 32 printed images representing climate change chosen based on description or use by experts such as the IPCC and local environmental organizations and asked to sort them twice: first according to how important the images made climate change seem to them personally, and then according to how the images made them feel they were personally able to do something about climate change (O'Neill & Nicholson-Cole, 2009).

The results of this task showed that participants still found dramatic images of climate change impacts—such as dried up lakes and famine—to be most salient, despite feeling that it was difficult to make any images seem "personally important" due to the spatial and temporal distance of climate change impacts, such as the perceived lack of adverse impacts locally and currently (O'Neill & Nicholson-Cole, 2009). Conversely, these fearful images were also sorted by participants as making them feel *least* able to contribute to stopping climate change, with more "personally empowering" images such as those of low energy light bulbs and bicyclists ranking the highest on self-efficacy—despite these images being ranked lowest in salience to climate change (O'Neill & Nicholson-Cole, 2009). However, the

affective qualities of these images were not directly measured in this study; an image being "fearful" was determined by the experimenters, based on participants' subjective reactions to the subject matter of the images (O'Neill & Nicholson-Cole, 2009).

A second study on individuals' personal preferences for climate change "icons" was also conducted, gathering the imagery that local participants and participants from an online climate change forum found to be "tangible entities which will be impacted by climate change, which the viewer considers worthy of respect, and to which the viewer can relate to and feel empathy for" (O'Neill & Nicholson-Cole, 2009). This was expounded upon in a further study, using three of the icons chosen from the non-experts in this initial phase and three commonly used icons from expert publications: the non-expert icons were a local wetland, the city of London, and polar bears; the expert icons were the West Antarctic Ice Sheet, ocean acidification, and thermohaline circulation (O'Neill & Hulme, 2009).

These six icons were then presented to participants as images on sheets detailing how specific climate change impacts might impact those icons, and participants' completed surveys on their impressions of and engagement with climate change both before and after viewing the icons and scenarios (O'Neill & Hulme, 2009). From these surveys, participants found climate change to be a more serious threat (particularly locally) after participating in the workshop than before, had a slight increase in willingness to read information on climate change that they may come across, and more frequently disagreed that climate change is overhyped or a real problem (O'Neill & Hulme, 2009). Notably, participants reported that the non-expert icons were easier to understand and more interesting than the expert icons, which seemed "too impersonal" and did not "tell a story" (O'Neill & Hulme, 2009). The non-expert icons of the wetlands and London were rated to be most relevant to climate change locally

and the expert icons were rated to be most relevant to climate change to others, while the non-expert polar bear icon was rated to be the least relevant overall—yet, uniquely, also the icon participants were most drawn to (O'Neill & Hulme, 2009). This shows support to the importance of non-expert knowledge, as the non-expert audience found the icons generated by other non-experts to be more understandable and relatable than the icons and imagery commonly found in expert publications. This type of method ensures that the target audience of these messages of climate change are understood and specifically targeted in ways that they will find meaningful, as previously suggested (e.g. Leiserowitz, 2006; Nerlich, Koteyko, & Brown, 2010).

Participants' attitudes toward and interest in climate change were measured before and after in this study, as previously reviewed (O'Neill & Hulme, 2009), but it was not reported in this study if there were any effects of attitude on icon preference or engagement. It was found that individuals with no scientific education were more likely to be "most drawn" to a non-expert icon and "least drawn" to an expert icon, while those with science-related degrees were more likely to be "most drawn" to expert icons (though still not as much as non-expert icons; O'Neill & Hulme, 2009). Similarly, while the non-expert local wetland icon was the most popular icon overall, it was the "least drawn to" of 40% of the 16-24 year old participants, suggesting that local imagery might be less salient to young people (O'Neill & Hulme, 2009). However, while higher education and youth have been correlated with pro-environmental attitudes (Dunlap et al., 2000; Hawcroft & Milfont, 2010), there are no direct relationships to be found between individuals' environmental or climate change attitudes and preference for climate icons.

There are similarities to the findings of both of these studies—individuals are more likely to determine that fearful images of the impacts of climate change make climate change seem most important, but also find them less personally relatable or empowering than small-scale solution-based imagery (O'Neill & Nicholson-Cole, 2009); individuals are more likely to find scientific, global icons more relevant to climate change for other people than personally relevant familiar, local icons (O'Neill & Hulme, 2009). These results seem to show that engagement with climate change can be improved through the use of relatable local imagery, to counteract the perceived distance of climate change impacts.

What these studies' results suggest *should* be done to communicate climate change through imagery is not necessarily the same as what is *actually* being done; several other studies, then, have investigated what images newspapers use online to visually represent climate change. A review of the digital versions of Canada's two prominent national newspapers was conducted, gathering the images attached to articles about climate change, global warming, and greenhouse gas emissions during the year 2008 (DiFrancesco & Young, 2011). Images of people were the most popular, representing 66% of the images gathered, with political figures, citizens, and business or industry figures being the predominant subcategories (DiFrancesco & Young, 2011). Images broadly depicting nature represented 42% of the images, primarily urban and natural landscapes, with the final 29% of images being related to industry and technology (DiFrancesco & Young, 2011).

Particularly interesting is the relative absence of polar bears and ice imagery which represented 3% and 5% of total images respectively, despite being locally relevant to climate change in Canada (DiFrancesco & Young, 2011). While these image themes are extremely common representations of climate change in countries where melting ice and polar bears are

not immediate problems (e.g. the UK in O'Neill & Nicholson-Cole, 2009; the US in Leiserowitz, 2006), their visual absence in Canadian news media seems to support the distancing of climate change from the opposite perspective: rather than relying on exotic or foreign imagery, the lack of threatened local imagery also seems to act to make climate change seem like a far-away problem, or at least not a priority within Canada, as suggested by the authors (DiFrancesco & Young, 2011).

A similar review of 13 popular newspapers from the United States, the United Kingdom, and Australia investigated the images that accompanied articles on climate change, global warming, and greenhouse gas emissions in the year 2010 (O'Neill, 2013). This revealed that 48% of these images from all three countries were of people, primarily political figures, scientists, and celebrities, respectively (O'Neill, 2013). Impacts of climate change was the second most common image theme, followed by protests, climate change causes, and climate change solutions (O'Neill, 2013).

Using 40 of these images representing these main themes, participants from the US, the UK, and Australia were asked to rank the images according to how important they made climate change seem and how able to do something about climate change they made the participant feel (O'Neill, Boykoff, Niemeyer, & Day, 2012). Across participants from all countries, images of climate change impacts, such as floods and ice sheets, were ranked as highly salient, making climate change seem the most important (O'Neill et al., 2012). Images of identifiable people, such as political leaders, were ranked very low in salience across participants from all countries (O'Neill et al., 2012). There were fewer direct similarities in image rankings for self-efficacy, but images depicting climate change solutions like alternative energy sources and certain lifestyle changes consistently were rated highly by all

participants, while the images of climate change impacts were ranked consistently very low by all participants (O'Neill et al., 2012). Again, as in O'Neill and Nicholson-Cole's (2009) first study, the apparent inverse relationship between imagery that promotes climate change's salience and individuals' self-efficacy seems to be maintained, even throughout participants of two different additional countries.

Interestingly, while this study recorded participants' attitudes toward climate change and achieved a varied sample as desired (O'Neill et al., 2012), any differences in perceived image saliency or self-efficacy by individual climate change beliefs were either not reported or not recorded. The researchers' intention to have samples that varied in attitude toward climate change implies an expected difference in image rating, yet this was not explored. As in previous studies, there were also no measures of the images' arousal or valence, or their emotional qualities in general.

All of these results, while important for the field, are impossible to replicate as none of these studies make available the images used, despite some being collected from permanent sources and presented to participants physically. There is also a lack of information on the relationship between the imagery individuals find salient and engaging regarding climate change and their environmental attitudes (whether broadly or specifically toward climate change), when they are recorded (e.g. Leiserowitz, 2006; O'Neill et al., 2012; O'Neill & Hulme, 2009). In O'Neill and Nicholson-Cole's (2009) study, only the interview results that related to fearful imagery were reported on, implying that those participants all held attitudes of concern toward climate change and the environment and that the results may be mainly only applicable to those who are also concerned about the environment and climate change.

There is no basis for comparison on individuals' affective attitudes on images of climate change across studies, either, as emotion is not directly, objectively measured in many of these studies—instead, images' affect is determined based on participants' reactions to and descriptions of the images; for example, climate change impact imagery can be determined to be negative based on participant interviews describing it as "very scary" (O'Neill & Nicholson-Cole, 2009) and "horrific" (O'Neill et al., 2012), rather than being asked directly if it was negative (e.g. Leiserowitz, 2006). Similarly, without the use of a quantifiable scale, images' affect cannot be ranked based on subjective descriptions—it is unclear whether a "horrific" image has greater negative affect than a "very scary" image, while an image rated as -5 in affect is certainly more negative than an image rated as -1 (e.g. Leiserowitz, 2006). Because of these factors, only loose comparisons and trends can be drawn between similar experiments using climate imagery because there is no continuity or standardization of these images, nor are the images being measured or rated using the same, objective variables across studies.

Dimensional Approach to Emotions

In this study, we are specifically interested in the emotional qualities of images of climate change because climate change does not exist in a vacuum and, like many political topics, both believers' and deniers' positions can have an emotional basis. As Mckie & Galloway point out, individuals on both sides of climate change "often hinge their arguments around emotions," (2007). Previously reviewed studies have determined that the images that individuals find to be most salient to climate change also seem to be intensely emotional (Leiserowitz, 2006; Nicholson-Cole, 2005; O'Neill & Nicholson-Cole, 2009), with some being described with language like "shocking" and "devastating" (O'Neill & Nicholson-Cole, 2009). Here, we aim to directly determine the affective characteristics of climate-

change relevant images as objectively as possible in order to have an image set that is diverse emotionally for future use in research.

To study the affective qualities of the images used in this experiment, we have chosen to use a dimensional approach. Similar to the IAPS (Lang, Bradley, & Cuthbert, 1997), the two dimensions of emotion on which our pictures are being measured are arousal and valence, or how calming/exciting and negative/positive the images seem. (The relevance of the images to climate change is, of course, also being measured, but this is not an inherently emotional quality of an image.) It was determined by Russell that these two dimensions were best used and most efficient in representing emotions, particularly with a circumplex model with emotions arranged in a gradient rather than discretely, as the properties of valence and arousal are combined in different ways (1980).

This model of measuring emotional qualities of visual stimuli is efficient, and it is easier to quantify ratings on the more objective axes of arousal and valence than to use more subjective (though common) emotion-words such as “happy” or “sad.” (An image described as “shocking and devastating” becomes “high arousal, low valence.”) Because of this, and the supportive use in other similar image-rating tasks, we have chosen to use these dimensions for this study.

Experimental Image Databases

There are multiple existing stimulus sets and databases for different types of visual stimuli, e.g. the Bank of Standardized Stimuli (Brodeur, Dionne-Dostie, Montreuil, & Lepage, 2010) and the Face Place (as used in Righi, Peissig, & Tarr, 2012). However, there is no stimulus set with images that have already been rated for their relevance to climate change, nor is there a single database with a suitable amount of images with subject matter that could be appropriately rated and used for climate change research. For example, the

University of Pennsylvania's Natural Image Database contains only photographs taken in Botswana (Tkačik, Garrigan, Ratliff, Milčinski, Klein, Seyfarth, Sterling, Brainard, & Balasubramanian, 2011), and the University of Texas's Natural Image Database contains only photographs taken in Texas (nature scene collection; Geisler & Perry, 2011), both of which lack any ice or Arctic themes that are popular in representing climate change.

One of the most frequently used image databases for emotional images is the International Affective Picture System (IAPS), originally containing 700 photographs, which were rated for their arousal, valence, and dominance (Lang, Bradley, & Cuthbert, 1997). The images are of a broad range of semantic categories, from animals and people to landscapes and common objects (Lang, Bradley, & Cuthbert, 2008). The ratings for these images were initially carried out by undergraduate students (Lang, Bradley, & Cuthbert, 2008) and have been determined to have high internal consistency and reliability both within- and between-subjects (Lang, Bradley, & Cuthbert, 1997).

The present study used a method similar to the IAPS: we have gathered a large amount of pictures of varying subject matter to be rated for their arousal, valence, and relevance to climate change (rather than dominance), and these initial ratings were carried out primarily by undergraduate students; similarly, our goal is to make this database of images and their ratings freely available for other researchers to use. In future research we also hope to achieve the high levels of internal consistency and reliability like the IAPS.

HYPOTHESES

This study aims to create an accessible database of images for use in climate research, with image ratings performed by a sample of non-experts in order to be more suited for use with non-expert audiences. Images are rated on three variables—relevance to climate change, arousal, and valence—and we predict:

(1) images rated highly relevant to climate change will also be most likely to be rated as being high-arousal and low-valence, given how images depicting dramatic, negative themes have consistently been found to be most salient to people regarding climate change (Leiserowitz, 2006; O'Neill, et al., 2012; O'Neill & Nicholson-Cole, 2009) and

(2) there will be a positive relationship between attitudes toward the environment and image ratings, given the NEP Scale's predictive validity in correlating positively with respondents' other environmental views (Dunlap et al., 2000).

METHOD

Participants

Participants for this experiment consisted of 67 males (n = 30) and females (n = 37) between the ages of 18 and 38 years old (M = 20.373, SD = 3.789), with normal or corrected-to-normal vision. They were recruited primarily through undergraduate psychology classes on Northern Michigan University's campus, receiving course credit for their participation. Informed consent was obtained from participants before beginning the experiment, and the research protocol was approved by the Institutional Review Board of Northern Michigan University.

Procedure

Image-rating stimuli

A total of 320 images, were gathered from a Google search using the following terms involving climate change: "climate change," "climate change causes," "climate change solutions," "climate change negative," and "climate change positive." These results were limited to high resolution images not containing clipart that were labeled for reuse

Image-rating task

The image-rating task was designed using E-Prime2 software (Psychology Software Tools, Pittsburg, PA). The image-rating task began with participants seated 59cm from the computer screen. They were told that they were going to be shown pictures and asked to rate them on a scale of 1 to 9 for each of the variables given on the screen. Images were pictured above a question and rating scale for each variable. For each image, participants were asked

how relevant or irrelevant it was to climate change (relevance), how calming or exciting it made participants feel (arousal), and how negative or positive the image appeared (valence), in that order consistently. Each image was presented for each variable scale before the next image was shown in a unique, random order (Fig. 1). Participants used the computer's keyboard number pad to input their ratings. The task was not timed, and took participants approximately an hour to complete.

Figure 1. Image-rating task screens. Participants were asked to rate the stimulus on it's (a) relevance to climate change, (b) arousal, and (c) valence. Participants rated each stimulus on each variable before the next stimulus was presented.

Questionnaire

Immediately after finishing the image rating task, participants were asked to complete the New Ecological Paradigm Scale (Dunlap et al., 2000). This was done after the image-rating task in order to avoid any potential priming of participants to think about climate change. Their responses were given on a 5-point Likert scale from "strongly agree" to "strongly disagree." As previously reviewed, the items on this questionnaire are meant to gauge the participants' views on the environment as a whole, and human beings' impact on the Earth (for full scale, see Dunlap et al., 2000). The 15-item questionnaire with 5-point response scale is used for this study as recommended based on meta-analysis of 30 years of NEP Scale usage (Hawcroft & Milfont, 2010). This questionnaire has high internal validity,

$\alpha = 0.83$, as determined through a representative sample of Washington state residents (Dunlap et al., 2000).

Data Analysis

Image-rating task

The mean rating of each variable (relevance, arousal, and valence) was collected for each of the 320 images. Pearson's Correlations were performed for to test for positive relationships between (1) relevance and arousal, (2) relevance and valence, and (3) arousal and valence. The significance level was set to $p < 0.05$, two-tailed.

Questionnaire

Participants' responses from 1-5 on the NEP Scale were made into composite scores, with reverse scoring for even numbered items as detailed by Dunlap et al. (2000). The highest possible composite score is 75, indicating greater interest in and concern for the environment, particularly its ability to be disrupted by human beings (Dunlap et al., 2000). The lowest possible composite score is 15, indicating feelings of human beings' dominance over nature and less concern for the environment (Dunlap et al., 2000).

Image-rating task + questionnaire

The relationship between participants' image ratings and NEP Scale questionnaire responses is also of interest. In order to accurately determine the potential relationship between participants' ratings of climate image relevance and their attitudes toward the environment, each participant's average ratings for relevance, arousal, and valence of the images determined to be *most* and *least* relevant ($n_{total} = 64$) were correlated with their response for each NEP Scale item using Pearson's Correlations. The significance level was set to $p < 0.05$, two-tailed.

RESULTS

Image-rating task

The average relevance ratings of the images (M = 5.909, SD = 1.033) were positively correlated with the average arousal ratings of the images (M = 4.651, SD = 0.531), $r(318)$ = 0.621, $p < 0.001$. The correlation was strong, showing that the images determined to be most relevant to climate change were also rated by participants as being highly arousing, or exciting to look at (Fig. 2).

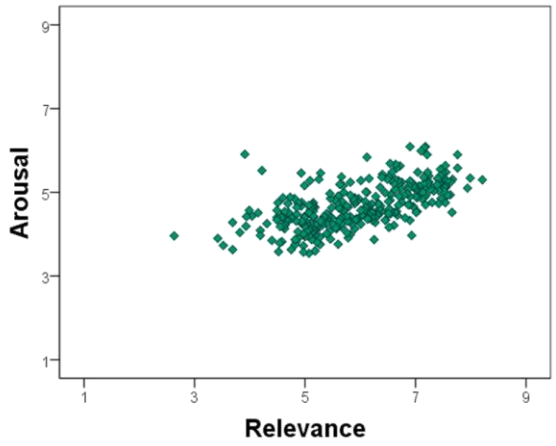

Figure 2. There was a strong, positive correlation between images rated high in relevance to climate change and images rated high in arousal.

The average relevance ratings were also negatively correlated with the average valence ratings of the images (M = 4.793, SD = 1.382), $r(318)$ = -0.432, $p < 0.001$. The correlation is moderately strong, and shows that the images most relevant to climate change were also rated as having low valence, or as being very negative (Fig. 3).

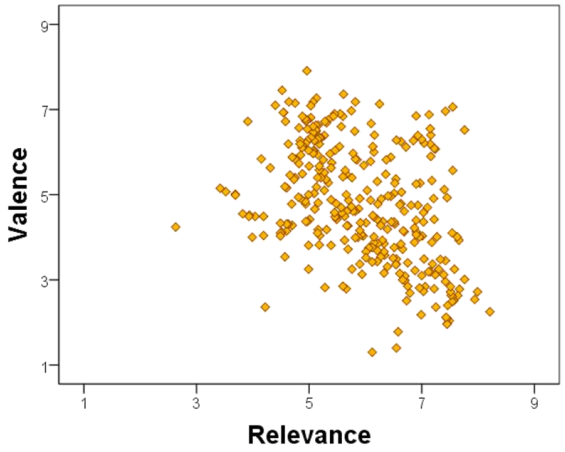

Figure 3. There was a moderately strong, negative correlation between images that were rated high in relevance to climate change and images that were rated low in valence.

There was also a moderate, negative correlation between the average arousal ratings and the average valence ratings of the images, $r(318) = -0.394$, $p < 0.001$, showing that the images that were rated as most exciting were also some of the most negative (Fig. 4). This is not surprising given the results of similar image ratings done in the IAPS, which initially reported having very few images which were rated as unpleasant yet also un-arousing (Lang, Bradley, & Cuthbert, 1997).

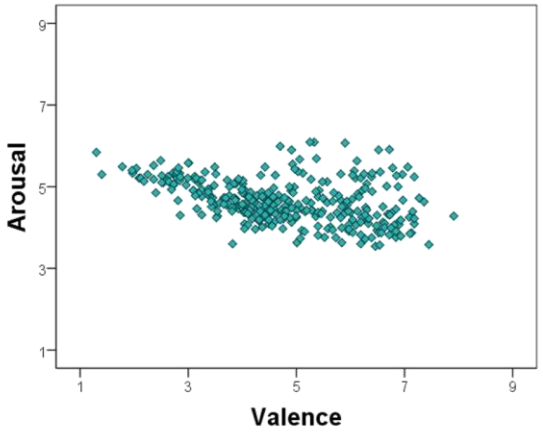

Figure 4. There was a moderate, negative correlation between images that were rated low in valence and images that were rated high in arousal.

We also selected the 10% *most relevant* images (n = 32; M = 7.537, SD = 1.304) and the 10% *least relevant* images (n = 32; M = 4.121, SD = 1.678) to be used in further correlation analyses. Common themes depicted in the *most relevant* images were polar bears, ice floes, industrial smog, and outcomes of natural disasters (Fig. 5), while common themes depicted in the *least relevant* images were landscapes, buildings, and people (Fig. 6).

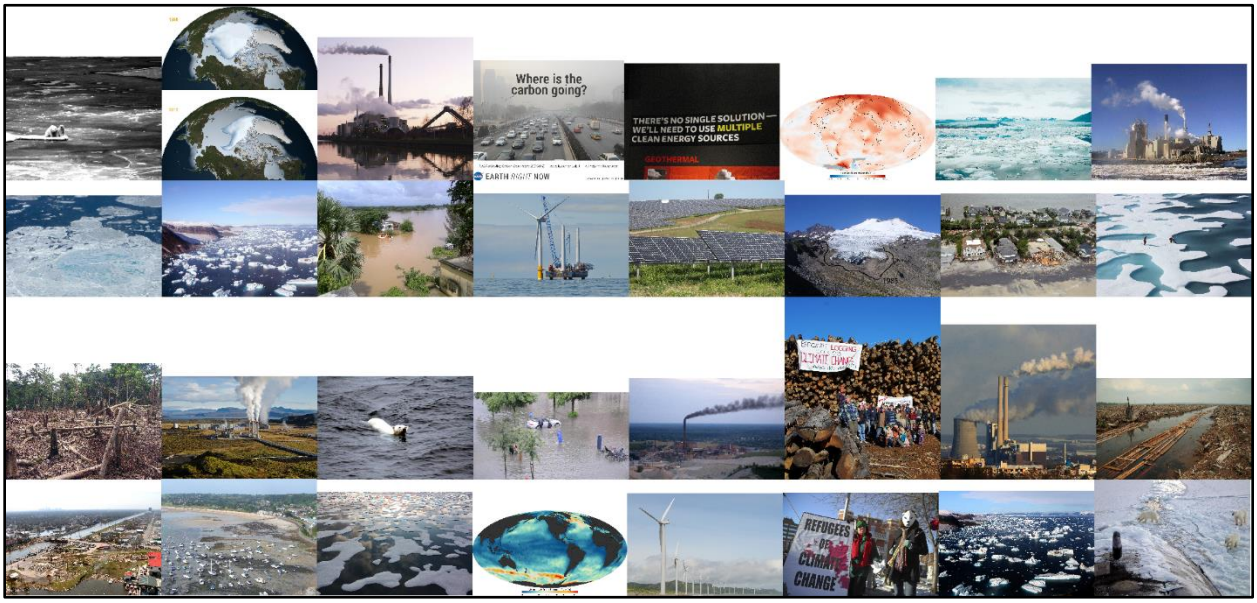

Figure 5. The 32 images rated highest in relevance to climate change, read from top left to bottom right.

Figure 6. The 32 images rated lowest in relevance to climate change, read from bottom right to top left.

Questionnaire

Of the 67 total participants, 62 completed the NEP Scale questionnaire following the image rating task. The highest score recorded in this experiment was 74 and the lowest was 32, out of a maximum 75 and minimum 15,with sufficient variance in responses, (M = 53.177, SD = 8.434).

Image ratings + Questionnaire responses

There were two significant relationships found between image ratings and questionnaire responses. There was a strong positive correlation between the average relevance ratings of the *most relevant* images and participants' NEP Scale scores, $r(60)$ = 0.419, p = 0.001. This shows that participants with higher scores on the NEP Scale—and

who likely have pro-ecological views—were more likely to give the *most relevant* images their high relevance ratings (Fig. 7).

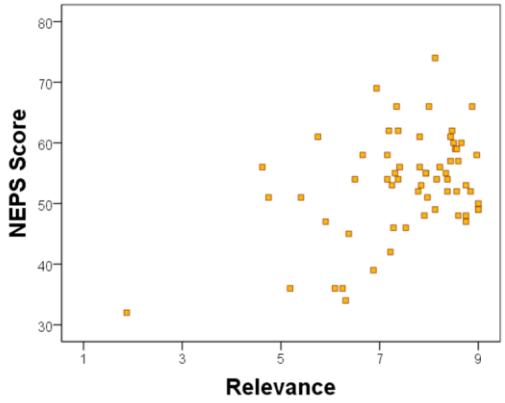

Figure 7. There was a strong, positive relationship between the average relevance ratings of the images determined to be *most relevant* to climate change and participants' score on the NEP Scale.

There was also a moderate positive correlation between the average relevance ratings of the *least relevant* images and participants' NEP Scale scores, $r(60) = 0.31$, $p = 0.003$. This shows that participants with higher scores on the NEP Scale were, again, more likely to give the *least relevant* images their low relevance ratings (Fig. 8).

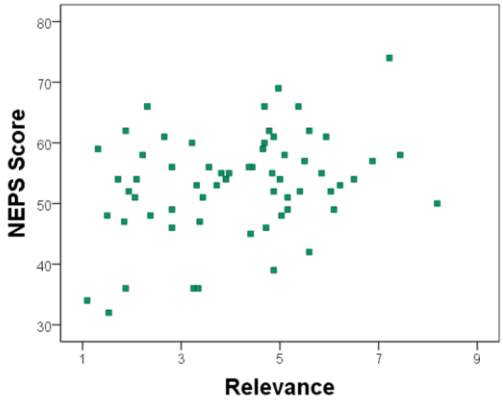

Figure 8. There was a moderate, positive relationship between the average relevance ratings of the images determined to be *least relevant* to climate change and participants' score on the NEP Scale.

There were no significant correlations between NEP Scale scores and the arousal scores, $r(60) = 0.001$, $p = 0.994$, and valence scores, $r(60) = -0.174$, $p = 0.175$, for the *most*

relevant images. Nor were there any significant correlations between NEP Scale scores and the arousal scores, $r(60) = -0.041$, $p = 0.751$, and valence scores, $r(60) = 0.005$, $p = 0.969$, of the *least* relevant images, however, suggesting that participants' ecological views may not have been related to their opinions on the emotional qualities of the images, only their opinions on the images' relevance to climate change.

DISCUSSION

From the image rating task, relevance to climate change and arousal were significantly positively correlated, as were relevance and valence. Arousal and valence were significantly negatively correlated. Therefore, images that were rated as highly relevant to climate change also tended to be rated as highly arousing and low in valence, while images that were rated high in arousal tended to be rated as low in valence in general. The 64 images that were rated *most* and *least* relevant were then selected for further correlation analysis.

We found from the questionnaires that participants had varying levels of concern and interest in the environment according to their scores on the NEP Scale, with high scores indicating greater concern for the environment and low scores indicating less concern. NEP scores were found to be significantly positively correlated with the relevance scores of the 32 *most* relevant images and the 32 *least* relevant images, but not with arousal scores or valence scores. Higher NEP scores were associated with higher relevance scores, among both the images rated *most* relevant to climate change and those rated *least* relevant to climate change.

Hypothesis 1

Our first hypothesis, that images rated highly relevant to climate change will also be most likely to be rated as being high-arousal and low-valence, was supported by our findings. The strong positive relationships between relevance and arousal show that generally, the images determined to be most relevant to climate change were also determined to be the most arousing, or exciting. The negative relationship between relevance and valence showed that the images most relevant to climate change also tended to be the most negative images,

emotionally. Exciting, emotionally negative images being rated as the most relevant to climate change in our study is also in line with previous research which has indicated that non-expert individuals tend to find alarming and upsetting imagery most salient when thinking about climate change and global warming (Leiserowitz, 2006; O'Neill, et al., 2012; O'Neill & Nicholson-Cole, 2009).

Image themes

The primary themes of subject matter in the images found to be *most* relevant to climate change in this study included ice, outcomes of natural disasters, and industrial buildings or smog (see Fig. 5). According to previous research, these three themes were among those that first came to mind to individuals thinking about climate change and global warming (Leiserowitz, 2006; O'Neill & Nicholson-Cole, 2009), and were also determined by individuals to make climate change seem most important (O'Neill et al., 2012; O'Neill & Nicholson-Cole, 2009). Images depicting the outcomes of natural disasters, such as flooding, exemplify what is meant by high-arousal/low-valence imagery in this study: they are dramatic and distinctly negative in affect. Similar images have also been found to be fear-inducing (O'Neill & Nicholson-Cole, 2009).

As in other studies (e.g. Leiserowitz, 2006), many of these most relevant images depict themes that are remote from our participants—particularly large ice floes, polar bears, and flooding—seeming to show that our participants are among the many that fall into thinking of climate change as spatially distant (McDonald, Chai, & Newell, 2015), although this was also likely due to the lack of specifically local images included in our study. The image themes represented in our most relevant images have also been fairly well-represented

in images accompanying articles on climate change, but were not the most common image theme, according to past studies (DiFrancesco & Young, 2011; O'Neill, 2013).

The image rated most relevant to climate change overall depicted polar bears on small ice floes in the water, though only three of the 32 *most* relevant images depicted polar bears. Polar bears are a popular visual symbol for climate change (Manzo, 2010), and in one study the iconic image of climate change that participants were most drawn to and understand overall was a polar bear (O'Neill & Hulme, 2009). Manzo (2010) suggests that the polar bear persists as a climate icon due to its emotional qualities as a creature vulnerable to climate change's impacts, which is a possible explanation for its rank here as the image most relevant to climate change despite being locally irrelevant to our participants. Indeed, the three polar bear images in this "most relevant" category were determined by our participants to be rather negative ($M = 2.85$, $SD = 0.62$).

Only three of the 32 images most relevant to climate change depicted potential solutions to climate change: windmills and solar panels. In the same vein, these types of images have not been ranked highly by individuals in past research on salience to climate change (Leiserowitz, 2006; O'Neill et al., 2012; O'Neill & Nicholson-Cole, 2009). Similarly, they are not popularly depicted in news media, making up less than 7% of images accompanying articles on climate change in the US, UK, and Australia (O'Neill, 2013) and 5% in Canada (DiFrancesco & Young, 2011). It is possible that these types of images are not as exciting to look at as images of destruction, and cannot overcome the high-arousal/low-valence trend that makes up the rest of the *most* relevant images. However, images of energy solutions *have* been ranked highly in terms of self-efficacy—these types of images are more

likely to make individuals feel that they can make a difference with climate change (O'Neill et al., 2012; O'Neill & Nicholson-Cole, 2009).

The primary themes of subject matter in the images found to be *least* relevant to climate change in this study included landscapes or nature, people, and buildings (see Fig. 6). Past research has found that images with similar themes, such as buildings and landscapes, have been ranked as making climate change seem least important (O'Neill & Nicholson-Cole, 2009), as have images of people, particularly if they are identifiable (O'Neill et al., 2012). This may explain, then, why a photo of American politician Al Gore was determined by our participants to fall into this category of images that are least relevant to climate change, despite having won the 2007 Nobel Peace Prize jointly with the IPCC for his work to spread awareness about climate change's anthropogenic nature (Gibbs & Lyall, 2007). Images of politicians—including Gore specifically—have been ranked very low in both salience and self-efficacy, apparently least likely to make climate change seem important or to make participants feel they could contribute to a solution (O'Neill et al., 2012). This seemed to stem from feelings of distrust and hypocrisy regarding politicians (O'Neill et al., 2012). This may be true in our study as well, though it seems equally likely that due to the ages of our participants (M = 20.373, SD = 3.789), the image of Gore was rated as one of the least relevant to climate change out of simple unfamiliarity. The same is likely true of Danish Prime Minister Lars Løkke, whose photograph also appears in this study as one of the least relevant images, given our sample of American undergraduate students.

The subject matter present in the images that were rated *most* and *least* relevant in this study shows that the high-arousal/low-valence, dramatic and negative, imagery that was correctly predicted to be most relevant to climate change was mainly represented by scenes

of natural disaster outcomes. Images of ice floes and industrial buildings with smog were also common themes in this category, although an image of polar bears on ice was rated as the image most relevant to climate change overall. The images rated *most* relevant to climate change consisted primarily of causes and consequences of climate change, with potential solutions to climate change represented very little, which replicates previous findings and suggests that the high-arousal/low-valence combination of emotional characteristics is particularly necessary for images to be seen as relevant to climate change—a combination of qualities not often achieved by images of alternative energy sources compared to those of flood damage. Meanwhile, many of the images in the *least* relevant to climate change category seem self-explanatory, such as a photo of a squirrel or a sunset. On the other hand, images of people are frequently found not to be salient to climate change, as represented in our findings, despite being the most common category of picture attached to news media on climate change (DiFrancesco & Young, 2011; O'Neill, 2013).

Hypothesis 2

Our second hypothesis, that there will be a relationship between attitudes toward the environment and image ratings, was partially supported by our findings. There were significant positive correlations between the NEP score (representing participants' attitude toward and concern about the environment) and their relevance ratings toward both the *most* and *least* relevant images, so it appears that environmental views moderated participants' ratings of the images' relevance to climate change. Individuals with more environmental interest appeared more likely to give high relevance ratings to the images that were subsequently determined to be *most* relevant to climate change, as well as appearing to be more likely to give higher relevance ratings to the images that were subsequently determined

to be *least* relevant to climate change. This seems to show that individuals who were highly concerned about the environment tended to find the images overall more relevant to climate change than participants who were not as concerned about the environment.

On the other hand, as there were no significant relationships between NEP scores and arousal or valence scores of the images both *most* and *least* relevant to climate change, it appears that we are not correct in predicting that individuals' environmental views are related to their ratings of images' affective characteristics. Meaning, exciting and negative images seemed exciting and negative to participants regardless of how they felt about the environment.

These findings, while not fully supporting our hypothesis, address the lack of consideration for environmental attitudes in previous research done on climate change imagery. For example, some of these previously reviewed studies have recorded participants' attitudes toward climate change, but not reported on investigating any relationships between these attitudes and how participants rated images as salient or self-efficacious regarding climate change (O'Neill et al., 2009; O'Neill & Hulme, 2009). In both cases, a sample with varied climate attitudes was desired and achieved, yet appears not to have been applied to the image ratings, only to how those attitudes may have changed based on engagement with educational workshops using climate icons (O'Neill & Hulme, 2009). So, our findings that individuals' environmental attitudes, measured by the NEP Scale, were related to their ratings of the images as being relevant to climate change partially supports our prediction for this study, and also attempts to fill a gap in literature on climate imagery.

Limitations and Strengths

Of course, there were limitations to our study that may have attributed to some of our findings, or lack thereof. Our sample size of 67 was relatively small, and given that the majority of our participants were psychology undergraduate students, the average age was approximately 20 years old (though the sex of our population was relatively balanced). Given that scores on the New Ecological Paradigm Scale have been positively correlated with both age and education (if only slightly; Dunlap et al., 2000; Hawcroft & Milfont, 2010), this convenience sample from our university may have had an effect on the image rating results. Perhaps with a larger sample size drawn from non-university populations, there would be an even greater variance in environmental interest, which may in turn lead to the images' emotional qualities also correlating with NEP Scale scores. Although, according to a meta-analysis of NEP Scale use, student samples have been found not to differ significantly in scores compared to representative samples (Hawcroft & Milfont, 2010), so simply recruiting participants from other university departments could also potentially increase variance in environmental interest. Similarly, not all participants completed the questionnaire, which, with a larger sample, would have less chance of affecting the results, and could have potentially influenced our results here.

There are also some limitations regarding the images that we used for this study. Specifically, results from the image-rating task has shown that very few images have been rated as both low-arousal and low-valence. As we intend to use these images and their ratings to create a database, we would prefer to have an equal spread of images with all combinations of affective characteristics, so that future users can choose images with qualities that meet their needs. However, this was also a problem encountered by IAPS in its

early stages (Lang, Bradley, & Cuthbert, 1997), so this could also potentially be rectified by expanding our sample size, both of participants and of images.

The images used in this study also did not include any local imagery, which has been found to engage people more fully with climate change than "global" imagery and better communicate possible local risks of climate change (O'Neill & Hulme, 2009), because our images were obtained from Google image searches that did not contain local keywords (e.g. "Climate change + causes," but not "climate change + Michigan"). While we were not intending to measure engagement in this study, it would be interesting to determine how local imagery compares with global imagery in terms of relevance to climate change and affective characteristics, in addition to how environmental attitudes may or may not moderate these ratings. In Marquette where this study was conducted, potential impacts of climate change may be both more visible—such as record-breaking high February temperatures in 2017 (Lam, 2017)—and less visible—such as the ability to still see ice on the lake well into spring, despite a trend of declining ice cover due to rising temperatures (Austin & Colman, 2007). The role of personal experience in shaping attitudes about climate change (e.g. Stern & Weber, 2011) could potentially have unique effects on the ratings of local images relevance to climate change, then.

There were also many strengths to this study, most notably our appeal to climate change non-experts, both as participants and as an audience for climate change communication. Scholars recommend that this communication be shaped according to the audience (Leiserowitz, 2006), appealing to what they find meaningful (Nerlich, Koteyko, & Brown, 2010). Given that climate change communication, and scientific communication in general, often uses visual imagery to illustrate these messages (Nicholson-Cole, 2005;

Trumbo, 1999), we chose to explore what visual imagery is meaningful to our non-expert participants. It is also recommended that climate communication should involve non-experts' understanding, emotions, and behavior (Ockwell, Whitmarsh, & O'Neill, 2009), which we have done by having participants rate the images' relevance to climate change (understanding) and arousal and valence (emotions), and then surveying their environmental attitudes (behavior). In this way our images and their ratings should be particularly suited for future use with other non-expert audiences.

Our study also adds further evidence to support an apparent gap between what imagery non-expert individuals feel is relevant to and best represents the importance of climate change, and what imagery is used by news media to illustrate articles about climate change. For example, print and digital newspapers in the Canada, US, the UK, and Australia all primarily use images of people, particularly politicians, to accompany these articles (DiFrancesco & Young, 2011; O'Neill, 2013), despite our study finding these types of images most commonly rated *least* relevant to climate change, and another finding them to make climate change seem the least important across participants in three countries (O'Neill et al., 2012). As this type of media seems to be most non-experts' primary source of information on climate change (Nicholson-Cole, 2005; Sundblad, Biel, & Gärling, 2009; Wilson, 2000), this gap is concerning. Clearly news media's climate communications are not attending to what their audiences find important in ways recommended by scholars in the field, and our results seem to add support to this.

As scientific language and colloquial language often use the same words with different meanings, the language used in climate change communication can create confusion rather than convey the facts, depending on the audience (Nerlich, Koteyko, & Brown, 2010).

Because of this, we utilized commonly-used language in our rating systems (calming or exciting, negative or positive) that still properly expressed our objective variables (arousal, valence), lessening the opportunities for misinterpretation by non-expert participants. Additionally, in our project to create this database, we hope to avoid the problem of language confusion entirely by focusing on climate-related imagery.

The objectiveness of these variables is another strength of our study; by using quantitative ratings of relevance to climate change, arousal, and valence, these images can be definitively measured against each other according to each variable. Past studies have only ranked images based on relevance (though not with numerical value; O'Neill et al., 2009; O'Neill & Hulme, 2009; O'Neill & Nicholson-Cole, 2009), with only subjective descriptions of the images' emotional qualities. Additionally, these ratings were performed on each image by each participant, as opposed to each participant rating only their own personally-relevant climate imagery on its affect (Leiserowitz, 2006). Because of this, our images' ratings come from a larger sample, and are thus more objective.

As there is no current database of image stimuli related to climate change, previous research has had to instead use mental imagery elicited from participants (Leiserowitz, 2006; O'Neill & Nicholson-Cole, 2009) or images gathered from expert scientific sources (O'Neill & Hulme, 2009) and newspapers (O'Neill et al., 2009), none of which have been made available online or are pictured in publications. Because of this, we plan for these images to be accessible to others, both to see exactly what images were rated as most or least relevant to climate change, and so that they can be used as stimuli in other research. Our rating system ensures that any future studies using these images will have the ability for direct comparison,

and eliminates any confounds in comparing the results of two studies due to different stimulus sets used.

Future Directions

Hosting the database of all 320 images used in this study along with their average ratings (including standard deviations) on relevance to climate change, arousal, and valence is our next immediate goal for this project. Making these images and their ratings accessible to others doing research on this topic, both on our campus and on others, is part of that goal, much like other similar datasets such as the IAPS (Lang, Bradley, & Cuthbert, 1997).We also intend to make both the image-rating task and the questionnaire able to be completed online, in order to widen our pool of participants, and hopefully attend to our limitations of sample size and potential variance in environmental views. In our lab, these images are being used as experimental and control stimuli for further research on individuals' environmental views and visual attention to climate-related imagery.

Conclusion

Our goal for this study was to gather objective, quantitative data on how individuals viewed the affective characteristics of climate-related imagery, and we achieved this goal while also supporting the findings of previous, similar studies on this subject that there are common subjects and emotional aspects that are most salient to people when visualizing climate change. We also found that individuals' interest in the environment has effects on the way they rate images as being relevant or irrelevant to climate change. Non-expert opinions were prioritized in this study, and it was carried out in such a way that it should generalize to non-expert audiences viewing these images in future studies and climate change communications.

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