Audiences, structures, and strategies: The promise and power of environmental documentaries

Dissertation

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Abstract

Human activity and unsustainable use of natural resources create increasingly severe environmental problems. Science and environmental documentaries are often used to explain these problems to the general public and to advocate for policies to address environmental issues. Despite the impact many of these films have had, empirical social science research on the genre is scant, in part due to the difficulty inherent in simply defining what is or is not a documentary.

Integrating theoretical perspectives on environmental behavior, narrative persuasion, affect, and documentaries, the present research tests how and why documentaries may be an effective means by which to inform the public and to persuade citizens in favor of particular policies, typically aimed at increasing regulation of environmental hazards. The studies presented here begin building our understanding of documentary audiences and effects by addressing three key questions: Who is watching environmental documentaries? How do aspects of documentaries, specifically narrative structure and message goal influence documentary effectiveness? What visual and verbal message design strategies make documentaries more or less effective? By addressing these questions, the present study enhances knowledge related to documentary audiences, documentary structures, and documentary message design features.

Dedication

To my parents, for showing me what's possible

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Publications

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Fields of Study

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Chapter 1: Introduction, Literature Review, and Theoretical Framework

Human activity and unsustainable use of natural resources create increasingly severe environmental problems. It is therefore necessary to utilize insight from psychology and communication to understand what drives environmental behavior as well as effective ways of changing it (Schultz, 2011; Stern, 1993). Of particular interest is the mismatch between concern about environmental problems and the prioritization of personal and governmental actions to mitigate them. For example, while a majority of Americans (76%) view climate change as a somewhat to very serious problem, only about 18% of the population is actively involved with the issue and its solutions and it is frequently ranked as less important than most other environmental and national issues (Dunlap & Saad, 2001; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011; Weber & Stern, 2011). On a smaller scale, interventions intended to promote low-cost pro-environmental behaviors such as recycling and reduced energy consumption reveal that although it is possible for most people to reduce their environmental impact, a majority of the population does not do as much as they could (Osbaldiston & Schott, 2012).

Mass media have the potential to impact environmental judgment and decision making because media messages are a primary means by which people learn about environmental issues after the completion of formal education (Bell, Lewenstein, Shouse, & Feder, 2009). This is especially true for emergent topics about which public opinion is relatively unsolidified. This study examines the influence of message structure, political

ideology, and message-induced affect on environmental behaviors and policy preferences within the context of documentaries.

Documentaries have been used since the early days of film to communicate information about the real world to the public (Horak, 2006). After the completion of formal education, documentaries represent a key means by which the public can become informed about science in a simplified, easy to understand way (Glaser, Garsoffky, & Schwan, 2012). One of the core assumptions of both producers and audiences is that documentaries promote education and learning while viewers are being entertained (Chris, 2006; León, 2007). In spite of its presumed influence on public discourse, theory development and empirical social science research on this genre is limited (Nisbet & Aufderheide, 2009).

Integrating theoretical perspectives on environmental behavior, narrative persuasion, affect, and documentaries, this research aims to test how and why documentaries may be an effective means of environmental information and persuasion, as well as to identify documentary audiences and to test the effectiveness of message design strategies. The present research will hopefully have significant implications for understanding how environmental documentaries shape audience behaviors and policy preferences and make unique scholarly contributions by addressing three key questions: Who is watching environmental documentaries? How does message structure influence documentary effectiveness, especially for resistant audiences? What visual and verbal message design strategies make documentaries more or less effective?

This study is interdisciplinary and as such it is informed by a wide array of previous research on the interrelated topics involved. In the following section I will

discuss (1) some of the barriers to environmental behavior and acceptance of environmental messages; (2) research on narrative persuasion that suggests it is a useful strategy for overcoming these barriers; and (3) structures and features of documentaries and evidence for their effectiveness. Building on this review of previous research, I will provide an overview of the proposed studies, models, and the hypotheses and research questions each will address.

Barriers to Environmental Behavior and Acceptance of Environmental Messages

Research on environmental psychology and risk has identified four key reasons for this disconnect between environmental concern and pro-environmental behaviors: cognitive biases/limits to rationality, failure to act consistently with one's values, failure to identify as part of nature, and a lack of normative social pressure to act (Heberlein, 2012; Schultz, 2011; Schultz & Kaiser, 2012). The proposed research will focus on cognitive biases and limits to rationality, with an emphasis on the role of affect and on ideological biases. For the purposes of this study, the phrase "environmental behaviors" is used as an umbrella term to describe both small-scale personal actions (e.g., recycling) as well as decision making about environmental policies (e.g., climate change mitigation).

For many environmental problems, public opinion is driven largely by perceptions of risk around a given issue. Evaluating environmental problems as risk issues is foundational to understanding how information processing tendencies may influence risk perceptions and pro-environmental behaviors and are thus an important component of the mismatch between environmental concern and pro-environmental behaviors. Understanding how the public perceives risk and environmental issues is of

crucial importance because regardless of accuracy, these public risk perceptions are a major determinant of legislative and budgetary agendas about environmental issues (Slovic, 1999). Decades of research on risk judgment and decision making have identified several factors that lead to systematically and predictably biased judgments and thus cause relatively low risks to be overestimated and relatively high risks to be underestimated. In particular, the present research aims to address two fundamental questions: how does affect impact environmental risk perceptions and behaviors, and how do ideological predispositions reception and acceptance of environmental messages?

Risk Perception and the Primacy of Affect

Early psychometric studies of risk perception found that public evaluations of risks frequently diverge from actual assessments of those risks (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Slovic, 1987). For example, the severity and probability of risks like nuclear power tend to be overestimated, while risks like automobile accidents tend to be underestimated. According to the psychometric paradigm, people's risk assessments are a function of how those risks map onto two dimensions: dread risk and unknown risk. Dread risk refers to low probability, high consequence events and results in high risk perceptions when risks are involuntary, uncontrollable, catastrophic, lethal, and inequitable. Unknown risk refers to risks that are new, not observable, unknown to science, and risks with delayed harmful impacts. The higher a risk scores on dread and uncertainty, the higher its perceived risk and the greater the public demand for risk mitigation policies. Experts' judgments of risk are also not immune to these biases (Kahneman, Slovic, & Tversky, 1982). This systematic overestimation of unknown and dreaded risks is driven largely by intuitive, affective risk

judgments rather than by effortful cognitive calculations of risks (Loewenstien, Weber, Hsee, & Welch, 2001).

Dual-process theories suggest that there are two functionally and anatomically distinct modes of thought (Chaiken & Trope, 1999; Sloman, 1996; Slovic, Finucane, Peters, & MacGregor, 2004). These theories use varying labels, but the experiential system relies on affective impressions and evaluations to enable rapid risk perception and decision making, while the analytic system relies on reason and logical calculations to make slower and more deliberate decisions. Here, affect is defined as the specific quality of 'goodness' or 'badness' (1) experienced as a feeling state (with or without consciousness) and (2) demarcating a positive or negative quality of a stimulus" (Slovic et al., 2004, p. 312). The efficient and intuitive responses of the experiential system occur prior to and guide the more cognitive processing of the analytic system (Zajonc, 1980). Affective risk responses serve three important functions – feelings act as information in judgment and decision making, focus attention on relevant new and recalled information and impressions, and motivate behavioral tendencies (Nabi, 2003; Peters, Västfjäll, Gärling, & Slovic, 2006; Schwarz & Clore, 2003).

Affect plays a primary role in risk judgment and decision making. Affective reactions often occur automatically and enable the decision maker to assign value and meaning to information more easily and effortlessly than complex calculations of relative risks and benefits (Lerner & Keltner, 2001). When affective and cognitive evaluations of risk diverge, affective impressions often dominate decision making (Loewenstein et al., 2001). Even in the presence of concrete information about relative risks, affective reactions may overwhelm analytic ones such that lower magnitude, affect-rich problems

(e.g., crime) are deemed more important to manage than higher magnitude, affect-poor problems (e.g., deer overpopulation; Wilson & Arvai, 2006). On a policy level, such bias causes affect-rich environmental issues to receive more attention from the public and greater demand for policy change (Slovic, 1999; Slovic, Finucane, Peters, & MacGregor, 2002).

Judgments based primarily on affective impressions characterize a mental shortcut referred to as the affect heuristic (Finucane, Alhakami, Slovic, & Johnson, 2000). Readily available affective impressions are easier to recall and allow for efficient decision making, especially when the decision is complex, the issue is complex, or under time pressure. For many complex environmental issues with which people have little direct experience, these "gut feeling" responses provide an easy means of decision making. While these responses are sometimes accurate, like all heuristics judgments based on the affect heuristic are subject to systematic bias.

One such bias regards the influence of the affect heuristic on judgments of relative risks and benefits. Although risk and benefit tend to be positively correlated in the real world, they are negatively correlated in people's minds and judgments (Fischhoff et al., 1978). The affect heuristic mediates this inverse relationship between perceived risks and benefits (Alhakami & Slovic, 1994; Finucane et al., 2000). The affective view of technologies such as nuclear power guides perceptions of risk and benefit. For example, when individuals are presented with information that benefit is high, positive affect is induced and risk is inferred to be low; when individuals are presented with information that risk is high, negative affect is induced and benefit is inferred to be low

(Finucane et al., 2000). Issues related to energy consumption may therefore be viewed as low risk due to the many benefits provided by fossil fuels.

The affect heuristic also influences judgments of risk probability and frequency. People have difficulty understanding low probabilities (Camerer & Kunreuther, 1989). For affect-rich outcomes, small probabilities are over-weighted relative to affect-poor outcomes (Hsee & Rottenstreich, 2004; Rottenstreich & Hsee, 2000). Affective valuations are highly sensitive to the presence or absence of risk (i.e., 0 versus some amount of risk) but largely insensitive to variations in scope. As a result, the probabilities of affect-rich risks have a tendency to be overestimated rather than underestimated (Keller, Siegrist, & Gutscher, 2006). Negative affect may therefore be a useful tool for increasing perceived risks.

Affect also affects risk imaginability and ease of recall. When information is presented in frequency formats, imagining the numerator can lead to non-intuitive judgments (Slovic, Monahan, & MacGregor, 2000). Slovic and colleagues (2000) conducted a study in which they asked experienced psychologists and psychiatrists to judge the likelihood that a mental patient would commit an act of violence in the future. Clinicians who viewed this information in terms of relative frequency (e.g., "of every 100 patients similar to Mr. Jones, 10 are estimated to commit an act of violence") rated Mr. Jones as more dangerous than did clinicians who viewed this information as a probability (e.g., "patients similar to Mr. Jones are estimated to have a 10% chance of committing an act of violence to others"). Although the likelihood of Mr. Jones committing an act of violence was the same for both groups, the frequency format may have caused people to

imagine a frightening and violent man and these affect-laden images produced the increased perception of risk for those who received frequency information.

Lastly, the availability heuristic may be driven in part by affect. The availability heuristic is a rule used by decision makers in which people judge the probability of an event by the ease with which they can think of examples of it (Plous, 1993; Tversky & Kahneman, 1974). Affect-laden images are easier to recall and imagine and thus are more likely to be used to make risk judgments (Slovic et al., 2004). Therefore, environmental risks that can be represented in memorable, emotional, and visual ways may benefit from higher risk perceptions and thus a greater tendency towards mitigation policies and behaviors. The interplay between affect and availability is reflected in the fact that highly publicized risks tend to be those that are sensationalistic and affectively charged, which may lead to both their overestimation as well as their prominence in the media relative to less visible risks (Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978).

Media messages clearly have the potential to influence judgments of environmental risks and thus environmental behaviors by producing affective responses in audiences Unfortunately, the effectiveness of affect-laden environmental messages is hampered because people evaluate environmental issues as psychologically distant from themselves (low involvement), because do not see them (selective exposure), or because people conform them to previously held beliefs (motivated reasoning).

Psychological Distance and Low Involvement

People live in the moment, but make decisions based on psychological distance from the decision object (Trope & Liberman, 2010). The reference point for this distance

is the self in the present and distance may take the form of temporal, spatial, hypothetical, or social distance. For temporal distance, events happening far in the future are more distant than events happening in the near future. For spatial distance, events happening at faraway locations are more distant than events happening proximally. For hypothetical distance, events that are uncertain or improbable are more distant than events that are relatively certain and highly probable. For social distance, individuals who are more different from the self are viewed as more distant than similar individuals.

Construal level theory proposes that individuals mentally represent psychologically near events using concrete, low-level construals and mentally represent psychologically distant events using abstract, high-level construals (Trope & Liberman, 2010). When an environmental risk is construed in an abstract way, people are more likely to make decisions based on overarching values rather than on specific and contextual information. As psychological distance decreases, construals become more concrete. When an environmental risk is construed in a concrete way the issue becomes more salient and people are more likely to be cognitively and emotionally engaged with the issue (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; Weber, 2006).

Many environmental risks (e.g., climate change) are psychologically distant because effects may not be felt for a long time and people evaluating these risks might not live in areas where the environmental threat is occurring (Spence, Poortinga, & Pidgeon, 2011). However, the same environmental issue can be viewed and described at varying levels of abstraction (White, MacDonnel, & Dahl, 2011). For example, a concrete construal of recycling might be "I will recycle by saving paper and aluminum

cans," whereas an abstract construal of recycling might be "I will recycle to save the environment."

Construal level theory addresses the importance of psychological distance in promoting behavior (Liberman & Trope, 2008). Framing environmental issues as less distant should make the benefits of pro-environmental action more tangible because the risks involved are made more concrete and urgent (Lorenzoni et al., 2007; Weber, 2006). People may be less likely to engage in environmentally risky behavior when the consequences of that behavior are made less psychologically distant (Sagristano, Trope, & Liberman, 2002). On the other hand, framing environmental issues as more distant should induce individuals to make decisions that are more in line with their core values. People may be more likely to engage in pro-environmental behavior when the abstract values that drive environmental behavior are made more salient. Recent research indicates that messages that combine an abstract mindset with specific goals may be the most useful in promoting pro-environmental behavior (Rabinovich, Morton, & Postmes, 2010).

High psychological distance between an individual and an environmental issue can lead to lower involvement with the issue because the individual may not think of the issue as something that either directly impacts him/her or as something that s/he directly impacts. This lack of involvement drives the mismatch between reported concern about the environment and lack of demand for governmental action around environmental issues. If an individual does not view an environmental problem to be personally relevant, it is unlikely that the individual will be motivated enough to do anything to correct the problem (Spence et al., 2011). Lack of involvement can lead to lower risk

perceptions not because the viewer disagrees with the message (as in motivated reasoning, discussed below) but because the viewer does not care about the issue enough to be concerned about it, likely due to low personal relevance of the issue. Low involvement is therefore a pathway to lower risk perceptions, even if an individual does not fundamentally disagree with messages promoting environmental concern.

Selective Exposure to Environmental Messages

Selective exposure refers to the tendency of individuals to prefer value-reinforcing media over that which conflicts with their preexisting beliefs (Hart et al., 2009) and presents a barrier to environmental messages because audiences may not see these messages at all or because different audiences (e.g., liberals and conservatives) are receiving vastly different information about the same issue. For example, in response to the documentary *Gasland* (2010), filmmaker Phelim McAleer created the documentary *Fracknation* (2013), which follows his quest to find the "truth" about fracking from a pro-fracking perspective. Audiences who watch only one film or the other will receive (and possibly adopt) very different perspectives on the issue.

Selective exposure theory suggests that an individual's likelihood of consuming a media text is a function of the degree to which that text supports his or her preexisting opinion – people prefer information from sources that are supportive of their current beliefs and values (Garrett, 2009; Lazarsfeld et al., 1944). Because many environmental issues are highly partisan, this selective exposure is frequently politically motivated and individuals tend to sort into partisan news sources. These sources may be networks such as FOX News or MSNBC or may take the form of a documentary associated with a particular political party's issue stance. For example, although the climate change

documentary *An Inconvenient Truth* (2006) was not directly associated with the Democratic Party, the film centers around a lecture/slideshow presented by Democrat and former vice president Al Gore, intermingled with personal scenes in which Gore reflects on his political career and his reasons for being so concerned with public understanding of climate change. The film was widely successful (worldwide box office total exceeded $50 million) and served to irrevocably link the issue of anthropogenic climate change to Al Gore and by proxy the Democratic Party of the United States (Johnson, 2009). In response to the release and popularity of *An Inconvenient Truth*, climate change skeptics produced a few documentaries to disseminate the opposite point of view. For example, *Not Evil Just Wrong* (2009) goes through the claims of *An Inconvenient Truth* and discounts them with refuting evidence. *Not Evil Just Wrong,* which was directed by Phelim McAleer as well, uses Al Gore as a target for its attacks on climate change science through the frequent use of phrases like "Al Gore would have you believe…", "According to Al Gore…", etc. In so doing the film attempts to draw on viewers' ideological predispositions as a means to promote its message. Individuals who only viewed one of these films would receive very different information (and thus possibly adopt very different opinions) from individuals who only saw the other film.

The reinforcing spirals model extends selective exposure theory to describe the dynamic interaction between media and audiences (Slater, 2007; Zhao, 2009). The reinforcing spirals model focuses on the reciprocal relationship between media selection an effects. Essentially, the model suggests that particular beliefs influence selective exposure to certain types of media messages and that these messages can in turn influence one's beliefs. The relationship between media and the audience is not static but

is instead an active and continuously unfolding interaction. These interactions can extend beyond the realm of media to interpersonal interactions. For example, exposure to science news was found to increase (perceived) understanding of science, which led to more conversations about science (Southwell & Torres, 2006).

Selective exposure and the reinforcing spirals model have important consequences for common understanding about scientific issues. Liberal and conservative audiences are frequently exposed to conflicting messages (often through partisan news outlets), leading to increased polarization and divergence of beliefs among viewers because different audiences are getting very different versions of the "higher truth." (Feldman, Maibach, Roser-Renouf, & Leiserowitz, 2012). This polarization is further enhanced by biased processing of such messages through motivated reasoning.

Motivated Reasoning and Ideological Predispositions

Environmental risk issues are frequently characterized by disagreement on the basis of political ideology. When environmental issues are politically charged, individuals may use their ideological values and identification (e.g., liberal or conservative) as an efficient way to form judgments and make decisions that should align with those values without investing much cognitive effort (Kuklinski & Quirk, 2000). In this way, political ideology can act as a heuristic cue and bias concern and action about environmental risks. Ideological heuristics may in part be driven by affective responses to the information presented (Neuman, Marcus, Crigler, & Mackuen, 2007). A politically charged stimulus will activate prior attitudes and thus drive the retrieval and processing of new information, leading to biased evaluations based on pre-existing ideological

beliefs in a process known as motivated reasoning (Erisen, Lodge, & Taber, 2014; Taber & Lodge, 2006).

Motivated reasoning occurs when people desire to arrive at particular conclusions and so rely on biased cognitive processes to support their previously held assumptions in the face of new information (Kunda, 1990). Research on a number of political issues has shown that citizens do not approach evidence and arguments evenhandedly (Lodge & Taber, 2000). Instead, their prior attitudes and political values strongly bias how they process these arguments through either selective judgment or selective exposure (as previously discussed). People evaluate arguments differently depending on whether they agree or disagree with those arguments' implications (Taber, Cann, & Kucsova, 2009). In general, those who have greater involvement with an issue are less likely to change their beliefs and so will frequently ignore and misinterpret arguments, regardless of their strength (Johnson & Eagly, 1989). These responses to attitudinally incongruent information occur for both liberals and conservatives and can lead to decreased trust in science as an institution (Kahan, 2013; Nisbet, Cooper, & Garrett, 2015).

Disconfirmation biases occur when people actively refute new evidence that challenges their prior beliefs (Kunda, 1990; Taber & Lodge, 2006). When individuals are motivated to discount challenging evidence, they will invest effort in denigrating and counterarguing attitudinally incongruent information (Taber et al., 2009; Taber & Lodge, 2006). This is a cognitively taxing process because individuals must engage in memory search and belief construction in order to support their biased goals (Kunda, 1990). It also means that those with greater knowledge may be better able to produce counterarguments and thus support their biases. In the case of environmental issues,

ideologically biased processing may lead to a discounting of the severity of environmental problems by some groups.

As a result of motivated reasoning, equally informed citizens with differing ideological predispositions may become more polarized over time and with increasing information exposure, creating belief gaps in accuracy about scientific issues (Hindman, 2009; Nisbet, Cooper, & Ellithorpe, 2015; Taber et al., 2009). This polarization tends to *increase* rather than decrease with information exposure. For example, when exposed to information about the risks and benefits of nanotechnology (a relatively non-controversial science topic), individuals with differing worldviews were more divergent in their beliefs about whether the benefits of nanotechnology outweighed the risks than were individuals who were exposed to no information at all (Kahan, Braman, Slovic, Gastil, & Cohen, 2008). Thus the assumption that enlightened and scientifically accurate public opinion will emerge from increasing scientific information is a faulty one. Instead, ideologically polarized opinions about science may be inevitable for some issues due to selective and biased processing of information to match political predispositions (Mutz & Martin, 2001).

Although selective exposure and motivated reasoning suggest that environmental messages will have limited effects on environmental behaviors and public opinion, communication researchers have identified strategies that leverage affective biases and reduce the impact of ideological biases. One such strategy that has received a great deal of empirical support is narrative persuasion.

Narrative Persuasion

Narrative persuasion is a key area of media effects research that seeks to explain the mechanisms by which such entertaining stories can promote attitude and behavior change. Narrative persuasion involves embedding persuasive messages in stories as a method to enhance engagement and avoid potential resistance to a message's advocated attitude or behavior change (Moyer-Gusé, 2008). Narrative persuasion theories identify the unique features of narratives that enable them to overcome barriers to change that non-narrative messages cannot. In the following sections I will define "narrative", summarize research on how affect operates within narratives, identify narrative features that facilitate involvement with these messages, and discuss how these features enable narratives to overcome resistance to persuasion.

Defining Narrative

People often learn about the world around them through stories. Stories are a basic mode of human interaction and are a convenient way to give and receive information. A narrative is a set of real or fictional actions or events that is represented in the coherent and sequential form of a story (León, 2007). Narratives are often defined in contrast to non-narratives, which would include didactic (intended to teach) and expository styles of communication. This definition highlights the importance of cause and effect: narratives tie actions together in a causal chain instead of using propositions and arguments that can vary in their cohesiveness (Green, 2006). These causal linkages enhance the persuasive impact of information presented in a narrative (Dahlstrom, 2010).

Previous research has demonstrated that people are more inclined to rely on scenario-based (or narrative) information than on frequentistic (or statistical) information

when making judgments about risks (Hendrickx, Vlek, & Oppewal, 1989). Hendrickx and colleagues (1989) presented people with information about a variety of risks in a frequentistic format (e.g., "1 in every 25 swimmers gets into trouble each summer, when they have gone swimming at that location"), a scenario-based format (e.g., describing a swimmer's experiences swimming in a dangerous area), or a combination of the two formats to examine the effects of message type on judgments of risk. They found that while frequency information had a strong effect when presented alone, the addition of scenario-based information suppressed this effect and was thus more influential on decision making. People relied on scenario-based information for decision making regardless of the presence of frequentistic information. The authors concluded that people prefer narrative information to statistical information as a basis for risk judgments and will rely on frequency information only when no narrative information is available.

Further research has demonstrated that individuals with low numeracy (numerical ability) are even more likely to rely on narrative information than are highly numerate individuals (Dieckmann, Slovic, & Peters, 2009). In this study, Dieckmann and colleagues (2009) presented participants with terrorism forecasts that combined narrative evidence with statistical likelihood assessments (e.g., probability of attacks occurring). They found that the risk likelihood perceptions of less numerate individuals were associated with their perceptions of narrative credibility and coherence and were insensitive to the numerical risk information provided. Highly numerate individuals showed the opposite pattern, indicating that less numerate individuals are more likely to be highly influenced by non-numerical and often affect-laden narrative information than are highly numerate individuals.

Narratives can serve as a form of evidence to enhance the effects of persuasive messages (Reinard, 1988). Narratives can present the lived experiences of others, which may make it more difficult for them to be discounted (Nisbett & Ross, 1980; Slater, 2002). This tends to occur even when the presented case is atypical (Strange & Leung, 1999). Stories that focus attention on the situational causes of a problem may bypass immediate discounting by providing concrete instances of it. Anecdotal evidence can serve as a concrete examples that are more plausible and more easily understood than statistical information and thus have the potential to exert a strong influence on attitudes and behaviors (Slater & Rouner, 1996).

Narratives and Affect

One of the primary reasons narratives may be particularly successful at influencing risk judgments is due to the fact that narrative formats are more effective than statistical ones at influencing affective responses (Pennington & Hastie, 1993; Sanfey & Hastie, 1998). When risk messages are presented in the form of vivid, affect-laden scenarios, audiences tend to perceive greater personal vulnerability (Slovic et al., 2004). These vivid scenarios are then more easily recalled and thus more influential in the formation of risk judgments. Narratives are more likely to influence experiential system information processing and thus may also bias downstream analytic system information processing as well (Slovic et al., 2004).

Narratives can leverage heuristics and biases to facilitate message-congruent attitudes and behaviors. By presenting risks in an affect-rich way, narratives are more likely than statistical formats to promote affective responses to the risk information, which in turn should increase risk perception around the featured issue. By utilizing the

emotional power of narratives, environmental risks can be communicated to audiences in ways that activate automatic affective responses that exert a strong influence on judgement and decision making. Because most environmental messages seek to increase risk perceptions, affect is an excellent tool for influencing attitudes and behavior without demanding effortful involvement or cognitive ability (to process statistical information) from viewers.

Narrative Features and Involvement

Several features of narratives lead to enhanced engagement and absorption with environmental messages relative to other forms of communication (Moyer-Gusé, 2008; Slater & Rouner, 2002). As a result of this greater involvement with the storyline, narratives can increase the likelihood of expressing message-consistent attitudes and behaviors because individuals who are engaged with the narrative vicariously experience the cognitive and emotional responses of the characters (real or fictional). Narrative persuasion theories maintain that cognitive and emotional involvement with the story and characters in a narrative inhibits message resistance (Moyer-Gusé, 2008; Slater & Rouner, 2002).

The two primary forms of involvement utilized by narratives are transportation and identification. Transportation occurs when individuals become involved with a story to the point at which mental capacity is focused on the events unfolding in the narrative (Green & Brock, 2000). The audience becomes more focused on vicarious engagement with the story the narrative events unfolding than on their present environment.

Identification is a related process in which the viewer takes on the role of a character or characters in a narrative, even to the extent of temporarily become the

character and taking on his or her perspective (Cohen, 2001). The viewer experiences the character's emotions and may adopt the character's goals and motivations (Quintero Johnson, Harrison, & Quick, 2013). Identification involves four dimensions: absorption (loss of self-awareness), cognitive (shared perspective with a character), empathic (shared feelings with a character), and motivational (shared goals with a character). Narratives naturally promote identification as a byproduct of storytelling (Oatley, 1999).

Identification is particularly important because it involves empathy towards others. According to Davis (1996), "empathy is broadly defined as a set of constructs having to do with the responses of one individual to the experiences of another" (p. 12). Empathy centers on two factors: sharing (affective) and understanding (cognitive) another's emotional state (Eisenberg & Strayer, 1987). The affective component deals with having emotional responses that are congruent with the how the character would react to the situation, whereas the cognitive component involves the ability to recognize and understand the emotions that the character has (Cohen & Strayer, 1996).

Perspective taking is a widely used technique for inducing empathy and involves understanding another individual by taking his or her perspective (Batson et al., 1995). The process of identification is a form of empathy, as viewers become the characters they are seeing and experience the world as the character would (Mar & Oatley, 2008). Experiencing the experiences of others through the mass media may allow for contact that in not otherwise possible (Schiappa, Gregg, & Hewes, 2005). This contact, in turn, can have the same benefits as actual interpersonal interaction in promoting positive attitudes and beliefs towards others. Mar and Oatley (2008) argue that narratives inherently encourage empathy because it is necessary for story comprehension.

Although there is a high degree of overlap between these constructs, research on the nature of narrative involvement suggests that being immersed in a story (transportation) and being involved with the characters in a story (identification) are empirically unique experiential phenomena that occur when audiences are deeply engaged with narratives (Busselle & Bilandzic, 2009). This engagement is fundamental mechanism by which narratives can overcome resistance to persuasion as well as increase issue involvement for those not concerned about environmental issues.

Overcoming resistance to persuasion

In addition to encouraging greater message involvement and stronger affective reactions, narrative features can also overcome biases that result from value-incongruent messages (Moyer-Gusé, 2008; Slater & Rouner, 1996). Theories of narrative persuasion suggest that high levels of story involvement and resistance to persuasion through counterarguing (generation of thoughts in opposition to the message) cannot occur simultaneously as both of these processes are cognitively taxing (Slater & Rouner, 2002).

The extended elaboration likelihood model explains how involvement with a narrative can enhance its persuasive effects by reducing counterarguing (Slater & Rouner, 2002). According to the extended elaboration likelihood model, the most impactful narrative messages are effective "not because of their educational or persuasive content, but because they are compelling drama" (Slater & Rouner, 2002, p.175). For explicit persuasive messages, motivation is a function of an individual's self-interest, but this process is different for persuasive messages embedded in narratives. In entertainment narratives, if the persuasive content becomes so obvious that it is more salient than the story, the narrative itself may fail and by extension so would the persuasive message. In

essence, the drama of the story must be compelling enough to keep viewers unaware of its persuasive intent. When the viewer is engaged and absorbed in the narrative, he or she is less likely to recall the message source and less likely to discount the message, thereby enhancing persuasion (Gilbert, 1991). Also, the viewer will be less likely to counterargue the message.

Counterarguing is the production of thoughts that disagree with the persuasive message and is a primary means by which people engage in motivated reasoning (Taber et al., 2009; Roberts & Maccoby, 1973). For entertainment programs, the extended elaboration likelihood model posits that "absorption in the narrative and counterarguing are fundamentally incompatible" (Slater & Rouner, 2002, p. 180). Viewers who are engaged in the narrative will not generate rebuttals to persuasive subtexts because they will be unaware of them. Narrative persuasion can be an effective method of promoting prosocial attitudes and behaviors because it blocks counterarguing, thus influencing those who might have been resistant to the persuasive messages.

The entertainment overcoming resistance model builds on the propositions of the extended elaboration likelihood model and further explains the effectiveness of narratives in overcoming resistance to persuasion (Moyer-Gusé, 2008). Resistance can be thought of as the opposite of persuasion – it is a reaction against a perception of pressure to change (Knowles & Linn, 2004). One major form of resistance is psychological reactance (Brehm, 1966). Reactance occurs when a person perceives that his or her independence is being threatened. Persuasive communication can induce this reaction, even if the message is beneficial to the recipient. "Boomerang effects" can also occur, whereby individuals shift their attitudes and behaviors in the direction opposite that

advocated as a means of asserting independence. According to the entertainment overcoming resistance model, narrative persuasion may overcome reactance because the viewer may be less aware of these messages' persuasive intent. Less overtly persuasive messages should not induce reactance and thus may be more effective in some situations (Moyer-Gusé & Nabi, 2010).

Narratives have received a great deal of scholarly interest, most of which focuses on the effects of pro-social messages embedded within fictional entertainment media. For environmental issues, however, viewers are more likely to get their information from documentary films and programs (sometimes referred to as "edutainment").

Documentary Structures, Strategies, and Impacts

Documentaries are an important means by which the public can be simultaneously informed and entertained as they learn about environmental issues (Léon, 2007). Although documentaries can have a major influence on public understanding of science and the environment, limited theoretical development and social science research has gone into understanding why and how documentaries can be effective (Nisbet & Aufderheide, 2009). In addition, unlike most other genres, the term "documentary" is used to describe a wide array of formats and so a discussion of documentaries must first begin with a definition of what this genre is. Following this definition, I will describe the two narrative structures most common to documentaries (expository and participatory), discuss two specific features of documentaries about which filmmakers must make decisions in how they present their subjects (visuals and episodic vs. thematic framing), and present evidence regarding the advantages and challenges of using documentaries to influence environmental behavior.

Defining Documentary

One of the early pioneers of documentary filmmaking, John Grierson, defined the format as the "creative treatment of actuality" (1926), a definition which highlights the central tension inherent in the genre. Whereas many genres such as horror or westerns are relatively easy to conceptualize, the line delineating a media text as a documentary or not is blurred at best due to the extensive variety of styles, techniques, and formats used (Aufderheide, 2007). The definition of documentary is inherently comparative – just as a complex concept such as love is defined by its contrast to hate, documentaries gain meaning through contrast with other types of media such as fictional films or news programs (Nichols, 2001). What separates a documentary from other forms of media?

Given the variety present within the documentary genre, many films that count as documentaries do not bear a close enough resemblance to one another to define documentaries on the basis of structural features. Therefore, instead of using common features within the genre, the best way to define documentaries is from an audience-centered perspective. Simply put, a documentary is whatever people commonly mean when they use the term (Eitzen, 1995; Tudor, 1973). This definition highlights the importance of audience assumptions in considering media effects. If an individual considers a media text to be a documentary, that person will interact with the text as a documentary. However, the boundaries of documentary are still variable in everyday discourse. For example, programs based on reenactments do not fit neatly into categorization as either a documentary or a non-documentary. Despite these challenges to explication, the fundamental audience expectation is that documentaries should in some way represent reality (Nichols, 1991). Documentary viewers approach these texts

with two common assumptions – that the images shown originate in the historical world and that documentaries are perceived to go beyond merely portraying the historical world by making some sort of "argument" or "claim" about it.

Using these assumptions, documentaries can differentiated from other forms of media by its susceptibility to the question "Might it be lying?" (Eitzen, 1995). While fictional films may claim to simulate reality, documentary films make truth claims about how the world is or was. Viewers expect documentaries to be made up of sounds and images that reflect the real world (Nichols, 1991). It is this assumption that both motivates audiences to seek out documentaries as well to as reject them when messages appear untruthful from the viewer's perspective.

Moving beyond a broad genre definition, it is worthwhile to examine the narrative structure characteristics that distinguish common types of science documentaries from one another, as these characteristics may lead to differences in message processing and effects.

Documentary Narrative Structures

Nichols (2001) identifies six modes (narrative structures) of representation that act as sub-genres of documentary – expository, participatory, poetic, observational, reflexive, and performative. The expository and participatory formats are the most common modes used in science and environmental documentaries.

The expository mode involves assembling fragments of the historical world to advance an argument, recount history, or propose a perspective (Nichols, 2001). These documentaries directly address the viewer with titles and typically use omniscient, voice-of-God narration through an on- or off-screen presenter. Expository documentaries rely

on logic and evidence to persuade the viewer of their truth claims about the natural world (León, 2007). The narrator commentary is used to organize and make sense of the images for the audience and is associated with objectivity (Nichols, 2001). The structure and editing of expository dramas is driven by the need to maintain the continuity of the presented argument or perspective. This type of evidentiary editing may reduce temporal and spatial continuity by stringing together a variety of sources to support the program's central claims. Generally, this mode is ideal for conveying knowledge without challenging or subverting existing knowledge. Such films frequently use common sense and common experience as a basis for argumentation. In the process of simplifying scientific complexities into straightforward arguments about the natural world, expository documentaries typically present their truth as uncontroversial and apparently irrefutable and are less likely to be accused of bias by audiences (León, 2007). Expository documentaries also use universal truths and values to support the evidence presented as objective and truthful.

A second common format for science and environmental documentaries is the participatory mode. In participatory documentaries, the filmmaker becomes part of the story (Nichols, 2001). Although on-screen narrators are used in the expository mode as well, the participatory mode is distinguished by the expectation that the viewer will witness the historical world through the eyes of someone actively engaging with it – the filmmaker becomes to varying degrees a part of the story. Audiences expect that the information conveyed in these documentaries is a subjective reflection of the filmmaker's encounters with the documentary subjects. The filmmakers in participatory documentaries may be directly and personally involved with the events that unfold or

may act as researchers or investigative reporters who are revealing the truth of the situation to the audience. In order to introduce broader perspectives, participatory filmmakers commonly use interviews to bring together different accounts into a single story organized around the filmmaker's experiences. Many films in the participatory mode seek to represent broad social issues through a compilation of perspectives and footage.

In addition to choosing the overall narrative format of a documentary, filmmakers must make decisions about specific message design strategies. Two such strategies that have received scholarly attention are the use of visuals and whether to use episodic or thematic framing.

Documentary Message Goals

In addition to distinguishing documentaries by mode, it is also useful to differentiate documentaries by both filmmaker and audience motivations. Here, motivation refers to both the filmmaker's goals in producing the documentary as well as the audience's reasons for consuming it. Two broad types emerge from this categorization: education-oriented and advocacy-oriented documentaries.

Education-oriented documentaries are didactic in nature and are produced with the intention of conveying knowledge (León, 2007). These documentaries frequently use the expository mode to emphasize the irrefutable truth of their claims, but education-oriented documentaries also exist in the participatory format (e.g., many wildlife films). Education-oriented documentaries intend to communicate scientific truths as uncontroversial. As a result, audiences typically approach these documentaries with a stronger assumption of truthfulness and with the goal of information acquisition.

Individuals are motivated to know accurate information, and so message processing is determined by task importance (rewards and punishments associated with the knowledge acquisition) and by intrinsic interest in the subject (Slater, 1997). Education-oriented documentaries thus produce didactic processing with the aim or information comprehension and retention. As a result, viewers pay close attention to the specific content of the message, which should enhance the likelihood of persuasive impact and recall. In the case of education-oriented documentaries, persuasion involves leading the audience to believe that the documentary accurately reflects scientific fact and the natural world. This form of documentary may therefore be especially powerful because it takes a great deal of effort for audiences to discount information after having first assimilated it with the goal of information acquisition (Gilbert, 1991).

Advocacy-oriented documentaries are more explicitly persuasive in nature and are produced with the intention of convincing the audience to adopt attitudes and behaviors that promote social and policy change (Nichols, 2001). These documentaries frequently use the participatory mode to situate the filmmaker in the story as a basis for presenting his or her experiences or investigations into scientific controversies. The filmmaker takes an ideological stance on an issue and presents evidence to support this stance.

Because advocacy documentaries convey a clear (and often political) viewpoint, these documentaries are far more likely to be viewed by audiences for whom they are value-congruent. As a result, audiences are motivated to view these films with value-reinforcement goals to strengthen and deepen preexisting beliefs (Slater, 1997). Viewers are highly receptive of the message because it aligns with their ideological orientation and these messages also serve to increase the confidence and strength of those attitudes.

It is worth noting that viewers may seek out advocacy-oriented documentaries that are value-incongruent for the purpose of value-protective processing. In this case, viewers aim to counterargue the message and so are unlikely to be persuaded even when presented with strong arguments (Slater, 1997). However, if the documentary is able to successfully undermine confidence in preexisting beliefs and appears credible, attitudinal change is possible (Price & Allen, 1990; Slater & Rouner, 1992).

Visuals

A hallmark of documentaries is the use of powerful visuals as evidence and to provoke emotional responses (León, 2007). Images represent concrete proof of the filmmaker's claims that is difficult to dispute because the viewer is placed in a position similar to an eyewitness. These vivid portrayals may reduce psychological distance by making environmental risks concrete and close to the experience of the viewer. Such portrayals may also provide powerful images that can be more easily recalled through the availability heuristic, leading to increased risk estimates. For example, a famous scene in the anti-hydraulic fracturing documentary *Gasland* (2010) shows a man lighting his tap water on fire because it has been contaminated by natural gas. This scene is unsettling and the clip has been used in several news reports about hydraulic fracturing. If an individual has seen *Gasland*, he or she may retrieve this scene from memory and use the visual demonstration of the consequences of fracking to inform his or her risk judgments.

Another common feature of documentaries, especially wildlife documentaries, is the use of close-up shots (Bousé, 2003). These shots create a sense of intimacy between the human audience and the animal subjects, which results in the impression that animals have human-like thoughts and emotional responses. The editing conventions of wildlife

films such as close-ups, shot/reverse shot, cuts on glances (e.g. the look-off), point of view shots, reaction shots, and eyeline matches allow the viewer to identify with the animal subject on the screen. Close-ups are used in wildlife films to provide information (e.g. show the intricate patterning of an animal or the sharpness of its teeth and claws), to indicate feelings and emotions (whether these are actual or projected is debated), to portray subjective experience (i.e. that of the filmmaker watching the animal), and to create intimacy and identification.

Physical closeness can intensify affective reactions to another person because it produces higher levels of emotional arousal and the nature of the reactions (i.e., positive or negative) will affectively tag this arousal (Middlemist, Knowles, & Matter, 1976; Schachter & Singer, 1962). Evidence suggests that this process extends to images on paper or screen because no region in the brain functions to differentiate the processing of mediated and unmediated experiences (Detenber & Reeves, 1996). As a result, presenting a person in a larger proportion of the screen frame is more likely to create a sense of personal space invasion that in presenting the person in a smaller proportion of the screen space.

Because reactions to media close-ups are similar to perceptions of real world personal distance, viewers should respond to these mediated images in the same way they would respond to a physically close other. Previous research has established that empathy leads to increased concern for a group (or a member of a group), even when the empathy is induced solely through media (Batson, Chang, Orr, & Rowland, 2002; Cao, 2013; Clore & Jeffery, 1972). Close-ups should therefore reduce psychological distance and encourage feelings of interconnectedness with nature.

Episodic vs. Thematic Framing

Documentary producers must make decisions about not only narrative structure and the use of visuals but also about how to frame an environmental issue. A "frame" can be defined as a central organizing storyline or idea that guides message processing and effects by making certain aspects of the message more salient than others (Entman, 1993). Framing of environmental problems can affect how individuals understand these problems by facilitating causal linkages and moral evaluations, essentially creating an interpretive schema through which the issue is viewed (Nisbet & Scheufele, 2009). Previous scholarship has investigated the effects of many types of frames; the present research will focus on a comparison of two general types of framing – episodic vs. thematic framing.

An episodic frame presents an issue by focusing on a specific individual or event, whereas a thematic frame presents an issue more abstractly by placing it into a broader context (Iyengar, 1991). For example, a news story about the effects of climate change could focus on one person's experiences or could provide statistics or information about how climate change is affecting the population at large. Episodic frames are frequently employed by journalists because they believe these frames are more engaging and thus more likely to draw in audiences (Gross, 2008).

Documentary filmmakers must decide which of these frames to use when presenting environmental issues. As previously discussed anecdotal evidence and individual case histories have been found to be more persuasive than broad group statistics (Slater & Rouner, 1996). However, thematic frames may be more effective in some cases because they place responsibility for problems on society at large, which may

lead to greater demand for policies to address these problems (Iyengar, 1991). In contrast, by focusing on individuals, episodic frames also place the blame for a problem on the individual who is experiencing it.

These contradictory assumptions about which type of frame is most effective can be resolved by examining the emotional effects of frames. Gross (2008) found that the persuasive effect of an episodic frame is contingent on how engaging the story is and on the emotional reactions the message is able to engender. Episodic frames that generate emotions such as sympathy and pity facilitate greater persuasion relative to thematic frames that present issues on a broader societal level. This suggests that documentary filmmakers should focus on creating stories with emotionally engaging episodic frames that engender empathy as a way to present environmental problems to the public, rather than focusing on providing statistical evidence about the scope of such problems.

Advantages of and Challenges to Documentary Impacts

Documentary narratives have been shown to be as emotionally engaging as fictional programs and are processed in similar ways (LaMarre & Landreville, 2009). Narratives are heavily used in environmental documentaries because they generate interest and engagement and facilitate easier information acquisition (León, 2007). However, differences in narrative structure necessitate further tailoring of narrative persuasion theories to explain documentary processing and effects.

Expository documentaries are less likely to have a strong narrative coherence due to the fact that they are structured around presenting a logical argument. As a result, transportation into the story world is likely to be limited. In addition, these films do not encourage identification with the filmmaker as their goal is to present an ostensibly

unbiased and objective representation of reality. Participatory documentaries, on the other hand, typically follow a more coherent narrative structure with a beginning, middle, and end and invite viewers to join the filmmaker on his or her journey. It is therefore likely that narrative involvement and thus persuasion may be greater for participatory documentaries than for expository documentaries.

Some documentaries are produced with the intention of conveying knowledge (which can be biased), while other documentaries are produced with (or are perceived to be produced with) the intention of convincing the audience to adopt attitudes and behaviors that promote social and policy change (León, 2007; Nichols, 2001). Documentaries intended to teach frequently use the expository format to emphasize the irrefutable truth of their claims and intend to communicate scientific truths as uncontroversial. As a result, audiences typically approach these documentaries with a stronger assumption of truthfulness and with the goal of information acquisition. Individuals are motivated to know accurate information, and so message processing is determined by task importance (rewards and punishments associated with the knowledge acquisition) and by intrinsic interest in the subject (Slater, 1997). Expository documentaries thus produce didactic processing with the aim of information comprehension and retention. As a result, viewers pay close attention to the specific content of the message, which should enhance the likelihood of persuasive impact and recall. In the case of expository documentaries, persuasion involves leading the audience to believe that the documentary accurately reflects scientific fact and the natural world. This form of documentary may therefore be especially powerful because it takes effort to discount information after having first assimilated it with the goal of information

acquisition (Gilbert, 1991). However, information acquisition goals are likely to reduce narrative involvement because the audience is focusing more on understanding the information than on engaging with the characters or becoming absorbed in the story world.

Participatory documentaries, on the other hand, situate the filmmaker in the story as a basis for presenting his or her experiences with or investigations into scientific and environmental controversies (Nichols, 2001). The filmmaker takes an ideological stance on an issue and presents evidence to support this stance. Because advocacy documentaries convey a clear (and often political) viewpoint, these documentaries are far more likely to be viewed by audiences for whom they are value-congruent. As a result, audiences are motivated to view these films with value-reinforcement goals to strengthen and deepen preexisting beliefs (Slater, 1997). Value-reinforcing viewers are typically highly receptive of the message because it aligns with their ideological orientation and these messages also serve to increase the confidence and strength of those attitudes. It is worth noting that viewers may seek out advocacy-oriented documentaries that are value-incongruent, which promotes value-protective processing. In this case, viewers aim to counterargue the message and so are unlikely to be persuaded even when presented with strong arguments (Slater, 1997). Because value-relevant arguments that are inconsistent with audience beliefs tend to produce more vigorous counterarguing and greater reactance, message acceptance for value-incongruent audiences of participatory documentaries may be largely dependent on narrative involvement, as this should reduce counterarguing and reactance.

Finally, all documentaries are typically viewed with the additional hedonic goal of entertainment (León, 2007). As documentary producers widely acknowledge, audiences must first be entertained if any learning or attitude change is to take place. The hedonic processing of such messages increases attention to and engagement in the story being told (i.e., narrative involvement; Slater, 1997). An advantage of this processing strategy is that it may lower resistance to value-incongruent messages (Slater & Rouner, 2002).

Documentaries have the potential to not only directly impact audience thinking about controversial environmental issues but can also impact news coverage and demand for policy change around these issues. The coalition model proposed by Whiteman (2004) broadens research on documentary effects by taking into consideration the filmmaking process, the larger political context, and discourse about films outside the mainstream. Science and environmental documentaries (especially participatory documentaries) are typically created to bring risks to the attention of the audience and thus define these risks as requiring action (Thompson, 2012). In so doing, these documentaries have the potential to impact three types of actors – individual citizens, activist organizations/social movements, and decision makers/political elites.

In the domain of activists and social movements, documentaries may play two possible roles – they can help movements get initial attention and they can aid in the maintenance of established movements (Tarrow, 1994). Advocacy documentaries have been found to reinvigorate and increase communication in activist groups as well as provide an entry point to and educational materials for the group (Gaventa, 1980).

More important than these within-activist impacts is the ability of science documentaries to bring issues to the attention and discussion of the general public and

move them from being mundane or unexceptional to being an issue that demands action (Whiteman, 2003). These films allow activist groups the visibility necessary to affect public discourse about an issue. Agenda-setting theory describes the process by which this occurs.

Agenda-setting theory focuses on how media coverage influences the salience of topics on the public agenda (McCombs & Shaw, 1972). It is based on two propositions – 1) the media sets the public agenda by choosing which topics to cover; and 2) prominently covered issues are deemed important by the public (McCombs, 2004). The fundamental conception of agenda-setting theory is that the media do not tell the public what to think but instead tell the public what to think *about*. By selectively choosing which topics to cover (and which to exclude), media gatekeepers can impact which issues the public demands action on from politicians.

Documentaries about science and environmental issues can play a key role in either introducing an issue to the public discourse or in making an ignored issue more salient to the general public. Advocacy documentaries can generate a wealth of news coverage that focus on either the issue or on controversy around the film itself. Increased coverage by news media is referred to as media agenda-setting, and when the media as a whole make an issue more salient they are said to drive public agenda-setting, which refers to how important the general public deems the issue to be (McCombs, 2004). The media is especially critical in setting the public agenda for unobtrusive issues, like climate change, that may not have much of an impact on people's everyday lives.

A third type of agenda-setting that is particularly relevant in the domain of advocacy documentaries is policy agenda-setting. Policy agenda-setting refers to how

much importance (and thus attention) is given to various issues by politicians (McCombs, 2004). Once the media set the public agenda of issue importance, the public agenda may lead to a demand for action to which politicians are compelled to respond. These impacts can be deliberative (policy makers hold formal discussions of policy problems), individualistic (policy makers apply sanctions against particular persons or organizations), and/or substantive (regulatory and legislative changes; Protess et al., 1991).

An excellent example of how this process plays out can be found in the controversy over the issue of hydraulic fracturing ("fracking") of natural gas. Fracking uses high pressure to force millions of gallons of water mixed with chemicals into shale rock to release oil and natural gas in order to collect fossil fuel deposits for human consumption (Johnson, 2012). Although fracking has been practiced for decades, the number of wells has increased from 23,000 in the year 2000 to over 300,000 in 2016 according to the U.S. Energy Information Administration (2016). This practice has always produced environmental damage and health risks but did not emerge as a public issue of concern for several years.

Quantity of coverage theory (QCT) builds on agenda-setting theory and helps explain how environmental hazards become important to the general public (Andrews & Carena, 2010; Mazur, 1990, 2009, 2014). QCT asserts that: 1) people do not pay attention to detailed news coverage but instead absorb simple images of hazards (e.g., polar bears stranded on floating ice as a symbol of climate change); 2) people are more affected by the quantity of news coverage than by its actual content (e.g., the availability heuristic; Tversky & Kahneman, 1974); 3) public concern about a hazard is a function of

its saliency and quantity of news coverage (agenda-setting); 4) the quantity of a coverage is determined more by "external" factors such as issue prominence and availability of sources than by scientific assessments of risk; 5) most environmental issues are first brought to widespread attention by a central group of large news sources (intermedia agenda-setting); 6) rise and fall of issue concern may be a function of the rise and fall of coverage by this central group of news sources; and 7) risk issues covered by American news organizations are often picked up and covered in other countries (Mazur, 2014).

The anti-fracking documentary *Gasland* was first released on HBO in 2010. *Gasland* follows filmmaker Josh Fox's quest to uncover the "truth" about fracking and takes a highly negative view of this drilling process, the companies engaged in it, and the lack of governmental regulation surrounding fracking. One of the most powerful scenes in *Gasland* involves a man lighting his tap water on fire. This simple, hard to counterargue, vivid image became a symbolic representation of fracking and the footage was used in a number of news reports about fracking following the release of the film. Mazur (2014) conducted a study using QCT to explore how fracking emerged as a controversial issue between 2010 and 2012.

Media attention and celebrity endorsement around the film *Gasland* created a slight rise in coverage about fracking (Mazur, 2014). Following the release of *Gasland* and the Deepwater Horizon offshore drilling disaster in the Gulf Coast, *The New York Times* ran a 10-part series focusing on the potential risks and benefits of the process. The story was then picked up by smaller media outlets and this increased coverage and attention across news organizations raised public concern about and opposition to fracking. *Gasland* also played a critical role in bringing international attention to the

issue of fracking – the film was screened in other nations and it got the attention of audiences already skeptical about gas and oil interests.

Although the process by which science and environmental documentaries influence public salience and thus policy demands about an issue can be difficult to predict, it is impossible to deny that documentaries at least have the *potential* to play a major role in shaping public discourse about these issues.

Overview of the Current Research

This literature review has summarized and integrated research from several different areas to reveal how and why documentaries may be able to overcome barriers to environmental behavior. By combining insight from multiple fields of study, the present research aims to empirically test individual-level effects of documentaries about the environment. In order to gain a greater understanding of documentary audiences and impacts, I propose three studies that build off the previously discussed research.

Study 1 – Documentary Audiences

The purpose of this study is to gain a greater understanding of documentary audiences. If documentary effects are guided by audience characteristics and predispositions, it is crucial to gain an understanding of who is actively choosing to view science and environmental documentaries. It is important to understand who is watching these documentaries in the real world in order to understand how they are impacted and how documentaries operate to influence public opinion around environmental issue. This exploratory study seeks to answer the following question:

RQ$_1$*:* What characteristics predict viewership of science/environmental documentaries?

Study 2 – Testing a Documentary Typology

The purpose of this study is to understand how two frequently used documentary narrative formats (expository and participatory) and two types of message goal (educational and advocacy) affect audience acceptance of documentary messages and to develop a model that explains the mediating and moderating mechanisms by which this is accomplished. This study is designed to test the processes by which narrative persuasion operates within documentaries to influence environmental behavior in the form of policy preferences.

Study 2 is an experimental study using abbreviated versions of environmental documentaries that vary in terms of narrative structure and message goal. Specifically, this study utilizes a 2 (expository, participatory) X 2 (educational, advocacy) mixed between- and within-subjects design to test the model shown in Figure 1.

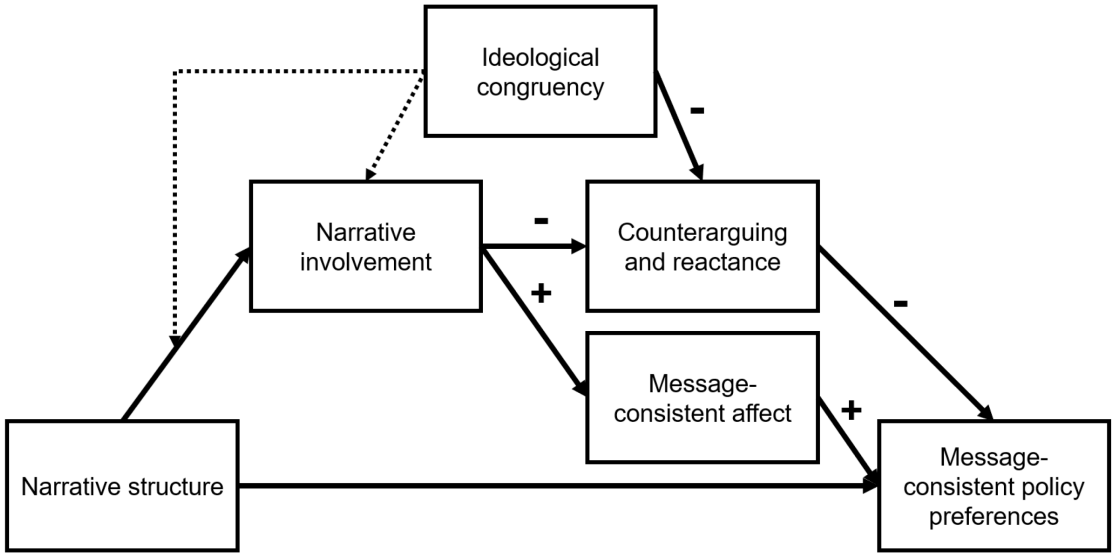

Figure 1. Proposed model for Study 2. This figure specifies the relationships between the variables hypothesized in Study 2. Dashed lines indicate unknown relationships/research questions.

As shown in Figure 1, this experiment will test a process model in order to gain an understanding of *how* documentary formats can influence environmental policy preferences. Based on the literature review and model, this study proposes the following hypotheses and research questions:

H_1: The participatory format will evoke greater narrative involvement (identification and transportation) than will the expository format.

H_2: Advocacy documentaries will evoke greater narrative involvement (identification and transportation) than will educational documentaries.

H_3: Narrative involvement will increase message-consistent affect about the issue.

H_4: Message-consistent affect will increase message-consistent policy preferences.

H_5: Narrative involvement will decrease counterarguing and reactance.

H_6: Counterarguing and reactance will decrease message-consistent policy preferences.

RQ_2: Does ideological congruency affect the level of narrative involvement or the impact of narrative structure on narrative involvement?

Study 3 – Documentary Framing Effects

The purpose of this study is to understand the impact of two specific message design techniques for documentaries – close-ups and episodic vs. thematic framing – on persuasion and to propose a pathway by which these effects occur. This study is designed to provide empirical evidence about documentary message design strategies that

can be applied by practitioners who want to influence attitudes about environmental behaviors.

Study 3 is an experimental study that will uses short documentary videos (approximately 3 minutes) about wolves that vary in framing and the use of close-ups. Specifically, this study utilizes a 2 (episodic, thematic) X 2 (no close-ups, close-ups) mixed between- and within-subjects design to test the model shown in Figure 2. This study tested its hypotheses using a demographically diverse sample recruited through Qualtrics Panels, providing evidence about effects on a broad audience.

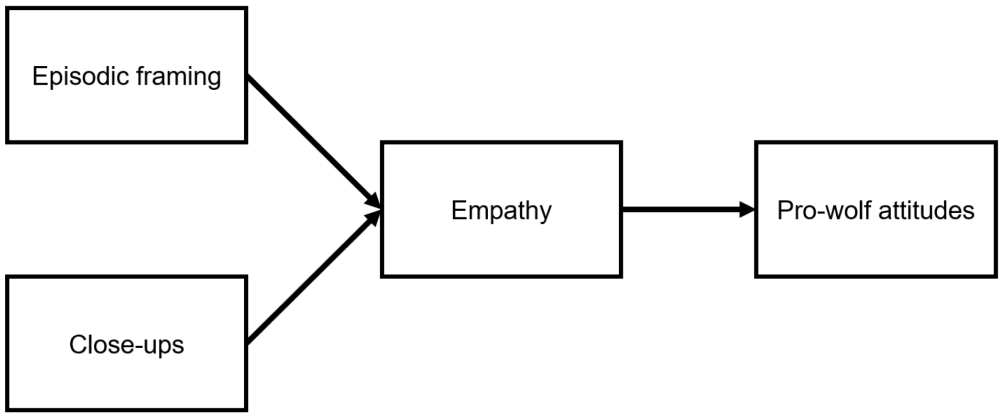

Figure 2. Proposed model for Study 3. This figure specifies the relationships between the variables hypothesized in Study 3.

As shown in Figure 2, this experiment will utilize a serial mediation model to test the impact of frames and visuals on documentary effectiveness. Based on the literature review and model, this study proposes the following hypotheses and research questions:

H_7: The episodic frame will evoke greater empathy than the thematic frame.

H_8: Close-ups will evoke greater empathy than no close-ups.

H_9: Empathy will increase pro-wolf attitudes.

RQ_3: Do any individual difference variables (e.g., demographic characteristics, values, media use behaviors, etc.) influence the effect of the manipulations (framing and use of close-ups) on empathy? Do any of these individual factors cause significant differences in empathy based on experimental condition, i.e., is the effect of condition on empathy moderated by any individual difference characteristics?

Chapter 2: Study 1 – Documentary Audiences

Purpose

As discussed previously, social science research on documentaries is incredibly scant relative to the number of studies examining formats such as news and entertainment. One of the many aspects of documentaries that has not yet been addressed is the fundamental question of who is actually watching these media messages in the real world.

The purpose of Study 1 is to gain a greater understanding of documentary audiences. Study 1 addresses this gap by using three datasets to predict science documentary use in order to uncover what characteristics are associated with an increased likelihood to watch science documentaries. If documentary effects are guided by audience characteristics and predispositions, it is crucial to gain an understanding of who is actively choosing to view science and environmental documentaries. It is important to understand who is watching these documentaries in the real world in order to understand how they are impacted and how documentaries operate to influence public opinion around environmental issues. The use of three datasets instead of one increases the strength of the findings and allows for a more complete answer to the question at hand:

RQ_1: What characteristics predict viewership of science/environmental documentaries?

Dataset 1

Method

Data collection. For this study, a demographically diverse sample of 1,098 adults participated in an online survey between June 25 and July 1, 2012 via a national paid opt-in online survey panel managed by Survey Sampling International. The sample was not randomly selected and thus fully generalizable to the U.S. population; however, the sample was highly heterogenous with demographic characteristics similar to national distributions, allowing for a diverse range of respondents for analysis. A detailed list of measures used in this study is provided in Appendix A.

Independent Variables

Four sets of independent variables were used in this analysis to examine what factors are associated with attention to science and environmental documentaries. The sets of variables used were: (a) socio-demographics; (b) ideology, identity, and knowledge/beliefs; (c) media use behaviors; and (d) attitudes about science.

Socio-demographics. Socio-demographics in this study included measures of age (M = 45.8, SD = 16.4), biological sex (49.8% male), and race (19.8% minority). Educational attainment was measured on an eight-point scale ranging from 1 = *no education* to 8 = *post-graduate training or professional schooling*, with 32.6% of the sample holding a 4-year college degree or higher (M = 5.7, SD = 1.5). In addition, measures of evangelical Christianity and biblical literalism were included to explore whether and how religion might influence documentary use; 34.5% of the sample identified as evangelical Christians, and 27.8% believe that the Bible should be taken literally.

Ideology, identity, and knowledge/beliefs. This set of variables represents highly persistent characteristics of the sample that often guide decision-making and could thus potentially impact one's choice to view science documentaries. Ideology was measured by asking respondents to separately rate how liberal and conservative they were on social issues and on economic issues on a seven-point scale ranging from 1 = *very liberal* to 7 = *very conservative*. These two items were averaged together to create an overall measure of ideology with conservatism coded high (M = 4.0, SD = 1.5, r = .82).

In addition to ideology, this set of variables includes a measure of environmentalist identity, which was assessed with a four-item Likert agreement scale that included items such as "I consider myself and environmentalist" and "Environmentalism is not an important part of who I am" (reverse coded). The four items were combined into a single measure of environmentalist identity (M = 3.9, SD = 1.4, Cronbach's α = .84).

The third variable in this set assessed participants' general scientific literacy, or knowledge of basic science. A slightly modified version of an index employed biannually by the National Science Foundation (2012) to assess the public's understanding of science using "factual science knowledge questions covering a range of science disciplines" (p. 19). Because this study is interested in the characteristics that make people inclined to view science and environmental documentaries, it was prudent to consider the impact of science-specific knowledge rather than just relying on education as a proxy indicator for this construct. The scientific literacy items were scored on a five-point true/false scale with accuracy coded high (i.e., 1 = *not accurate at all*, 5 = *very accurate*). Sample items included "Electrons are smaller than atoms" (true), "Antibiotics

will kill viruses as well as bacteria" (false), and "All radioactivity is man-made" (false). The seven items used in this study were averaged into a single measure of biophysical scientific knowledge ($M = 3.7$, $SD = 0.7$).

The final variable in this set assessed participants' efficacy around science information, i.e., how informed and competent participants feel about science information. Efficacy was measured on a seven-point Likert agreement scale using items such as "I think I am better informed about science than most people" and "It is impossible to figure out the truth about scientific controversies" (reverse coded). Seven items were averaged into an overall measure of science information efficacy ($M = 4.4$, $SD = 1.0$, Cronbach's $\alpha = .77$)

Media use behaviors. There is a growing body of evidence that suggests that rather than competing with one another various forms of media may drive exposure to other messages (Cooper & Tang, 2009; Yuan, 2011). This study therefore included several different media use behaviors in order to examine the impact of each on documentary use. The media use behaviors included in this study can be split into three categories: (a) general media use; (b) topical media use; and (c) partisan news outlets.

General media use. General media was assessed by measuring general TV exposure in average number of hours per day ($M = 4.6$, $SD = 2.7$) and by measuring newspaper use with a seven-point scale ranging from 1 = *never* to 7 = *all the time* ($M = 3.7$, $SD = 2.2$), along with computed measures of entertainment television use and TV news use. The measure of entertainment TV use consisted of items asking respondents how often they viewed each of five major TV genres (crime, comedy, drama, reality, and science fiction/fantasy) on a seven-point scale ranging from 1 = *never* to 7 = *all the time*.

These five items were averaged into a single overall measure of entertainment TV use (*M* = 3.6, *SD* = 1.4, Cronbach's α = .70). Finally, TV news use was assessed with two items asking respondents how often they used local and national broadcast evening news as a source of news and opinions using a seven-point scale ranging from 1 = *never* to 7 = *all the time*. These two items were combined into a single measure of TV news use (*M* = 4.3, *SD* = 1.9, *r* = .72).

Topical media use. Two measures were used to assess attention to particular topics in the news – politics and science/environment – that have the potential to impact documentary viewership. Attention to political news was assessed using two items that asked respondents how much attention they paid to news about politics in general and to news about the 2012 election on a seven-point scale ranging from 1 = *no attention at all* to 7 = *a great deal of attention.* These two items were averaged into a single measure of attention to political news (*M* = 4.3, *SD* = 1.9, *r* = .87).

Similarly, attention to science and environmental news was assessed using two items that asked respondents how much attention they paid to news about science and technology and to news about the environment, measured on the same scale as the political news items. These two items were averaged into a single measure of science and environmental news attention (*M* = 4.2, *SD* = 1.6, *r* = .67).

Partisan news outlets. Because use of partisan news outlets has been linked to differences in knowledge about issues like climate change (Feldman, Maibach, Roser-Renouf, & Leiserowitz, 2012), it is worthwhile to examine whether or not these news outlets also predict an individual's documentary use. Attention to conservative news outlets was assessed using two items that asked how often respondents got their news and

opinions from Fox News and from conservative blogs or websites using a seven-point scale ranging from 1 = *never* to 7 = *all the time*. These two items were averaged an overall measure of conservative news use ($M = 2.6$, $SD = 1.6$, $r = .45$).

Attention to liberal news outlets was assessed using three items that asked how often respondents got their news and opinions from CNN, from MSNBC, and from liberal blogs and websites, measured on the same scale as the conservative news items. These three items were averaged into an overall measure of liberal news use ($M = 2.6$, $SD = 1.6$, Cronbach's $\alpha = .80$).

Attitudes about science. The final set of variables included in this analysis deal with respondents' attitudes about science. These attitudes were assessed using four different scales that address different aspects of science-related attitudes: scientific relativism, scientific deference, reliance on intuition, and trust in the scientific community.

Scientific relativism refers to whether or not a person believes that a universal, objective scientific truth exists. Scientific relativism was assessed using a seven-point Likert agreement scale and included items such as "What counts as truth is defined by power" and "Scientific truths are unbiased" (reverse coded). Six items measuring scientific relativism were combined into an overall measure with relativism scored high, i.e., high scores on this measure indicate that the participant is more likely to believe that there is no objective scientific truth ($M = 3.9$, $SD = 1.0$, Cronbach's $\alpha = .71$).

Scientific deference refers to a predisposition to believe scientific authority. Essentially, those with high deference to scientific authority should hold attitudes toward emerging technologies that are consistent with scientific consensus (Brossard & Nisbet,

2006). Scientific deference was measured using and seven-point Likert agreement scale and included items such as "Scientists, not the public, should make the decisions about what types of policies are needed" and "The public knows best about what policy decisions are needed more so than scientists" (reverse coded). Five items measuring scientific deference were combined into an overall measure with deference scored high (M = 4.2, SD = 1.1, Cronbach's α = .73).

Reliance on intuition refers to whether a person trusts his or her "gut feelings" versus scientific evidence when judging scientific arguments. Reliance on intuition was assessed using a seven-point Likert agreement scale that included items such as "I trust my gut to tell me what's true and what's not" and "I rely on reason to figure out what the truth is" (reverse coded). Six items were combined into an overall measure with reliance on intuition scored high, i.e., high scores on this measure indicate that the participant is more likely to rely on his/her intuition than on scientific reasoning when making judgments about scientific issues (M = 4.3, SD = 0.8, Cronbach's α = .60).

The final measure in this set, trust in the scientific community, refers to how much confidence a person has in the trustworthiness of the scientific community. Scientific trust was assessed using a seven-point Likert agreement scale that included items such as "I trust the scientific community to do what is right" and "The scientific community is dishonest" (reverse coded). Four items measuring scientific trust were combined into an overall measure with trust scored high (M = 4.8, SD = 1.2, Cronbach's α = .84).

Dependent Variable

The purpose of this analysis is to determine what individual characteristics predict one's likelihood of viewing science documentaries. The measure of documentary use consisted of items asking respondents how often they viewed each of four major science documentary genres (nature and wildlife, science and technology, outdoor adventure, and space and astronomy) on a seven-point scale ranging from 1 = *never* to 7 = *all the time*. These four items were averaged into a single overall measure of science documentary use that served as the dependent variable for this study ($M = 3.4$, $SD = 1.6$, Cronbach's $\alpha = .87$).

Analyses

Hierarchical ordinary least squares (OLS) regression was used to test the relative influence of the variables and variable sets described above on science documentary use. This process produces a series of models with each subsequent model adding an additional set of independent variables to explain science documentary use.

Results

The results of this analysis are presented in Table 1, with standardized coefficients (β) and *p*-values reported for each variable in the models. Model 1 indicates that socio-demographic control variables accounted for 6.1% of the variance in science documentary use ($p \leq .001$). Model 2 added political ideology (conservatism coded high), environmentalist identity, scientific literacy, and science information efficacy, explaining an additional 10.3% of the variance in science documentary use ($p \leq .001$).

Models 3 and 4 added media use variables as predictors. Model 3 added the general media use and topical media use items and explained an additional 24.4% of the

variance in science documentary use ($p \leq .001$). Model 4 added the partisan news outlets as predictors, explaining an additional 5.8% of the variance in science documentary use ($p \leq .001$).

Finally, Model 5 added the four measures of scientific attitudes (scientific relativism, scientific deference, reliance on intuition, and trust in the scientific community) and explained an additional 0.7% of the variance in science documentary use ($p \leq .05$). Overall, the final model explained a total of 46.8% of the variance in science documentary use.

Examining the influence of each predictor in Model 5 reveals that several factors are associated with increased science documentary use. The demographic variables that significantly predicted science documentary use in the final model were age ($\beta = -.08$, $p \leq .01$), education ($\beta = -.08$, $p \leq .01$), sex (male coded high, $\beta = .11$, $p \leq .001$), and evangelical Christianity ($\beta = .05$, $p \leq .05$). Younger ages, lower education levels, being male, and being and evangelical Christian were associated with increased science documentary use.

Of the four ideology, identity, and knowledge/beliefs variables, only scientific literacy ($\beta = .07$, $p \leq .01$) and science information efficacy ($\beta = .14$, $p \leq .001$) significantly predicted scientific documentary use in the final model. Both variables were positively associated with science documentary use, indicating that those with higher general science knowledge and those who believe themselves capable of making sense of controversial science are more likely to view science documentaries than are

Table 1. Dataset 1: OLS Regression Predicting Science Documentary Use

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
	β	β	β	β	β
Age	-.16***	-.15***	-.14***	-.09**	-.08**
Educational attainment	.01	-.04	-.06*	-.08**	-.08**
Sex (male high)	.17***	.13***	.12***	.10***	.11***
Race (minority high)	.05	.04	.04	.01	.01
Biblical literalism	.05	.07*	.02	.01	.01
Evangelical Christianity	.05	.08*	.07**	.05	.05*
Ideology (conservative high)		.00	.06*	.02	.03
Environmentalist identity		.18***	.04***	.04	.04
Scientific literacy		-.03	.00	.06*	.07**
Science information efficacy		.25***	.16***	.14***	.14***
TV use			.06*	.06*	.07**
Newspaper use			.04	-.02	-.02
TV news use			.02	-.03	-.03
Entertainment TV use			.24***	.17***	.17***
Attention to political news			-.07*	-.17***	-.16***
Attention to science/environmental news			.41***	.38***	.37***
Attention to conservative news				.22***	.23***
Attention to liberal news				.17***	.17***
Scientific relativism					.01
Reliance on intuition					-.08**
Scientific deference					.07*
Trust in science					.03
Adjusted R^2	.061	.162	.405	.463	.468

Standardized coefficients reported.
* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

those with less general science knowledge or science information efficacy. Interestingly, political ideology was only a significant predictor in Model 3 ($\beta = .06$, $p \leq .05$), with conservatism associated with an increased likelihood of science documentary use.

The general and topical media use variables added in Model 3 produced the greatest increase in the explanatory power, as these variables alone explained 24% of the variance in science documentary use. Within this set of predictors, general TV exposure ($\beta = .07$, $p \leq .01$), entertainment TV use ($\beta = .17$, $p \leq .001$), political news attention ($\beta = -.16$, $p \leq .001$), and science/environmental news attention ($\beta = .37$, $p \leq .001$) had a significant impact on science documentary use in the final model. General TV exposure, entertainment use, and science/environmental news attention were associated with increased science documentary use, whereas political news attention was negatively associated with science documentary use. This indicates that viewers who are more likely to pay attention to political news are less likely to frequently view science documentaries than are those who pay limited attention to political news.

Attention to partisan news outlets strongly predicted science documentary use in the final model. Both attention to conservative news ($\beta = .23$, $p \leq .001$) and attention to liberal news ($\beta = .17$, $p \leq .001$) were associated with increased science documentary use, with attention to conservative news being a stronger predictor than was attention to liberal news.

Finally, the scientific attitude variables added in Model 5 varied in their influence on science documentary use. Scientific relativism and trust in the scientific community were not associated with science documentary use. However, both reliance on intuition

(β = -.08, $p \leq .01$) and scientific deference (β = .07, $p \leq .05$) predicted science documentary use. The association between reliance on intuition and science documentary use was negative, indicating that those who are *less* likely to rely on intuition when judging scientific arguments were *more* likely to view science documentaries. The association between scientific deference and science documentary use was positive, indicating that those who are predisposed to believe scientific authority are also predisposed to view science documentaries.

Discussion

The current research examined the correlates of science documentary viewing using hierarchical OLS regression to gain an understanding of the audience for this genre. The aim of this study was to answer RQ_1: What characteristics predict viewership of science/environmental documentaries?

To this end, the results of the study indicate that several factors increase the likelihood of science documentary use to varying degrees. The strongest predictor of science documentary use was attention to science/environmental news – this is no surprise as it stands to reason that someone interested in science and environmental news would frequently choose documentaries as a source of such news.

The various media use behaviors in the model had a large impact on science documentary use. In addition to science/environmental news attention, overall TV use, entertainment TV use, and attention to both conservative and liberal news outlets significantly predicted documentary viewership. This suggests that those who consume more media in general are more likely to consume science documentaries and that the more similar the message being compared is to science documentaries the greater

predictive power that media use behavior has. Interestingly, only one media use behavior was *negatively* associated with science documentary use – attention to political news. Those who reported paying more attention to political information were significantly *less* likely to view science documentaries. In contrast to this negative association, viewing politically partisan news channels increases one's likelihood of science documentary use.

Individual demographic characteristics and beliefs also appear to exert an influence on one's likelihood of viewing science documentaries. The findings indicate that younger individuals and those with lower educational attainment are more likely to watch science documentaries than are older and more highly educated individuals. This outcome may be a function of differences in previous knowledge or exposure – those with less life experience (younger) and/or those who are less educated presumably have more to potentially learn from science documentaries and so may be more inclined to seek out this media content than those who are more likely to have already seen similar messages either through formal education or through exposure over their lifetimes. Males and evangelical Christians were also significantly more likely to view science documentaries than were females and those who do not identify as evangelical Christians, respectively.

Science information efficacy appears to play an important role in science documentary use. Indeed, if one is confident in one's own ability to seek out and process science information it stands to reason that the same individual would frequently view science and environmental documentaries as sources of such information. These same individuals are likely to be high in scientific literacy, indicating that their beliefs about their own science information efficacy are likely grounded in reality. By watching

science and environmental documentaries, individuals high in science information efficacy are confirming and strengthening their own beliefs about their ability of effectively consume science information.

Finally, certain attitudes towards science and scientists can impact the likelihood of science documentary use. Unsurprisingly, those whose attitudes toward science are largely in line with scientific consensus are more likely to view science documentaries which, for the most part, tend to match the views of the scientific community and thus the viewers' own beliefs/knowledge about science. In addition, deference to scientific authority has been associated with greater acceptance of new technology (Brossard & Nisbet, 2006). Science documentaries frequently focus on new groundbreaking findings or emergent crises and so those who accept scientific findings as truth may be more likely to pursue new information about science as well. Deference to scientific authority is a value predisposition largely shaped by the U.S. educational system. Students are taught throughout their education that science is an objectively neutral system that increases our knowledge of the natural world (Irwin, 2001).

Reliance on intuition contradicts scientific deference as those who rely on intuition favor their own preexisting beliefs and their feelings about science when making judgments. It is no surprise then that although the impact of reliance on intuition is almost equivalent to that of scientific deference the two variables exert opposite effects on science documentary use. Those who rely on intuition are *less* likely to view science documentaries, while those with greater scientific deference are *more* likely to view science documentaries.

These findings paint a complex portrait of science documentary viewership that has a high degree of face validity. Because the present study aims to answer a research question rather than to test hypotheses, the results cannot be compared and statistically tested against a null hypothesis (H_0). Instead, a similar analysis was run on two additional datasets in order to support these findings via convergent validity. If the similar variables are associated with science documentary use across the three datasets, this supporting evidence will strengthen this study's claims about the characteristics of science documentary audiences.

Dataset 2

In order to gain a more complete understanding of science documentary audience characteristics, a secondary analysis was performed on a large, statistically representative dataset. Because this analysis was conducted using data collected for a different purpose, the measures used function as somewhat less precise approximations of the constructs of interest. However, Dataset 2 adds important information about science documentary audiences because this analysis (a) replicates the Dataset 1 analysis, increasing the strength of potential convergent findings; and (b) is more generalizable to the U.S. population than is Dataset 1 because it uses a statistically representative sample.

Method

Data Collection

For this study, a secondary data analysis was conducted using data collected for the Ohio State University 2012 Election Study. A demographically diverse sample of 1,289 adults participated in this online survey administered by Knowledge Networks. This survey company utilizes probability-based sampling to generate a statistically

representative sample of the U.S. population using phone and mail recruitment. This sample is thus highly generalizable and allows for a diverse range of respondents for analysis that matches U.S. population characteristics.

Independent Variables

As with Dataset 1, four sets of independent variables were used in this analysis to examine what factors are associated with attention to science and environmental documentaries. The sets of variables used were: (a) socio-demographics; (b) ideology and identity; (c) media use behaviors; and (d) attitudes about science. Although the sets of variables used in this study mirror those used in Dataset 1, the actual variables within these sets measure many of the constructs involved in a different way. A detailed list of measures used in this study is provided in Appendix B.

Socio-demographics. Socio-demographics in this study included measures of age (M = 49.9, SD = 16.8), biological sex (49.8% male), and race (22.5% minority). Educational attainment was measured on a fourteen-point scale ranging from 1 = *less than high school* to 14 = *professional or doctorate degree*, with 29.1% of the sample holding a 4-year college degree or higher (M = 10.1, SD = 2.0). In addition, measures of evangelical Christianity and biblical literalism were included to explore whether and how religion might influence documentary use; 28.6% of the sample identified as evangelical Christians, and 25.2% believe that the Bible should be taken literally.

Ideology and identity. This set of variables represents highly persistent characteristics of the sample that may guide decision-making and could thus potentially impact one's science documentary use. In this dataset, ideology was measured using a single item asking respondents to rate how liberal or conservative they were on a scale

ranging from 1 = *very liberal* to 10 = *very conservative* resulting in a measure similar to that in Dataset 1 with conservatism coded high (M =6.1, SD = 2.1).

In addition to ideology, this dataset contained two measures that serve as proxies for environmentalist identity. The first item asked if respondents belong to any "environmental groups" (1 = *yes*, 0 = *no*; 2.9% of the sample). The second item asked if respondents ever participated in the "Environmental Rights Movement" (1 = *yes*, 0 = *no*; 2.6% of the sample). If a respondent answered "yes" to *either* item, the respondent received a score of 1 for this variable (4.4% of the sample); otherwise respondents received a score of 0 for this variable.

Media use behaviors. As with Dataset 1, this analysis included several different media use behaviors in order to examine the impact of each on documentary use, although these constructs were measured somewhat differently in Dataset 2. However, the media use behaviors analyzed can be split into the same three categories as in Dataset 1: (a) general media use; (b) topical media use; and (c) partisan news outlets.

General media use. General media use was assessed by measuring general TV exposure, along with computed measures of entertainment television use and TV news use. Th general TV exposure measure asked respondents how often they watched television was scored on a five-point scale that was reverse coded to match the direction of the TV use variable in Dataset 1 such that higher TV use resulted in higher scores on this variable, which thus ranged from 1 = *never* to 5 = *every day*. (M = 4.6, SD =0.8). The measure of entertainment TV use consisted of items asking respondents how often they viewed each of seven major genres of broadcast programs (crime investigation programs, sitcoms, animated comedies, reality programs, dramas, action/adventure series, and

science fiction programs) on a five-point scale ranging from 1 = *never* to 5 = *three times a week or more often*. These seven items were averaged into a single overall measure of entertainment TV use (M = 2.5, SD = 0.9, Cronbach's α = .81). Finally, TV news use was assessed using two items asking respondents how often they watched local and national broadcast evening news using a five-point scale ranging from 1 = *never* to 5 = *three times a week or more*. These two items were combined into an overall measure of TV news use (M = 3.3, SD = 1.4, r = .69).

Topical media use. As with Dataset 1, two measures were used to assess attention to particular topics in the news – politics and science/environment – that have the potential to impact science documentary use. Attention to political news was assessed using two items that asked respondents how much attention they paid to news about politics in general and to news about the 2012 election on a seven-point scale that was reverse coded such that 1 = *no attention/interest at all* to 7 = *a great deal of attention/interest.* These two items were averaged into a single measure of attention to political news (M = 2.5, SD = 0.8, r = .56).

Attention to science and environmental news was measured the same way as in Dataset 1 by using two items that asked respondents how much attention they paid to news about science and the environment on a seven-point scale ranging from 1 = *no attention at all* to 7 = *a great deal of attention*. These two items were averaged together into a single measure of science and environmental news attention (M = 4.1, SD = 1.5, r = .69).

Partisan news outlets. For Dataset 2, measures of attention to conservative and liberal news outlets were scored dichotomously (1 = *yes*, 0 = *no*). Attention to

conservative news outlets was assessed using a single item that asked respondents if they've watched Fox News Channel in the past 6 months (38.4% of the sample answered yes). Attention to liberal news outlets was assessed using two items that asked respondents if they've watched CNN and MSNBC, respectively, in the past 6 months. If a respondent answered "yes" to *either* item, the respondent received a score of 1 for this variable (39.3% of the sample); otherwise respondents received a score of 0 for this variable. This was done to keep attention to conservative and liberal news outlets on the same scale.

Attitudes about science. Because this analysis was conducted on a survey that did not focus heavily on science and environmental communication, the available measures of attitudes toward science were limited. Two different measures were used to address science-related attitudes: a measure of support for environmental protection and trust in the scientific community.

Support for environmental protection involved a single item that was measured using a ten-point bipolar matrix. Respondents were asked to indicate they agree with competing phrases on either side of the measure. This item was reverse coded such that a score of 1 indicates complete agreement with the phrase "We should encourage economic growth without environmental restrictions" and a score of 10 indicates complete agreement with the phrase "We should protect the environment and try to make our cities and countryside more beautiful." The item thus represents support for environmental protection, which is coded high ($M = 6.6$, $SD = 2.6$).

The second measure used to examine the relationship between attitudes about science and science documentary use was a scale assessing trust in the scientific

community. As in Dataset 1, this scale refers to how much confidence a person has in trustworthiness of the scientific community, rated on a seven-point Likert agreement scale. Unlike in Dataset 1, trust in science consists of six items in this analysis, including three of the same items used previously. These six items were averaged together into an overall measure with trust scored high (M = 4.5, SD = 0.9, Cronbach's α = .81).

Dependent Variable

The dependent variable, science documentary use, was measured very differently in this Dataset than in Dataset 1. Science documentary use was assessed by using channels that frequently contain science documentary content as a proxy for science documentary viewing because attention to documentaries was not directly measured in Dataset 2. A summative (count) index was created for each participant using items that asked participants if they had viewed a given channel "within the last 6 months." The channels used for this index were: Animal Planet (viewed by 30.9 % of the sample), Discovery Channel (viewed by 44.5% of the sample), Discovery Health (viewed by 1.9% of the sample), National Geographic Channel (viewed by 33.2% of the sample), NatGeo Wild (viewed by 4% of the sample), the Outdoor Channel (viewed by 2.8% of the sample), Planet Green (viewed by 6% of the sample), the Science Channel (10.8% of the sample), and Discovery en Español (viewed by 0.7% of the sample). Participant scores on this index increased by one for each channel the participant reported viewing, resulting in a proxy measure of science documentary use that ranged from 0 to 8 (M =1.3, SD = 1.6). About 44.5% of the sample had a score of 0 on this measure, indicating that nearly half of the sample did not view these channels. Although this is only a proxy measure of science documentary viewership, for ease of understanding the dependent

variable in this study will be referred to as "science documentary use" to match the language used in the previous analysis.

Analyses

As in the previous analysis, hierarchical ordinary least squares (OLS) regression was used to test the relative influence of the variables and variable sets described above on science documentary use. Unlike in Dataset 1, missing responses for various items were much more frequent. When this occurred, the missing responses were replaced with the mean value for the given variable. Had cases with missing items been removed from the analysis completely the sample size would be much smaller, reducing the power of the following results.

Results

The results of this analysis are presented in Table 2, with standardized coefficients (β) and *p*-values reported for each variable in the models. Model 1 indicates that socio-demographic control variables accounted for 2.8% of the variance in science documentary use ($p \leq .001$). Model 2 added political ideology and a proxy measure of environmentalist identity, which did not explain any additional variance in science documentary use ($p = n.s.$).

Models 3 and 4 added media use variables as predictors. Model 3 added the general media use and topical media use items and explained an additional 8.3% of the variance in science documentary use ($p \leq .001$). Model 4 added the partisan news outlets as predictors, explaining an additional 10.8% of the variance in science documentary use ($p \leq .001$).

Table 2. Dataset 2: OLS Regression Predicting Science Documentary Use

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
	β	β	β	β	β
Age	.15***	.15***	.07*	-.01	-.01
Educational attainment	-.04	-.04	-.09**	-.11***	-.11***
Sex (male high)	.07**	.07**	.05	.06*	.05*
Race (minority high)	.04	.04	.03	.01	.01
Biblical literalism	-.10**	-.10**	-.07*	-.05	-.04
Evangelical Christianity	.03	.03	.03	.01	.02
Ideology (conservative high)		.01	.03	.02	.03
Environmentalist identity		.02	-.01	.02	.02
TV use			.18***	.14***	.14***
TV news use			-.02	-.07*	-.06*
Entertainment TV use			.08*	.06*	.06*
Attention to political news			.09**	.03	.02
Attention to science/environmental news			.18***	.16***	.15***
Attention to conservative news				.19***	.19***
Attention to liberal news				.26***	.25***
Environmental protection support					-.01
Trust in science					.06
Adjusted R^2	.028	.028	.107	.215	.216

Standardized coefficients reported.
* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

Finally, Model 5 added two measures of attitudes about science, which only explained and additional 0.2% of the variance in science documentary use (p = *n.s.*). Overall, the model explained a total of 21.6 % of the variance in science documentary use.

Examining the influence of each predictor in Model 5 reveals several factors that are associated with increased science documentary use. The demographic variables that significantly predicted science documentary use in the final model were educational attainment ($\beta = -.11$, $p \leq .001$) and sex ($\beta = .05$, $p \leq .05$). Those with lower education levels and being male were associated with increased science documentary use.

The second model added political ideology and environmentalist identity, neither of which significantly predicted science documentary use in any of the models.

The general and topical media use variables quadrupled the predictive power of the model and these variables alone explained 8.3% of the variance in science documentary use. Within this set of predictors, general TV exposure ($\beta = .14$, $p \leq .001$), TV news use ($\beta = -.06$, $p \leq .05$), entertainment TV use ($\beta = .06$, $p \leq .05$), and attention to science/environmental news ($\beta = .15$, $p \leq .001$) had a significant impact on science documentary use in the final model. General TV use, entertainment TV use, and attention to science/environmental news were associated with an increase in science documentary use, whereas TV news use was negatively associated with science documentary use. This means that viewers who are more likely to watch local and national broadcast evening news are less likely to frequently view science documentaries than are those who pay limited attention to evening news.

As in Dataset 1, attention to partisan news outlets strongly predicted science documentary use in the final model. These two variables alone doubled the predictive power of the analysis and together explained 10.8% of the variance in science documentaries when added to the model. Both attention to conservative news ($\beta = .19$, $p \leq .001$) and attention to liberal news ($\beta = .25$, $p \leq .001$) were associated with increased science documentary use, but unlike with Dataset 1 attention to liberal news was a slightly stronger predictor than was attention to conservative news instead of the other way around.

Finally, the scientific attitude variables added to the model had no influence on science documentary use. The addition of both variables only explained an additional 0.2% of the variance in science documentary use when added to the model, indicating that these variables (as measured in Dataset 2) have very little impact on the dependent variable. Trust in science was marginally significant ($\beta = .06$, $p = .07$), indicating that this variable is somewhat more associated with differences in science documentary viewing than is the measure of support for environmental protection.

Discussion

The way science documentary use was measured in this dataset limited the predictive power of the variables in the model because the dependent variable did not directly reflect the construct of interest. Unlike the measure in Dataset 1, which asked respondents to report how often they viewed *science documentary genres*, the dependent variable was only based on respondents' viewing of *channels that frequently air science documentaries*. The measurement instrument used in Dataset 2 was weaker than that used in Dataset 1 for two primary reasons: (1) the measurement excluded those who

watch science documentaries through other outlets, such as Netflix; and (2) the measurement may have included individuals who watch mainly non-science programming on these channels (e.g., *Naked and Afraid*, a survivalist reality show, on the Discovery Channel). The imprecision of the dependent variable in Dataset 2 may explain differences in results from Dataset 1 as well as why the final model in Dataset 2 only explained less than half of the variance in science documentary use than did the final model in Dataset 1 (21.6% and 46.8%, respectively).

Despite the fact that this and other measures in the analyses were rather blunt instruments to approximate the variables of interest, the findings of the Dataset 2 analysis largely mirror the findings of the Dataset 1 analysis. There were, however, some notable differences between the two analyses.

In Dataset 1, the strongest predictor was attention to science/environmental news; in Dataset 2 the strongest predictor was attention to liberal news, followed by attention to conservative news and then attention to science/environmental news was the third-most impactful variable in the model. All three media use behaviors had a positive relationship with the dependent variable, once again suggesting that those who consume more media in general are more likely to consume science documentaries. The relationship between science documentary news use and attention to both partisan news sources was once again strong and positive, indicating that individuals who consume a lot of partisan news are more likely to view science documentaries, regardless of whether they prefer conservative or liberal news outlets.

Once again, the media use behaviors in the model had the largest impact on science documentary use. In addition to partisan news and attention to

science/environmental news, overall TV use, entertainment TV use, and TV news use were all significantly associated with science documentary viewership. Whereas overall and entertainment TV use were positively associated with science documentary use, the only media behavior variable that was negatively associated with science documentary use was TV news use. This indicates that those who view a lot of local and national television news are less likely to also watch science documentaries than are those who consume TV news less frequently.

Similar to Dataset 1, a few individual demographic characteristics were also found to influence one's likelihood of viewing science documentaries. The analysis indicates that individuals with lower educational attainment and males are more likely to view science documentaries, reinforcing the findings of the Dataset 1 analysis. However, unlike in the previous analysis, age was not a significant predictor of science documentary use in the final model, although it was significant in Models 1, 2, and 3. This suggests that there may be shared variance between age and attention to partisan news outlets (added in Model 4) such that the effects of the latter cancel out the effects of the former.

Lastly, neither of the variables assessing science attitudes had a significant impact on science documentary use, although trust in science was marginally significant. These variables may have lacked in effectiveness due to how the dependent variable was measure or to other differences in the way information was collected in this study. For example, the bipolar matrix used to measure support for environmental protection pits environmental protection against economic growth. Such a dichotomy ignores the nuances involved in environmental policymaking by suggesting that protecting the

environment always restricts economic growth and that people must strike a balance between these competing needs. As a result, participants may have been less likely to support environmental protection as according to this item doing so means less support for economic growth.

Combined with the Dataset 1 findings, this analysis adds to our understanding of science documentary audiences. The Dataset 2 findings confirm the associations between science documentary use and lower educational attainment, being male, TV use, entertainment TV use, attention to science/environmental news, and attention to partisan news outlets discovered in the Dataset 1 analysis. In order to further confirm and strengthen these results, a third dataset was analyzed in a similar manner to Datasets 1 and 2. If similar variables are found to be associated with science documentary use in all three datasets, the analyses will provide powerful convergent evidence about the characteristics of science documentary viewers.

Dataset 3

As a final means of developing a well-supported profile of science documentary audiences, a third analysis was performed using previously collected data. This dataset differs from Dataset 2, however, in that measures related to science documentary use were deliberately included when this dataset was collected, including the items that comprise the dependent variable. The results of this analysis are therefore more directly comparable to those found in Dataset 1, with the additional benefit that the data used in the current analysis was collected more recently than were the other two datasets.

Method

Data Collection

A total of 1,879 respondents participated in an online survey administered in March 2015 through Qualtrics with the sample drawn from a national survey panel managed by Survey Sampling International. Although the sample was not randomly selected and thus not fully generalizable to the U.S. population as a whole, it was selected with highly heterogeneous characteristics similar to national distributions.

Independent Variables

Four sets of independent variables were used in this analysis to examine what factors are associated with attention to science and environmental documentaries. The sets of variables used were: (a) socio-demographics; (b) ideology, identity, and knowledge/beliefs; (c) media use behaviors; and (d) attitudes about science. A detailed list of measures used in this study is provided in Appendix C.

Socio-demographics. Several socio-demographic variables were included in the model, including age (M = 46.7, SD = 16.1), biological sex (46.2% male), and race (22.0% minority). Educational attainment was assessed on an eight-point scale (1 = *none at all*, 8 = *post-graduate degree or training after college*), and 35.6% of the respondents reported having completed a four year college degree or higher (M = 5.8, SD = 1.4). In addition, measures of evangelical Christianity and biblical literalism were included to explore whether and how religion might influence documentary use; 27.6% of the sample identified as evangelical Christians, and 23.2% believe that the Bible should be taken literally.

Ideology and knowledge/beliefs. Political ideology was assessed by asking respondents to separately rate how liberal and conservative they were on social issues and on economic issues on a seven-point scale ranging from 1 = *very liberal* to 7 = *very conservative*. These two items were averaged together to create an overall measure of ideology with conservatism coded high (M = 3.9 SD = 1.5, r = .82).

Scientific literacy was assessed using ten items employed biannually by the National Science Foundation (2012) to measure the accuracy of public beliefs about science and included many of the same scientific literacy items used in Study 1. Each participant was randomly assigned to answer five out of the ten items on a five-point true/false scale with accuracy coded high (i.e., 1 = *not accurate at all*, 5 = *very accurate*). A summative index of correct answers was created for each participant, with both "definitely true" and "probably true" considered correct for the true items and "definitely false" and "probably false" considered correct for the false items. Participant scores ranged from one to five (M = 3.3, SD = 1.1).

Media use behaviors. As in Study 1, this study included several different media use behaviors in order to examine the impact of each on documentary use. The media use behaviors included in this study can be split into three categories: (a) general media use; (b) topical media use; and (c) partisan news outlets.

General media use. General media use was assessed by measuring general TV exposure in terms of hours per day during the typical week and was scored on a twenty-five-point scale (1 = n*ever watch TV*, 25 = *twelve or more hours a day*). The average amount of daily TV viewing for the sample was four to five hours per day (M = 10.9, SD = 5.9). Newspaper use was assessed using three items measured on seven-point scale

asking respondents how often they read the local daily newspaper, the *New York Times*, and *The Wall Street Journal* (respectively) using a scale that ranged from 1 = *never* to 7 = *all the time* (M = 2.6, SD = 1.1, Cronbach's α = .67). Attention to entertainment media was assessed using five items measured on a seven-point scale asking respondents how often they watch various types of entertainment television (1 = *never*, 7 = *all the time*). The five entertainment genres used were crime, comedy, drama, reality, and science fiction/fantasy. These five items were averaged together to create an overall measure of attention to entertainment television (M = 3.8, SD = 1.4, Cronbach's α = .70). Finally, TV news use was assessed with two items asking respondents how often they used local and national broadcast evening news as a source of news and opinions using a seven-point scale ranging from 1 = *never* to 7 = *all the time*. These two items were combined into a single measure of TV news use (M = 4.4, SD = 1.9, r = .68).

Topical media use. Attention to political news was assessed using a single item on a seven-point scale (1 = n*o attention at all*, 7 = *a great deal of attention*). The item asked how much attention respondents paid to "news about national politics" (M = 4.5, SD = 1.8).

Attention to science news was assessed by averaging two items measured on a seven-point scale (1 = n*o attention at all*, 7 = *a great deal of attention*). The items asked how much attention respondents paid to "news about environmental issues" and "news about science and technology" (M = 4.3, SD = 1.5, r = .58).

Partisan news outlets. The measures of partisan news use in this study were identical to those used in Dataset 1 with one exception – the measure of conservative news attention included an additional item about the use of conservative talk radio shows.

Attention to conservative news outlets was assessed using three items that asked how often respondents got their news and opinions from Fox News, from conservative blogs or websites, and from conservative talk radio shows (respectively) using a seven-point scale ranging from 1 = *never* to 7 = *all the time*. These three items were averaged into an overall measure of conservative news use (M = 2.3, SD = 1.4, Cronbach's α = .77).

As in Dataset 1, attention to liberal news outlets was assessed using three items that asked how often respondents got their news and opinions from CNN, from MSNBC, and from liberal blogs and websites (respectively), measured on the same scale as the conservative news items. These three items were averaged into an overall measure of liberal news use (M = 2.6, SD = 1.4, Cronbach's α = .74).

Attitudes about science and discussion behaviors. The final set of variables in this analysis deal with respondents' attitudes about science, as well as their penchant for discussing issues with others. Science attitudes were assessed by measuring scientific deference and reservations about science.

To assess scientific deference, this study used an expanded version of the scale described in detail in Dataset 1. This scale measures a predisposition to believe scientific authority using twelve items on a seven-point Likert agreement scale. These items were combined into an overall measure with deference coded high (M = 4.2, SD = 1.0, Cronbach's α = .89).

A new measure of attitudes about science was included in this analysis. This scale assessed participants' reservations about science and scientific progress. Essentially, those with high reservations about science believe that scientific progress is more harmful than it is beneficial. Reservations about science were measured using a

seven-point Likert agreement scale and included items such as "We depend too much on science and not enough on faith" and "Scientific research is essential for improving the quality of human lives" (reverse coded). Eleven items measuring reservations about science were combined into an overall measure with reservations scored high (M = 3.1, SD = 0.9, Cronbach's α = .84).

Additionally, this study included measures of discussion behavior not included in Datasets 1 and 2. These items asked how often respondents engaged in both online and offline discussion with others using an eleven-point scale ranging from 1 = *never* to 11 = *very often*. One item asked respondents how often they talk about public affairs with others (M = 5.5, SD = 2.9). The other item asked respondents how often they talk about science-related issues with others (M = 4.8, SD = 2.8). Although these items were relatively correlated with one another (r = .72), they were entered into the model separately because politics and science are treated separately throughout these analyses.

Dependent Variable

The dependent measure for this study was science documentary viewership. Science documentary viewership was calculated by combining four items regarding viewership of four major scientific documentary genres through TV shows or films – nature and wildlife, science and technology, outdoor adventure, and space and astronomy. These items asked how often the participant viewed each type of programming on a seven-point scale (1 = *never*, 7 = *all the time*). Overall science documentary viewership was measured by averaging these four items (M = 3.3, SD = 1.6, Cronbach's α = .88).

Analyses

As in the previous analyses, hierarchical ordinary least squares (OLS) regression was used to test the relative influence of the variables and variable sets described above on science documentary use.

Results

The results of this analysis are presented in Table 3, with standardized coefficients (β) and *p*-values reported for each variable in the models. Model 1 indicates that socio-demographic control variables accounted for 5.3% of the variance in science documentary use ($p \leq .001$). Model 2 added political ideology (conservatism coded high) and scientific literacy, explaining an additional 1.2% of the variance in science documentary use ($p \leq .001$).

Models 3 and 4 added media use variables as predictors. Model 3 added the general media use and topical media use items and explained an additional 35.0% of the variance in science documentary use ($p \leq .001$). Model 4 added the partisan news outlets as predictors, explaining an additional 3.6% of the variance in science documentary use ($p \leq .001$).

Finally, Model 5 added the two measures of scientific attitudes (scientific deference and reservations about science), along with two measures assessing respondents' proclivity for discussing public affairs and science, respectively. This last set of variables explained an additional 4.3% of the variance in science documentary use ($p \leq .001$), driven largely by the measures of discussion behaviors. Overall, the final model explained a total of 49.3% of the variance in science documentary use.

Examining the influence of each predictor in Model 5 reveals that several factors are associated with increased science documentary use. The demographic variables that significantly predicted science documentary use in the final model were education (β = -.09, $p \leq .001$), sex (male coded high, β = .11, $p \leq .001$), and evangelical Christianity (β = .06, $p \leq .01$). Younger ages, lower education levels, being male, and being and evangelical Christian were associated with increased science documentary use.

Unlike in Datasets 1 and 2, ideology was a significant predictor of science documentary use such that conservatives were more likely to view science documentaries than were liberals (β = .04, $p \leq .05$). As in Dataset 1, scientific literacy was positively associated with science documentary use, indicating that those with higher general science knowledge are more likely to view science documentaries than are those with less general science knowledge (β = .07, $p \leq .001$).

As in Datasets 1 and 2, the general and topical media use variables added in Model 3 had a profound impact on the model's explanatory power as these variables alone explained 35% of the variance in science documentary use. Within this set of predictors, general TV exposure (β = .07, $p \leq .001$), entertainment TV use (β = .13, $p \leq .001$), and science/environmental news attention (β = .28, $p \leq .001$) had a significant impact on science documentary use in the final model. Like the previous analyses, general TV exposure, entertainment use, and science/environmental news attention were associated with increased science documentary use.

Attention to partisan news outlets strongly predicted science documentary use in the final model. Both attention to conservative news (β = .14, $p \leq .001$) and attention to

Table 3. Dataset 3: OLS Regression Predicting Science Documentary Use

Variable	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β
Age	-.18***	-.18***	-.10***	-.05*	-.01
Educational attainment	.00	-.01	-.08***	-.07***	-.09***
Sex (male high)	.14***	.14***	.14***	.13***	.11***
Race (minority high)	.02	.02	.00	-.02	.00
Biblical literalism	-.05	-.02	-.03	-.05*	-.04
Evangelical Christianity	.05*	.07**	.07***	.06**	.06**
Ideology (conservative high)		-.06*	.07***	.04**	.04*
Scientific literacy		.09***	.08***	.09***	.07***
TV use			.08***	.07***	.07***
Newspaper use			.18***	.04	.02
TV news use			.00	-.01	.01
Entertainment TV use			.17***	.13***	.13***
Attention to political news			-.02	-.08***	-.04
Attention to science/environmental news			.43***	.41***	.28***
Attention to conservative news				.17***	.14***
Attention to liberal news				.17***	.12***
Scientific deference					.01
Reservations about science					.02
Public affairs discussion					-.14***
Science discussion					.35***
Adjusted R^2	.053	.064	.414	.450	.493

Standardized coefficients reported.
* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

liberal news (β = .12, $p \leq .001$) were associated with increased science documentary use at similar levels. The influence of these variables was more similar to that found in Dataset 1 than to the large amount of additional explained variance these measures added to the model in Dataset 2.

Finally, the scientific attitude variables added in Model 5 had no influence on science documentary use. However, the two measures of discussion behavior were strongly associated with increased science documentary viewing. In fact, the tendency to discuss science with others had a greater influence on science documentary use than did any other variable in the model and in the Dataset 3 analysis (β = .35, $p \leq .001$). Discussing public affairs also significantly predicted science documentary use (β = -.14, $p \leq .001$) but in the opposite direction – discussing public affairs had a *negative* relationship with science documentaries. This means that individuals who like discussing science are more likely to view science documentaries than are those who do not, while those who like discussing public affairs are *less* likely to view science documentaries than are those who do not.

Discussion

This final analysis further strengthened the findings from Datasets 1 and 2 and added more nuance to our understanding of science documentary audience characteristics. The results of the present analysis largely mirror the findings of the previous analyses.

As in Dataset 1, attention to science and environmental news was a very strong predictor of science documentary use, bested only by the tendency to discuss science with others. The influence of these variables makes intuitive sense – someone who enjoys

discussing science with others is likely to pay a lot of attention to both science news and to science documentaries as sources of information. It stands to reason that someone who enjoys discussing science prefers to be informed (or assume s/he is informed) about scientific issues and so would be more likely to seek out this information than would those who do not engage in science discussions as frequently.

Similar to the previous analyses, the general and topical media use behaviors had a strong impact on science documentary use – in fact, the addition of this group of variables increased the explanatory power of the model over six-fold. Once again, this pattern suggests that those who consume more media across various genres are also more likely to consume science documentaries. Unlike the previous analyses, no media use behavior had a significant negative association with science documentary use.

One finding unique to this analysis was the significant association between political ideology and science documentary use. Unlike in Datasets 1 and 2, the effect of political ideology was not washed out by the inclusion of more variables in the model and instead ideology had a persistent significant impact across all of the models. Interestingly, conservatism was associated with increased science documentary use. This is somewhat surprising as science documentaries are often made to advocate for liberal positions such as environmental protection, although (as discussed in the Literature Review and Theoretical Framework) a broad range of messages and styles fall under the umbrella term "documentary" and so it is possible that participant conceptualizations of documentary might vary from those of researchers and between participants.

Reinforcing the findings of the previous analyses, some demographic characteristics were also found to influence science documentary use. Once again, lower

educational attainment, being male, and being an evangelical Christian were positively associated with viewing science documentaries.

As in Dataset 2, neither of the variables used in this dataset to measure attitudes towards science had a significant impact on science documentary use. Unlike in Dataset 1, deference to scientific authority was *not* associated with an increased likelihood of viewing science documentaries.

Lastly, the inclusion of discussion behaviors as predictors in this analysis enhances our understanding of documentary audiences above and beyond the findings from Datasets 1 and 2, which did not measure these constructs. The findings indicate that one's proclivity to discuss certain types of issues can have a profound effect on one's media choices. This idea has face validity as individuals often intentionally seek out certain messages as a way to acquire information or to survey their environment (Slater, 1997) and it stands to reason that one motivation behind such goals is to be able to communicate with others about topics of interest. If an individual relishes the opportunity to discuss science topics, he or she can acquire the information needed to conversate competently from a variety of media sources, including science documentaries.

General Discussion

The purpose of this study was to shed light on the characteristics of documentary audiences, as this is a crucial element to understanding documentary effects that not only furthers theoretical development and social science research about this genre but also has practical implications for message creators. Knowing who is watching science documentaries is critical to understanding both how these documentaries influence

viewers as well as how they operate to influence public opinion in the real world (i.e., outside of experimental settings).

This study was exploratory in nature, and convergent findings across the three datasets indicate that certain individual characteristics are highly likely to incline individuals towards science documentary use. Several findings were relatively consistent across the datasets, indicating that these same variables will likely be associated with science documentary use if included in future research.

Across all three datasets, media use behaviors had a large impact on science documentary use. This evidence provides support for media use models which posit that instead of competing with one another many media use behaviors drive other media use, including cross-platform exposure (Cooper & Tang, 2009). Additionally, it stands to reason that those who consume a lot of media in general are also likely to view any given genre of research interest. However, the associations between specific types of media use and science documentary viewing suggest that people are likely to persistently choose similar media content. This is best evidenced by the relatively strong influence of attention to science/environmental news across the three datasets. Science documentaries are essentially a method of paying attention to science and environmental news. Therefore, the likelihood of media use behavior predicting other media use behavior is largely a function of similarities between the content types.

This idea is further supported by the fact that attention to partisan news was also a strong predictor of science documentary use. Those who are engaged enough with current events to frequently view cable news channels are likely to be interested in new information about issues with potential societal impacts, which describes much of the

science documentary landscape. Whether these individuals are viewing science documentaries for value-congruent or for value-incongruent purposes is unclear; however, the fact that individuals who frequently view ideologically polarized news channels are also highly likely to view science documentaries may be driven in part by a desire to know more about controversial current events and issues, perhaps for the purpose of future discussion.

The strong influence of science information efficacy (Dataset 1) and of tendency to discuss science issues provides further evidence that a desire to know about science issues, paired with confidence in one's own ability to make sense of scientific information and controversies, would likely lead an individual to seek out media content like science documentaries. Enjoyment of discussing science should enhance these tendencies as this would make consuming science media even more goal-oriented for the audience.

Together, these analyses add empirical support and important information to our conceptualization of science documentary audiences. Knowing the characteristics of this audience can help documentary filmmakers develop messages in ways that would be most effective for those who actually seek out and view science documentaries in their real lives. This knowledge is also vital to understanding why certain documentary structures may be more or less effective, which is the focus of the next study (Study 2).

Chapter 3: Testing a Documentary Typology

Purpose

One major challenge to the social scientific study of documentaries is the difficulty in not only defining the genre itself but also in creating a typology of formats to describe these messages. The latter is crucial because a first step towards developing models that predict documentary effects is understanding which *qualities* of documentaries produce these effects. Previous research compared narrative involvement between documentaries and fictional entertainment TV shows and found no significant differences in narrative involvement between the two genres (Cooper & Nisbet, 2016). In order to move beyond simple comparisons between the effects of documentaries vs. non-documentaries, the present research aims to reveal under which conditions documentaries are most effective, i.e., what aspects of documentary storytelling lead some of them to become household names and spark social movements and others to have limited or no impact.

As shown in Figure 1, this study will utilize a parallel serial mediation model to test the impact of four documentary formats. The documentaries used in this study vary along two dimensions: narrative structure (expository vs. participatory) and motivation (educational vs. advocacy). Table 4 depicts a simple typology of the four resultant formats: expository educational, participatory educational, expository advocacy, and participatory advocacy. Briefly, participatory documentaries are distinguished from

expository documentaries by the presence of an involved, on-screen narrator. Advocacy documentaries are distinguished from educational documentaries by an increased persuasive emphasis.

Table 4. Typology of documentary formats

	Message goal		
Narrative structure		Education	Advocacy
	Expository	• Didactic messages • Intention is to convey information • Use universal truths and values to simplify complex concepts	• Persuasive messages • Intention is to promote social/policy change • Use universal truths to support value propositions
	Participatory	• Subjective informative messages • Filmmaker is actively engaged in event in the natural world • Hides persuasive intent (if any)	• Subjective persuasive messages • Filmmaker is actively engaged in promoting a particular position • Persuasive intent is obvious

This study will test the model in Figure 1 using documentaries that focus on environmental issues, specifically hydraulic fracturing of natural gas (fracking), oil drilling, coal mining, water pollution, and physical pollution (i.e., trash). Based on the

literature review and previous research (Cooper & Nisbet, 2016), this experiment will test the following hypotheses and research question:

H_1: The participatory format will evoke greater narrative involvement (identification and transportation) than will the expository format.

H_2: Advocacy documentaries will evoke greater narrative involvement (identification and transportation) than will educational documentaries.

H_3: Narrative involvement will increase message-consistent affect about the issue.

H_4: Message-consistent affect will increase message-consistent policy preferences.

H_5: Narrative involvement will decrease counterarguing and reactance.

H_6: Counterarguing and reactance will decrease message-consistent policy preferences.

RQ_2: Does ideological congruency affect the level of narrative involvement or the impact of narrative structure on narrative involvement?

Method

Research Design

This study involved four conditions based on narrative structure (expository or participatory) and motivation (educational or advocacy) in a 2x2 mixed within- and between-subjects experimental design. There will be two different stimuli, or sub-conditions, used for each condition in order to increase external validity through stimulus sampling. Stimulus sampling involves using multiple stimuli in each category as a means to avoid unintentional ways in which instances within a category might vary that could potentially influence the dependent variable (Wells & Windschitl, 1999). Stimulus

sampling allows the results of each sub-condition to be combined, and if significant differences persist between the main conditions the differences can be presumed to be due to a common feature within each category (i.e., narrative structure and motivation) rather than to random differences between the specific stimuli chosen for a given study.

The sub-conditions focused on a variety of environmental issues: hydraulic fracking, oil drilling, coal mining, water pollution, and physical pollution (each sub-condition is described in detail below). The specific items in a participant's questionnaire was dependent upon which sub-condition he or she was assigned to.

Participants and Procedure

Undergraduate students at a large Midwestern university in the United States (N = 292) participated in this experiment in exchange for course credit. Participants first completed an online pretest questionnaire measuring socio-demographic variables, ideology, affective risk perceptions, and policy preferences about controversial environmental issues. Upon beginning this Time 1 questionnaire, participants were randomly assigned to one of the eight sub-conditions and only responded to risk and policy items relevant to the environmental issue featured in the documentary they were assigned to view at Time 2.

At least 3 days after completing the Time 1 questionnaire, participants attended the lab to view the video for the sub-condition to which they were assigned. Each participant viewed his/her assigned video in a private, distraction-free (e.g., no cell phones) room with a television screen-sized computer monitor. After viewing, participants completed a Time 2 posttest questionnaire measuring reactions to the video, affective risk perceptions, and policy preferences.

Stimulus Materials and Manipulation

The goal of the manipulation in this experiment was to generate variations in narrative involvement as a function of (a) narrative structure and (b) motivation. To that end, eight documentaries were selected so that there were two instances of each format shown in the Table 4 typology. These four formats represent the four conditions that were used in the analyses. All of the videos used were television and film documentaries and were edited to be 45-75 minutes long so that the length of the eight videos were roughly equivalent. Because narrative structure and involvement are crucial to the hypotheses of this study, extreme care was taken when editing the videos to preserve storytelling structure when shortening the videos. Links to the videos used in this study can be found in Appendix D.

Expository educational condition. These documentaries present information in a relatively straightforward way without the presence of an on-screen narrator who is actively involved in the events that unfold and focus more on conveying knowledge about an issue than on arguing for a certain position on it. The videos used for the expository educational condition were *Future Earth: Addicted to Power* (oil drilling) and *Fracking: Shattered Ground* (hydraulic fracking).

Participatory educational condition. These documentaries feature an on-screen narrator who takes part in and experiences the events of the story and also focus on conveying knowledge about an issue rather than arguing for a certain position on it. The videos used for the participatory educational condition were *Frontline: Poisoned Waters* (water pollution) and *Plasticized* (physical pollution).

Expository advocacy condition. These documentaries present information in a relatively straightforward way without the presence of an involved on-screen narrator and focus on persuasively promoting social and policy change. The videos used for the expository advocacy position were *A Crude Awakening: The Oil Crash* (oil drilling) and *The Last Mountain* (coal mining).

Participatory advocacy condition. These documentaries feature an on-screen narrator who is actively engaged with an issue and in so doing is passionately working to persuasively promote social and policy change. The videos used for the participatory advocacy condition were *Gasland* (hydraulic fracking) and *Tapped* (water pollution).

Measures

A detailed list of measures used in this study is provided in Appendix E.

Socio-demographics. Socio-demographics included in this study included age (M = 20.8, SD = 3.7), biological sex (39.2% male), race (19.9% minority), and evangelical Christianity (22.0% yes). As an additional control, at Time 1 respondents rated how familiar they were with the environmental issue featured on the video they watched, using a scale ranging from 1 = *not at all familiar* to 7 = very familiar. To avoid priming the respondents, each respondent answered items for every issue featured in the study; the value for the issue that matched each respondent's sub-condition was then used as the measure of familiarity for that respondent (M = 3.4, SD = 1.7).

Ideology and scientific literacy. Political ideology was included in this study to explore the role it might play in the model (RQ_2) and was measured by asking respondents to separately rate how liberal and conservative they were on social issues and on economic issues on a seven-point scale ranging from 1 = *very liberal* to 7 = *very*

conservative. These two items were averaged together to create an overall measure of ideology with conservatism coded high (M = 3.6, SD = 1.5, r = .67).

Scientific literacy assesses an individual's general science knowledge and was included in this study as a control variable. Because the documentaries feature scientific issues and because the sample was largely similar in age and education (college students), including a measure of scientific literacy is a useful way to account for differences in relevant knowledge among the participants. Scientific literacy was measured using seven items on a five-point true/false scale with accuracy coded high (i.e., 1 = *not accurate at all*, 5 = *very accurate*). Sample items included "The continents on which we live have been moving their locations for millions of years and will continue to move in the future" (true) and "Lasers work by focusing sound waves" (false). These seven items were averaged into an overall measure of scientific literacy (M = 3.7, SD = 0.6).

Mediators. The model shown in Figure 1 contains several mediators working in both sequence and in parallel as key intermediaries between the independent and the dependent variable in this study. The mediators listed below are ordered by model/hypothesis sequence.

Narrative involvement. Narrative involvement was the focus of Hypotheses 1 and 2 and represents a critical link between the experimental manipulations and other subsequent variables. Narrative involvement was measured by combining two scales that measure one's engagement with a narrative: transportation and identification. Transportation, or degree to which a viewer becomes a part of the story world, was measured using a modified version of Green and Brock's transportation scale (2000). Sample items were rated on a seven-point Likert agreement scale and included "While

viewing the video, I felt as if I was part of the action" and "I found my mind wandering while watching the video (reverse coded). Identification, or the degree to which a viewer takes on the role of a character in a story, was measured using an operationalization adopted from previous research (Cohen, 2001). The items from this scale were modified in such a way that they could apply to all videos used, which resulted in more general statements referring to "people in the video" rather than measuring identification with a single character. Sample items for identification were rated on a seven-point Likert agreement scale and included "The people featured in the video share my values" and "I felt connected to the people in the video."

Based on previous research (Cooper & Nisbet, 2016) demonstrating high intercorrelation between the transportation and identification scales, the measures from both scales were combined to create a comprehensive measure of narrative involvement ($M = 4.8$, $SD = 0.8$, $\alpha = .92$).

Counterarguing and reactance. In order to assess how disagreement with a message can be influenced by narrative involvement/message format as well as how such disagreement can affect message-congruent policy preferences, this study included two scales that were adapted from previous research and combined to produce an overall measure of "resistance to persuasion" (see Moyer-Gusé & Nabi, 2010; Nabi, Moyer-Gusé, & Byrne, 2007). Counter-arguing, or the generation of thoughts that disagree with the message, was measured using five items on a seven-point Likert agreement scale. Sample items included, "I found myself looking for flaws in the way [ISSUE] was presented in the video" and "I sometimes found myself thinking about ways the information about [ISSUE] was inaccurate or misleading," with [ISSUE] being

whichever environmental problem was featured on the video the participant viewed. Reactance, or a participant's resistance to perceived persuasive pressure, was measured using six items on a seven-point Likert agreement scale. Sample items included "The video tried to manipulate me" and "The video did not try to force its opinion on me" (reverse coded). The measures of counterarguing and reactance were combined for the analysis into a single measure of resistance to persuasion (M = 3.6, SD = 0.9, α = .81).

Negative affect. Previous research indicates that negative emotions operate differently and are more powerful than positive emotions for influencing responses to risk messages (Baron, Logan, Lilly, Inman, & Brennan, 1994; Cooper & Nisbet, 2016; Finucane, 2008). In addition, all of the documentaries used in this study (and indeed most environmental documentaries) aimed to raise concern and negative emotions about the risks featured and so for the purposes of this study "message-consistent affect" is synonymous with negative affect. Negative affect was assessed at Time 1 and Time 2 using eight items that asked respondents to what degree they felt specific emotions about the issue featured in whichever video they viewed using a ten-point scale ranging from 1 = *not at all* to 10 = *extremely*. The emotions used were upset, hostile, ashamed, nervous, afraid, worried, concerned, and angry (Watson, Clark, & Tellegen, 1988). These items were averaged into a single measure with negative affect coded high (Time 1: M = 4.7, SD = 2.3, α = .95; Time 2: M = 6.2, SD = 2.1, α = .94).

Risk perception. The cognitive component of risk (risk perception) was measured at Time 1 and Time 2 using five items modified from previous research measuring environmental concern (Schultz, 2001). The items are prefaced with "How much risk does [ISSUE] pose to…" followed by "you, personally," "your family," "human health in

general," "people in the United States," and "plants and animals" with [ISSUE] being whichever environmental problem was featured on the video the participant viewed. These five items were measured on seven-point scale ranging from 1 = *no risk at all* to 7 = *extreme amount of risk* and averaged into a single overall measure of risk (Time 1: M = 4.4, SD = 1.4, α = .90; Time 2: M = 5.3, SD = 1.1, α = .86).

Dependent Variable

This study tests how documentary format differences result in different levels of policy support in order to study the societal-level implications of environmental documentaries. Policy support was measured at Time 1 and Time 2 using six items that focused on governmental regulations around environmental issues. The items were measured on a seven-point scale ranging from 1 = *strongly oppose* to 7 = *strongly support*. The items were made as equivalent across issues as possible, with wording differences minimized. Sample items included "Government regulation of [ISSUE] is necessary to protect the public" and "No new restrictions should be placed on [ISSUE]" (reverse coded), with [ISSUE] being whichever environmental problem was featured on the video the participant viewed. The items were recoded with preference for regulation scored high and averaged into a single overall measure of policy preferences (Time 1: M = 5.2, SD = 1.0, α = .85; Time 2: M = 5.9, SD = 0.9, α = .80).

Analyses

Ordinary least squares (OLS) regression was used to test the hypotheses based on theoretically derived causal order. Analyses were also conducted using the PROCESS macro outlined in Hayes (2018). This is a computational tool that allows for path

analysis-based mediation and moderation analysis using OLS regression to estimate model coefficients.

Initial testing and a series of post hoc analyses revealed that risk (cognitive risk perception) is a critical component in the pathway from message format to policy preferences. Additionally, as described below addressing RQ_2, ideology/ideological congruency was found to have no major impact on the variables in the model. Thus, risk was added to the model and ideology was removed and the model shown in Figure 1 was modified to the version shown in Figure 3. The analyses that follow are based on the final Figure 3 version of the model.

Dummy coding was used to control for differences between the two sub-conditions within each condition in order to ensure that these differences were not driving the effects. These dummy codes were included in the analyses but not are not of theoretical interest and are thus not reported in the tables that follow.

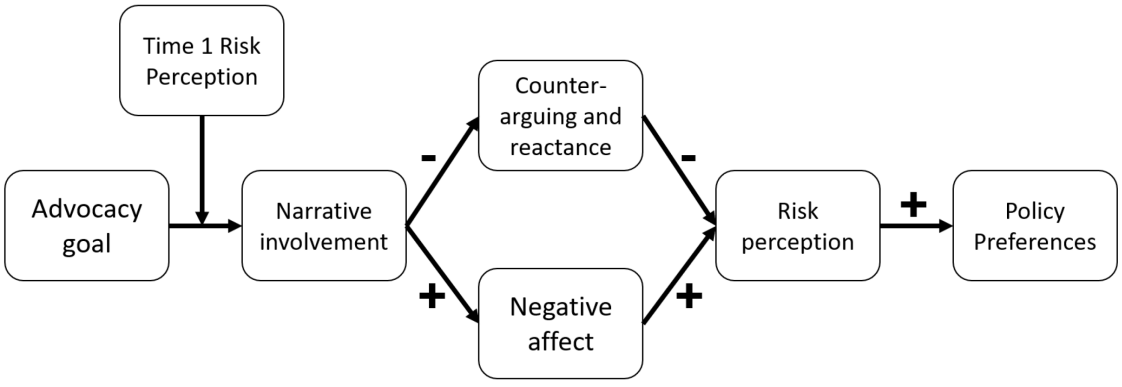

Figure 3. Revised model for Study 2 based on initial and post hoc analyses

Results

Narrative Involvement Factor Analysis

As discussed above, the transportation and identification scales were combined into a single measure of narrative involvement due to high intercorrelation between the scales found in previous research (Cooper & Nisbet, 2016). In the current study, the correlation between the identification and transportation subscales was $r = .70$. In order to further probe the structure these two dimensions of narrative involvement, an exploratory factor analysis was performed to probe how the items in each scale related to one another.

An exploratory factor analysis was conducted using maximum likelihood method and varimax rotation to determine the factor structure. Oblique promax rotation was used because the factors being analyzed (transportation and identification) are known to be correlated. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for each variable in the model was .917, indicating that the sampling was adequate. When comparing the percentage of variance explained, a one-factor structure explained 38.2% of the variance and a two-factor structure explained 46.1% of the variance. Moving from a one-factor model to a two-factor model did not explain much more of the variance, suggesting that a one-factor model (i.e., single measure for narrative involvement) is preferable to a two-factor model (i.e., separate measures for transportation and identification).

Predicting Narrative Involvement

Of crucial importance to the present research is whether differences in documentary format can produce different levels of narrative involvement resulting in downstream effects on policy preferences. The applicability of the study results for documentary filmmakers rests largely on whether or not a recommendation about format can be made based on how one format affects narrative involvement compared to another. Analysis of covariance (ANCOVA) was performed to test the relationship between each of the following and narrative involvement: (a) expository versus participatory narrative structure; (b) educational versus advocacy goals; (c) the interaction of narrative structure and goal; and (d) categorical condition. The following control variables were included in each analysis: age, sex, race, evangelical Christianity, issue familiarity, ideology, and scientific literacy, as well as Time 1 negative affect, risk perception, and policy preferences.

Hypothesis 1 (H_1) predicts that the participatory format will evoke greater narrative involvement than will the expository format. The ANCOVA revealed that there was no significant difference in narrative involvement for the participatory conditions compared to the expository conditions, $F(1, 272) = 0.18$, $p = n.s.$ H_1 was therefore not supported as narrative involvement did not vary as a function of narrative structure.

Hypothesis 2 (H_2) predicts that documentaries with an advocacy goal will evoke greater narrative involvement than will documentaries with an educational goal. The ANCOVA revealed that there was no significant difference in narrative involvement for the advocacy conditions compared to the educational conditions $F(1, 272) = 0.16$, $p =$

n.s.. H_2 was therefore not supported as narrative involvement did not vary as a function of the message's goal.

A third ANCOVA demonstrated that narrative structure and goal do not interact in a significant way to influence narrative involvement $F(1, 272) = 1.12$, $p = n.s.$

Finally, an ANCOVA was performed to test how narrative involvement varied by condition in ways that were not a function of the manipulations. That is, the final ANCOVA tested whether or not narrative involvement was influenced differently by the conditions/documentary formats typology despite the insignificant relationships between the manipulations and narrative involvement, which would indicate that there may be some other fundamental difference(s) between the categories used that is not a result of either the narrative structure or goal manipulations in the research design. In order to enable post hoc comparisons, control variables were left out of this analysis. The final ANCOVA shows that across the four conditions there was not a significant variation in narrative involvement $F(3, 288) = 1.71$, $p = n.s.$ Post hoc least significant difference (LSD) testing was used to test if the estimated means of narrative involvement for each condition were significantly different from one another at the $p \leq .05$ level. These comparisons indicate that the only significant difference in narrative involvement was between expository educational ($M = 4.67$, $SD = 0.09$) and participatory educational ($M = 4.97$, $SD = 0.10$) conditions ($p \leq .05$). This comparison indicates that the participatory educational documentaries increased narrative involvement significantly more than did the expository educational documentaries.

Overall, the results of these analyses indicate that while there were significant differences in narrative involvement based on condition these differences were not necessarily result of the specific manipulations of interest to this study.

Moderating the Relationship between Format and Narrative Involvement

Because the manipulations did not have the predicted effects on narrative involvement, a series of post hoc analyses were run to test if other Time 1 variables might moderate the relationship between either manipulation and narrative involvement. Tests were run to see if ideology (RQ_2), sex, Time 1 negative affect, Time 1 risk perceptions, or Time 1 policy preferences moderated the effect of either participatory versus expository narrative structure or advocacy versus educational goal on narrative involvement. These analyses revealed one significant relationship: Time 1 risk perceptions moderate the effect of advocacy versus educational goals on narrative involvement. This indicates that the two documentary goals function differently to influence narrative involvement depending on an individual's prior risk perceptions about the environmental issue in question.

To test this conditional relationship, a simple moderation analysis was run and plotted using PROCESS. In this analysis, participants are sorted into low, medium, and high Time 1 risk perceptions based on the 16^{th}, 50^{th}, and 84^{th} percentile value of the moderator, respectively. The results of this analysis indicate a significant interaction between message goal and Time 1 risk perception ($b = -0.17$, $p \leq .05$). Curiously, although the overall interaction was significant none of the conditional effects of message goal on narrative involvement at different levels of preexisting risk perception were significant. Regardless, Figure 4 illustrates the pattern of results that emerges. For those

with low preexisting risk perceptions, the advocacy conditions were more effective than the educational conditions at increasing narrative involvement ($b = 0.25$, $p = n.s.$). For those with moderate preexisting risk perceptions, the advocacy and educational conditions were relatively equally likely to increase narrative involvement ($b = 0.01$, $p = n.s.$). For those with high preexisting risk perceptions, the educational conditions were more likely to increase narrative involvement ($b = -0.23$, $p = n.s.$). Although the conditional effects are not significant, this analysis indicates that H_2 is somewhat supported but only for those with relatively low initial risk perceptions about the environmental issue.

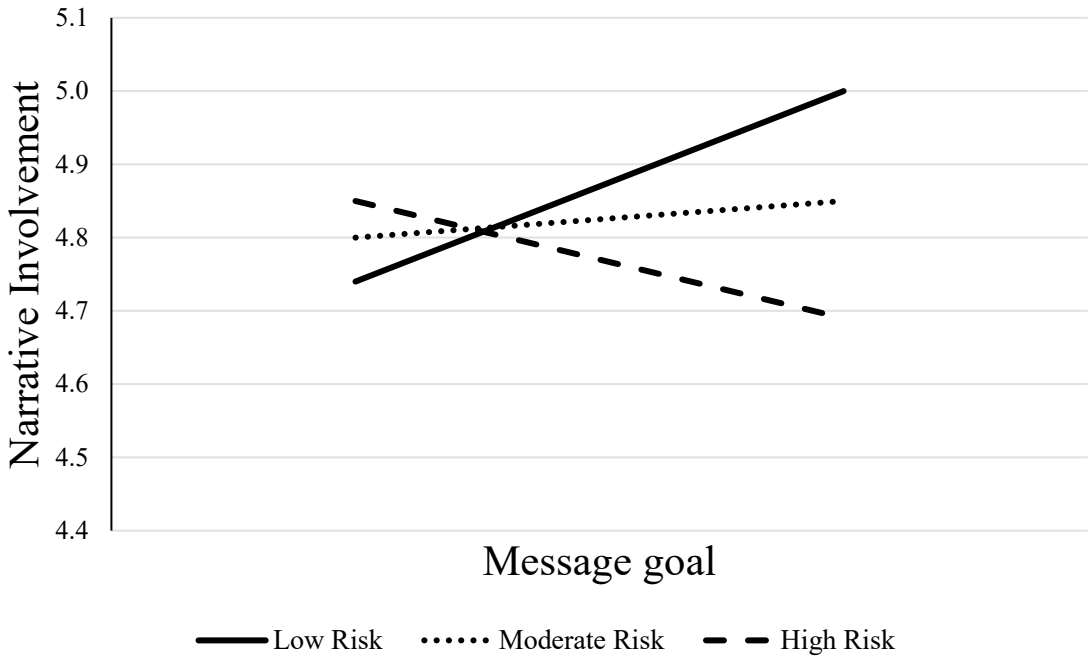

Figure 4. Study 2: Interaction between message goal and preexisting risk perceptions predicting narrative involvement.

As the relationship between one of the manipulations and Time 1 risk perceptions was significant and of theoretical interest, this moderation was added to the original model as shown in Figure 3 and included as part of the subsequent mediation models.

Serial and Parallel Mediation Model

The PROCESS macro was used to test each step in the model through sequential regression analyses with bootstrap (10,000 times) confidence intervals used to make inferences about the total direct and indirect effects in the final proposed model. The model was run separately for expository versus participatory narrative structure and educational versus advocacy goal, but these results are presented together in Table 5 as the models for each are identical for all but the first step of the analysis. Table 5 presents the results of the analysis with goal as the focal predictor for the model due to the significant interaction between message goal, initial risk perceptions, and narrative involvement discussed previously. The following control variables were also included in the analysis: age, sex, race, evangelical Christianity, issue familiarity, ideology, and scientific literacy, as well as Time 1 negative affect, risk perception, and policy preferences.

Table 5 shows the results of a series of regression analyses used to test each step of the model (listed as the outcome variables at the top of the table). As previously discussed, in the ANCOVAs the advocacy versus educational goal manipulation did not directly influence narrative involvement. However, in the final model both the advocacy versus educational goal manipulation (b = -0.17, p = *n.s.*) as well the interaction between the advocacy versus educational goal manipulation and Time 1 risk did significantly predict narrative involvement (b = 0.76, $p \leq .05$). As shown in the second column of

Table 5, negative affect at Time 1 was also a significant predictor of narrative involvement ($b = 0.14$, $p \leq .001$). Overall, the variables in this model explained 29.5% of the total variance in narrative involvement ($p \leq .001$).

Hypothesis 3 (H_3) predicted that narrative involvement would increase message-consistent (negative) affect about the environmental issue featured in a documentary and was supported by the analysis ($b = 1.17$, $p \leq .001$). As shown in the third column of Table 5, sex ($b = -0.51$, $p \leq .01$; i.e., females more likely to experience negative affect), issue familiarity ($b = -0.11$, $p \leq .05$), and negative affect at Time 1 ($b = 0.33$, $p \leq .001$) were also significant predictors of negative affect at Time 2. Overall, the variables in this model explained 61.1% of the total variance in Time 2 negative affect ($p \leq .001$).

Hypothesis 5 (H_5) predicted that narrative involvement would decrease counterarguing and reactance, meaning that as narrative involvement increases resistance to persuasion is expected to decrease. This hypothesis was supported by the analysis ($b = -0.37$, $p \leq .001$). As shown in the fourth column of Table 5, evangelical Christianity was also a significant predictor of counterarguing and reactance ($b = -0.36$, $p \leq .001$; i.e., evangelical Christians were less likely to engage in counterarguing and reactance). Overall, the variables in this model explained 20.8% of the total variance in counterarguing and reactance ($p \leq .001$).

Hypothesis 4 (H_4) predicted that message-consistent (negative) affect (Time 2) would increase message-consistent policy preferences and was supported in the original version (no Time 2 risk) of the model ($b = 0.14$, $p \leq .001$). In addition, the relationship

Table 5. Study 2: Multiple linear regressions predicting narrative involvement, counterarguing/reactance, negative affect, risk perceptions and policy preferences at Time 2

Variable	Narrative involve-ment	Negative affect	Counter-arguing and reactance	Risk perception	Policy preferences
	b	*b*	*b*	*b*	*b*
Age	0.01	-0.02	0.00	0.00	0.01
Sex (male)	-0.14	-0.51**	0.20	-0.15	-0.11
Race (minority)	-0.01	-0.26	-0.25	0.45**	-0.13
Evangelical Christianity	-0.12	-0.32	-0.36**	0.03	0.04
Issue familiarity	0.03	-0.11*	-0.02	0.01	-0.01
Ideology (conservative)	0.04	-0.04	0.05	0.00	-0.05
Scientific literacy	0.11	-0.19	0.08	0.04	0.14*
T1 Negative affect	0.14***	0.33***	0.05	-0.01	-0.02
T1 Policy preferences	0.09	0.20*	-0.11	0.02	0.39***
Advocacy goal	0.76*	—	—	—	—
T1 Risk perception	0.07	—	—	—	—
Advocacy goal x T1 Risk perception	-0.17*	—	—	—	—
Narrative involvement	—	1.17***	-0.37***	—	—
T2 Negative affect	—	—	—	0.31***	—
Counterarguing and reactance	—	—	—	-0.01	—
T2 Risk perception	—	—	—	—	0.24***
R^2	.295	.611	.208	.419	.527

Unstandardized coefficients reported. * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.
T1 = Time 1, T2 = Time 2. Words in parentheses next to a variable indicate the direction coded high for that variable.

between negative affect and Time 2 risk perception shown in Figure 3 was significant (b = 0.31, $p \leq .001$).

Hypothesis 6 (H_6) predicted that counterarguing and reactance would decrease message-consistent policy preferences and was supported in the original version (no Time 2 risk) of the model (b = -0.15, $p \leq .001$). However, the relationship between counterarguing and reactance and Time 2 risk perception shown in Figure 3 was not significant (b = -0.01, p = *n.s.*).

Although not a priori hypothesized, the analyses indicate that both Time 2 negative affect and counterarguing/reactance predict Time 2 risk perception, which is shown as the outcome variable in the fifth column of Table 5. In addition to these two mediators, race was also a significant predictor of risk perception at Time 2 (b = 0.45, $p \leq$ .01). Overall, the variables in this model explained 41.9% of the total variance in Time 2 risk perception ($p \leq .001$).

In the updated version shown in Figure 3, the final step of the serial mediation model predicted the dependent variable, Time 2 policy preferences, which were coded such that higher values on this variable indicate greater support for policies regulating industries that pose environmental risks. As shown in the sixth column of Table 5, Time 2 risk perception was a significant predictor of policy preferences (b = 0.24, $p \leq .001$). In addition, scientific literacy (b = 0.14, $p \leq .05$) and policy preferences at Time 1 (b = 0.39, $p \leq .001$) were also significant predictors of policy preferences at Time 2. Overall, the variables in the final model explained 52.7% of the variance in Time 2 policy preferences ($p \leq .001$).

Discussion

These analyses revealed that a parallel serial mediation model can be used to explain the relationships between message format, negative affect, resistance to persuasion (counterarguing and reactance), risk perceptions, and policy preferences. Unfortunately, the weakest part of this model was the link between the documentary format manipulations and narrative involvement, resulting in rejection of H_1 and H_2. The narrative structure and goal differences on the whole did not have a significant effect on narrative involvement. However, post hoc analyses revealed that preexisting (i.e., Time 1) risk perception interacts with message goal to influence narrative involvement.

The interaction between message goal and preexisting risk perception raises some interesting questions. The overall interaction was significant but the conditional effects at different levels of preexisting risk perception were not. However, an interesting pattern emerges whereby the advocacy documentaries were most effective at influencing narrative involvement for those with low preexisting risk perceptions while the educational documentaries were most effective for those with high preexisting risk perceptions. This pattern is promising as a major goal of most advocacy documentaries is to mobilize a typically uninvolved public into caring about an issue enough to promote policy change. As the goal of such films is usually to not only promote individual change but also to get the message shared with as many people as possible, messages that engage viewers with identifiable "characters" and carry them into the "story" world of the documentary can be effective at reaching broad audiences who either do not care about environmental issues due to psychological distance and/or those individuals for whom scientific consensus is value-incongruent. It is also worth noting that these effects

occurred despite the advocacy documentaries' persuasive intent, which is presumed to have been fairly obvious to participants.

The results of this study support a wealth of research on narrative persuasion about the effects of narrative involvement on counterarguing and reactance. As predicted, highly engaging narratives reduced counterarguing and reactance, ultimately leading to higher policy preferences for regulation because narrative involvement reduces the negative effect resistance to persuasion would otherwise have on message-consistent attitudes of any kind. By reducing counterarguing and reactance, documentaries featuring engaging narratives can promote message-consistent policy preferences. This suggests that documentary filmmakers would be well-advised to focus not only on conveying information about environmental issues but also invest effort into telling a good "story" about the problem to draw in and maintain audiences, especially among those with low preexisting risk perceptions.

The results of this study also support a wealth of research on the primacy of affect in directing cognitive risk perceptions and policy preferences. The order of these variables in the model was theoretically derived from several dual processing theories which posit that affective responses to risk (and in general) occur more automatically and thus precede more cognitively taxing risk perceptions and policy preferences. The more cognitively taxing nature of the latter two variables is highlighted by the fact that scientific literacy, or understanding general scientific knowledge, was only significant in the model when predicting policy preferences. This suggests that individuals may weigh their preexisting scientific knowledge against the position advocated by a documentary when ultimately deciding on policy preferences around environmental risks. The nature

of this association is such that individuals who are high in scientific literacy are more likely to support stricter regulations on environmental hazards. This indicates that one's ability to understand science can promote message-consistent attitudes and in this case the relationship between scientific literacy and policy preferences is positive, indicating that those who are more scientifically literate are also more likely to support policy preferences promoting stricter regulation of environmental risks. Such an outcome makes intuitive sense as the documentaries used in this study largely support scientific consensus.

Research question 2 (RQ_2) explored whether and how political ideology may interact with message format or other variables to influence policy preferences. Many of the documentaries focused on environmental issues that often create ideological divides between conservatives, who generally favor fewer governmental regulations, and liberals, who generally favor increased governmental regulations, especially in the case of social impact issues such as environmental problems. However, none of the many post hoc analyses run supported a link between ideology and any of the variables in the model, nor did they suggest that ideology moderates any of the relationships in the model.

Overall, the results of this study suggest that successfully increasing narrative involvement is a key strategy for documentary effectiveness. Unfortunately, due to the shortcomings of the manipulation, this study was not able to provide useful information for practitioners about *how* to increase narrative involvement as a result of formatting choices.

Chapter 4: Study 3 – Documentary Framing Effects

The purpose of Study 3 is to test the effectiveness of different ways of presenting the same information: (1) framing (i.e., whether the story focuses on individuals or on broader societal trends; and (2) the use of close-up shots of wildlife. This study is designed to test the mechanisms by which different visual and verbal techniques influence attitudes towards wolves. Ideally, the findings of this study will aid in theoretical development about documentaries and will also provide actionable information that documentary filmmakers can use when determining the most effective methods of verbal and visual presentation.

As shown in Figure 2, this experiment will utilize a serial mediation model to test the impact of frames and visuals on documentary effectiveness. Based on the literature review and this model, Study 3 proposes the following hypotheses and research question:

H_7: The episodic frame will evoke greater empathy than the thematic frame.

H_8: Close-ups will evoke greater empathy than no close-ups.

H_9: Empathy will increase pro-wolf attitudes.

RQ_3: Do any individual difference variables (e.g., demographic characteristics, values, media use behaviors, etc.) influence the effect of the manipulations (framing and use of close-ups) on empathy? Do any of these individual factors cause significant differences in empathy based on experimental condition, i.e., is the effect of condition on empathy moderated by any individual difference characteristics?

Method

Participants

A demographically diverse sample of 631 adult participants were recruited for this two-wave study via a national paid opt-in online survey panel run by Qualtrics Panels. Participants completed Wave 1 between 16 April and 22 May 2018 and completed Wave 2 between 1 May and 24 May 2018.

Experimental Design

Participants first completed an online questionnaire that contained items measuring (1) socio-demographics, (2) ideology and identity, (3) media use behaviors, and (4) attitudes towards wolves. At least one week later, participants were randomly assigned to view a short video in one of four experimental conditions described below in a 2 (frame: episodic or thematic) x 2 (no close-ups, close-ups) mixed between- and within-subjects design. After viewing, participants completed a posttest questionnaire regarding (1) empathy, and (2) attitudes towards wolves.

Stimulus Materials

The goal of the manipulation in Study 3 was to generate audience variation in empathy across the four experimental conditions. To that end, stimuli were created by the research in order to control for extraneous factors (e.g., differences in production quality). All four video conditions featured the same video footage of wolves in nature, which was edited from the National Geographic Channel documentary *In the Valley of the Wolves* (Landis, 2009). The study stimuli were created by varying the voiceover audio and the use of close-ups in order to manipulate the videos' message and visual frames, respectively.

An important consideration when designing the message frames is the concept of attribution of responsibility. Episodic frames often lead to individualistic attributions of responsibility (i.e., the person suffering is responsible for that suffering), while thematic frames often lead to societal attributions of responsibility (i.e., society is responsible for a person's suffering; Gross, 2008; Iyengar, 1990, 1991). The societal attributions of responsibility present in thematic framing often leads people to support investing in governmental solutions, whereas the individual attributions of responsibility often leads people to blame individuals and hold them responsible for their struggles, leading to decreased support for investing in governmental solutions to address problems. Episodic frames may generate increased sympathy and empathy by providing an identifiable "character" the audience can relate to, but these frames can also encourage less support for policy change as they also encourage individualistic attributions. In the context of climate change, previous research found that thematic framing increases policy support more so than does episodic framing and this effect is mediated by attribution of government responsibility, i.e., thematic framing is more effective at increasing support for policies that mitigate climate change because this framing assigns responsibility for this problem to society at large (Hart, 2011). However, that study did not test the mediating role of empathy, which is expected to be increased for the episodic framing relative to the thematic framing (H_7).

In designing the message frame manipulation, care was taken to focus only on individual wolves and avoid any mention of humans in the episodic frame in order to circumvent the attribution wolves' struggles to human causes. In essence, the episodic frame removed all mention of humans as a way to (hopefully) lead the audience to

individualistic attributions of responsibility as this is a major element of episodic framing. In contrast, the thematic framing manipulation discussed wolves generally and included multiple references to humans that directly attributed wolves' struggles to human activities such as hunting, habitat fragmentation, and the introduction of diseases through domestic dogs. In essence, the thematic frame focused audience attention on how humans negatively impact wolves as a way to (hopefully) lead the audience to societal attributions of responsibility as this is a major element of thematic framing. Because this study focuses on non-humans, hardship due to human activity is considered "societal responsibility," while hardship not due to human activity is considered "individualistic responsibility."

For the message frame manipulation, the video featured one of two message frames communicated using voiceover audio. The episodic frame conveyed information about wolves by focusing on describing the struggles of a few specific individual wolves (e.g., "Sasha and Shadow must beat the odds if their pack is to make it through the winter"). The thematic frame conveyed information about wolves that focused on societal trends and consequences without making direct references to the specific wolves shown in the film (e.g., "Wolves must hunt every two to three days to survive, which has become increasingly difficult because wolves compete with human hunters for the same prey"). Full versions of the stimuli scripts are provided in Appendix G.

For the close-ups manipulation the same video footage used in the no close-ups conditions was manipulated by digitally altering the footage to contain more medium close-ups and close-up shots of the wolves featured. Following the approach detailed in Cao (2013), the video footage was zoomed in approximately 200% to increase the

number of clips featuring wolf faces for the close-up condition. Footage in the no close-ups conditions were not digitally altered – this was the baseline video that was edited to create the close-ups conditions. Links to view the four video conditions can be found in Appendix F and scripts for the episodic and thematic framing can be found in Appendix G. For the analysis, the episodic condition and the use of close-ups were coded high.

Measures

A detailed list of measures used in this study is provided in Appendix H.

Socio-demographics. Socio-demographics in this study included measures of age (M = 49.2, SD = 15.8), biological sex (50.1% male), and race (16.0% minority). Educational attainment was measured on an eight-point scale ranging from 1 = *no education* to 8 = *post-graduate training or professional schooling*, with 29.3% of the sample holding a 4-year college degree or higher (M = 5.9, SD = 1.3). In addition, measures of evangelical Christianity and biblical literalism were included to explore whether and how religion might influence documentary use; 22.5% of the sample identified as evangelical Christians, and 20.3% believe that the Bible should be taken literally.

In addition to these demographic variables, participants were asked which state they lived in and could select the states Idaho, Michigan, Minnesota, Montana, Wisconsin, Wyoming, or indicate that they lived in a different U.S. state. These six states were used because they are locations where wolves have been reintroduced. Previous research suggests that discourse about wolves differs based on the presence or absence of wolves in a given location (Houston, Bruskotter, & Fan, 2010), so this study oversampled participants from wolf states in order to create greater range in the outcome variable,

attitudes toward wolves, as well as to uncover whether or not location influences the effect of the experimental manipulation on empathy (RQ_3). Responses to this item were coded into two categories based on whether the participant lived in a state with wolves (0 = *does not live in a state with wolves*, 1 = *lives in a state with wolves*). Due to the deliberate oversampling, 51.2% of the participants in this study lived in states with wolf populations.

Ideology and identity. Political ideology was measured by asking respondents to separately rate how liberal and conservative they were on social issues and on economic issues on a seven-point scale ranging from 1 = *very liberal* to 7 = *very conservative*. These two items were averaged together to create an overall measure of ideology with conservatism coded high (M = 4.1, SD = 1.6, r = .87).

A measure of environmentalist identity was also included in this study. Environmentalist identity was assessed with a four-item Likert agreement scale that include items such as "I think of myself as an environmentalist" and "I am not the type of person to be involved with pro-environmental activities" (reverse coded). These four items were combined into a single measure of environmentalist identity (M = 3.6, SD = 1.4, Cronbach's α = .87).

Media use behaviors. Two potentially relevant media use behaviors were included in this analysis – attention to science/environmental news and science documentary use. Attention to science and environmental news was assessed using two items that asked respondents how much attention they paid to news about science and technology and to news about environmental issues, measured with a seven-point scale ranging from 1 = *no attention at all* to 7 = *a great deal of attention*. These two items

were averaged into a single measure of science and environmental news attention (M = 4.1, SD = 1.6, r = .69).

Science documentary use was assessed with a set of items asking respondents how often they viewed each of four major science documentary genres (nature and wildlife, science and technology, outdoor adventure, and space and astronomy) on a seven-point scale ranging from 1 = *never* to 7 = *all the time*. These four items were averaged into a single overall measure of science documentary use (M = 3.2, SD = 1.6, Cronbach's α = .89).

Mediating variable. As shown in Figure 2, this study tested a model in which empathy mediates the effects of the manipulation. Empathy was measured after participants viewed the videos using two subscales that assessed participants' perspective-taking experience and participants' emotional experience, respectively. Following Cao (2013), perspective-taking was measured using four slightly-modified statements based on the perspective-taking items in the Interpersonal Reactivity Index (Davis, 1996). This measure was assessed on a seven-point Likert agreement scale and included items such as "I felt what it was like to be in the wolves' situation" and "I found it difficult to see things from the wolves' point of view" (reverse coded). Also following Cao (2013), emotional (eudaimonic) exerience was assessed with commonly used measures (e.g., Batson et al., 2002; Davis, 1996) that asked participants to rate the extent to which they felt five emotions (sympathetic, compassionate, softhearted, tender, and moved) when thinking about the wolves in the video. These items were assessed using a six-point scale ranging from 1 = *not at all* to 6 = *extremely*.

To combine the items for empathy, which were measured on different scales, the z-score for each item was calculated and the z-scores for all nine items were averaged into a single overall measure of empathy (M = 0.00, SD = 0.8, Cronbach's α = .93).

Dependent variable. Attitudes towards wolves was used as the final outcome in this study and was assessed during both pretest and posttest so that the analyses could control for pretest attitudes when predicting the dependent variable. Attitude towards wolves was assessed using a five-item version of measures from previous research (Bruskotter, Schmidt, & Teel, 2007). Participants were asked to rate their agreement with each item using a seven-point Likert scale that included items such as "Wolves are an important part of the ecological world" and "We are better off without wolves" (reverse coded). These five items were combined into an overall measure of attitudes towards wolves, with pro-wolf attitudes coded high (Pretest: M = 5.0, SD = 1.1, Cronbach's α = .76; Posttest: M = 5.0, SD = 1.1, Cronbach's α = .71).

Analyses

Ordinary least squares (OLS) regression was used to test the hypotheses for this study. The proposed serial mediation model showing in Figure 2 was tested using the PROCESS macro outline in Hayes (2018). This computational tool is used for path analysis-based mediation and moderation analysis and uses OLS regression to estimate model coefficients.

To address RQ_3, which asks if any individual difference variables cause the experimental manipulations to produce significant differences in empathy, analysis of variance (ANOVA) was used to examine the impact of each condition on empathy as a function of individual differences measured at Time 1.

Results

Manipulation Checks

A manipulation check was performed to assess whether the stimuli manipulations had the intended effect on the mediating variable, empathy. A factorial ANOVA was used to test differences in empathy based on framing and the use of close-ups, as well as the interaction between these two aspects of the stimuli. Frame included two levels (episodic, thematic) and close-ups consisted of two levels (no close-ups, close-ups). The following variables were controlled for in this analysis: age, sex, race, biblical literalism, evangelical Christianity, political ideology, environmentalist identity, attention to science/environmental news, attention to science documentaries, and Time 1 attitude towards wolves.

There were no significant effects of the manipulations or of an interaction between the manipulations at the $p \leq .05$ level. The main effect for frame yielded an *F*-ratio of $F(1, 627) = 0.3$, $p = n.s.$, indicating that there was no significant difference in empathy based on whether episodic ($M = 0.02$, $SD = 0.04$) or thematic ($M = -0.02$, $SD = 0.05$) framing was used in the video. The main effect for close-ups yielded an *F*-ratio of $F(1, 627) = 0.1$, $p = n.s.$, indicating that there was no significant difference in empathy based on the presence ($M = -0.01$, $SD = 0.05$) or absence ($M = 0.01$, $SD = 0.04$)of close-ups. Additionally, the interaction effect between the two manipulations was not significant $F(1, 627) = 0.5$, $p = n.s.$

Hypothesis H_7 predicted that the episodic frame would evoke greater empathy than would the thematic frame. This hypothesis was not supported as the results of the ANOVA show that empathy did not differ significantly by frame. Hypothesis H_8

predicted that close-ups would evoke greater empathy than would no close-ups. This hypothesis was not supported as the results of the ANOVA show that empathy did not differ significantly by frame. Lastly, the factorial ANOVA revealed that the interaction between frame and close-ups (i.e., stimuli conditions) also had no significant effect on empathy.

Because the manipulation did not have any effect on the mediating variable, post hoc analyses were performed to test whether any potentially important individual difference variables (e.g., demographic characteristics, values, media use behaviors, etc.) caused significant differences in empathy based on experimental condition (reported below).

Empathy Exploratory Factor Analysis

An exploratory factor analysis was performed on the empathy measure because the manipulation failed to produce differences in this mediating variable. The purpose of the factor analysis was to determine if the two subscales of empathy (perspective taking and eudaimonic) could be split into functionally distinct subscales that might be more effective in the model.

An exploratory factor analysis was conducted using maximum likelihood method and varimax rotation to determine the factor structure. Oblique promax rotation was used because the factors being analyzed (perspective taking and eudaimonic dimensions of empathy) are known to be correlated. The KMO measure of sampling adequacy for each variable in the model was .919, indicating that the sampling was adequate. When comparing the percentage of variance explained, a one-factor structure explained 64.9% of the variance and a two-factor structure explained 76.7% of the variance. Moving from

a one-factor model to a two-factor model did not explain much more of the variance, suggesting that a one-factor model (i.e., single measure for empathy) is preferable to a two-factor model (i.e., separate measures for perspective taking and eudaimonic components of empathy). Additional post hoc tests using each component in the model (i.e., using just the perspective taking or eudaimonic component of empathy rather than the combined measure) also failed to find any effects of the manipulation.

Primary Analyses

The results of the regression analysis are presented in Table 6 with unstandardized coefficients reported. The PROCESS macro tested each step in the model using sequential OLS regression and bootstrap (10,000 times) confidence intervals were used for inference about the total direct and indirect effects in the final proposed model (Figure 2).

Verification of the manipulation check and of rejecting Hypotheses 7 and 8, which predicted that episodic framing and the use of close-ups would evoke greater empathy can be found in the results of the regression analysis. The model was analyzed twice - once for each stimulus factor while controlling for the other stimulus factor and these results were combined to produce Table 6. As in the manipulation check, neither the message framing ($b = 0.04$, $p = n.s.$) nor the close-ups ($b = -0.03$, $p = n.s.$) manipulations produced significant differences in empathy.

Although the manipulations failed to predict empathy, a few of the covariates in the model were significantly associate with empathy, including sex ($b = -0.22$, $p \leq .001$), environmentalist identity ($b = 0.14$, $p \leq .001$), attention to science/environmental news (b

= 0.07, $p \leq .01$), science documentary use ($b = 0.07$, $p \leq .01$), and pretest attitudes towards wolves ($b = 0.18$, $p \leq .001$). In total, these variables explained 30.4% of the variance in empathy ($p \leq .001$).

The second stage of the model tested the association between empathy and posttest wolf attitudes in the serial mediation model. Because the pretest measure of attitudes towards wolves was included in the model, posttest wolf attitudes are interpreted controlling for pretest attitudes, i.e., the posttest wolf attitude measure demonstrates the difference between attitudes towards wolves in Waves 1 and 2. Therefore, it can be presumed that significant effects on attitudes towards wolves are likely due to viewing one of the stimulus videos.

Hypothesis H_9 predicted that empathy will increase pro-wolf attitudes and was supported by the analysis ($b = 0.21$, $p \leq .001$). In addition to empathy, the framing manipulation predicted posttest wolf attitudes ($b = 0.13$, $p \leq .05$). Unlike in the proposed model, empathy did not mediate the relationship between framing condition and instead the framing condition had a direct influence on posttest attitudes towards wolves. This variable is coded such that 0 = thematic framing and 1 = episodic framing. The effect of framing on posttest wolf attitudes can therefore be interpreted as follows: individuals who viewed one of the episodic framing conditions were more likely to hold pro-wolf attitudes than were individuals who viewed one of the thematic framing conditions. Because framing was expected to increase pro-wolf attitudes through empathy, these results match the predicted direction of Hypothesis H_7 but did not support the pathway

proposed by the model in Figure 2. As shown in Table 6, the close-up condition did not have any effect on posttest wolf attitudes.

Table 6. Study 3: Multiple linear regressions predicting empathy and attitude towards wolves at posttest

Variable	Empathy	Attitude towards wolves
	b	*b*
Frame (0 = thematic, 1 = episodic)	0.04	0.13*
Close-ups (0 = no close-ups, 1 = close-ups)	-0.03	0.01
Location (wolf states coded high)	-0.11	0.05
Age	0.00	0.00
Educational attainment	-0.04	0.03
Sex (male coded high)	-0.22***	-0.10
Race (minority coded high)	0.15	-0.08
Biblical literalism	0.13	-0.09
Evangelical Christianity	-0.04	0.01
Ideology (conservative coded high)	-0.02	-0.06**
Environmentalist identity	0.14***	-0.04
Attention to science/environmental news	0.07**	0.00
Science documentary use	0.07**	0.00
Pretest attitude towards wolves	0.18***	0.72***
Empathy		0.21***
R^2	.304	.629

Unstandardized coefficients reported.
* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

In addition to the key variables of interest, the following factors increased the likelihood that a participant would be more pro-wolf after viewing the videos: political ideology (conservative coded high; b = -0.06, $p \leq .01$) and pretest wolf attitudes (b = 0.72, $p \leq .001$). The association between ideology was negative, which means that participants who were more liberal were more likely to hold pro-wolf attitudes after viewing the videos than were conservatives. Overall, the variables in this model explained 62.9% of the variance in posttest wolf attitudes, suggesting that the variables included in the analysis were highly associated with the outcome variable, although this association did not occur through the theory-derived proposed pathways shown in Figure 2.

Post hoc Analyses

A series of post hoc OLS regression analyses were run in order to test whether or not any of the individual difference variables measured at pretest influenced the effect of the manipulations (framing and use of close-ups) on empathy (RQ_7). Because the manipulations did not affect empathy as predicted, these analyses explore whether or not other individual differences might moderate the relationship between each manipulation and empathy in an attempt to uncover any ways in which the manipulations affect empathy that were not proposed in the original model.

Regressions predicting empathy as a function of the interaction between the manipulated variables (framing and use of close-ups) and individual differences were run for all pretest variables included in the other analyses (location, age, education, sex, race, biblical literalism, evangelical Christianity, ideology, environmentalist identity, attention

to science/environmental news, science documentary use, and pretest attitudes towards wolves). Out of the dozens of post hoc analyses performed, only two interactions between an individual difference variable and one of the manipulations were found to be significant.

One analysis found that science documentary use interacts with the close-ups manipulation to influence empathy. Although the interaction between the close-ups manipulation and science documentary use produced only a small change in the variance of empathy (R^2 change = .004), this association was significant at $p \leq .05$. This interaction was further probed using the PROCESS macro to test how the conditional pathway between the use of close-ups and empathy differed as a function of science documentary use. Although the overall interaction was significant, the conditional effects of the close-up manipulation on empathy were not significant at $p \leq .05$. At low and moderate levels of science documentary use, the association between the close-up manipulation and empathy was negative. Because of the way the close-up manipulation was coded, this negative association indicates the non-close-up condition is more effective than is the close-up condition for individuals who view science documentaries infrequently (b = -0.14, p = .08) and for those who view documentaries with moderate frequency (b = -0.03, p = *n.s.*). This result is surprising and does not fall in line with any of the hypotheses in this study. In contrast, the association between the close-up manipulation and empathy was positive for those who frequently view science documentaries (b = 0.05, p = *n.s.*). This means that the close-up conditions were more effective than were the non-close-up conditions for individuals who frequently consume

science documentaries, although this (and the other) conditional effect was non-significant.

A second analysis found that pretest wolf attitudes interact with the frame manipulation to influence empathy. Although the interaction between the frame manipulation and science documentary use produced only a small change in the variance of empathy (R^2 change = .007), this association was significant at $p \leq .05$. This interaction was also probed using the PROCESS macro. The conditional effect of the frame manipulation on empathy was only significant for those with more negative pretest attitudes towards wolves (i.e., because attitude towards wolves is coded with pro-wolf attitudes high, those with lower values for this variable hold more negative attitudes towards wolves than do those with higher values for this variable). For those with more negative wolf attitudes, the association between the frame manipulation and empathy was positive ($b = 0.17$, $p \leq .05$). Because of the way the frame manipulation was coded, this positive association indicates that the episodic frame was more effective than was the thematic frame for those who had relatively negative attitudes towards wolves during the pretest. Framing is therefore most likely to influence the effects of these messages for those who are predisposed to disagree with the message, as all of the stimuli were pro-wolf.

Discussion

These analyses produced an interesting pattern of relationships between framing, the use of close-ups, various individual difference variables, empathy, and attitudes towards wolves. Unfortunately, the manipulation did not work as expected, resulting in rejection of H_7 and H_8. The verbal and visual differences between the conditions did not

have a significant effect on empathy. However, the variables in the model explained over 50% of the variance in wolf attitudes, suggesting that these variables play an important role in environmental attitudes. At issue and a subject for future research is determining how to leverage these variables effectively through message design strategies.

This study tested the impact of two message design strategies should have theoretically increased empathy towards the wolves in the video – episodic framing and the use of close-ups. Of these manipulations, the only one that had a significant influence in the proposed model was framing, although this effect was direct rather than through the mediator as predicted in the hypotheses.

The fact that the individual differences included in this study had a pronounced impact on both empathy and attitudes towards wolves suggests that effective environmental communication is likely a function of how the viewer's characteristics interact with the way this information is communicated. As a result, science communicators must consider who their target audience is when creating pro-environmental messages as a given message format may be effective for one group of people and not another based not on the characteristics of the message itself but on how message structures interact with audience predispositions. As with marketing and psychographic segmentation, science communicators would be well-advised to create psychological and demographic profiles of their target audiences in order to figure out which messaging strategies to use. Of course, further research needs to be done to create a more complete profile of which audience characteristics are most likely to interact with which message design strategies and to what effect.

In this vein, one heartening outcome of this analysis is that the episodic frame did influence the relationship between pre-existing attitudes towards wolves and empathy for those who reported more negative attitudes towards wolves. This means that information about wolves framed in an episodic manner is more likely to impact audiences who are predisposed to disagree with the message than is thematically framed information about wolves. Therefore, wildlife documentary filmmakers should consider using this type of framing to create individual animal "characters" and exemplars and focus on telling stories about the struggles of these characters rather than about the struggles of the species as a whole. This is a more effective messaging strategy for resistant audiences than are environmental messages that focus on broad descriptions of species' struggles for survival.

Chapter 5: General Discussion and Conclusion

Combined, the results of these studies increase our understanding of documentary audiences and effects by analyzing these processes empirically and by performing statistical tests to examine whether or not the assertions of film studies and other qualitative documentary research are supported by data. On the whole, these three studies increase our understanding of science documentaries by (1) describing the real-world audience for this content; (2) testing whether differences in message goal and narrative structure produce different outcomes; and (3) testing whether specific message design features such as framing and the use of close-ups increase the effectiveness of science documentaries.

The results of Study 1 indicate that certain audience characteristics are consistently associated with science documentary use. Across the three datasets used in this study, other media use behaviors had a powerful impact on one's likelihood of viewing science documentaries. This outcome is plausible as those who consume a lot of media in general are also likely to consume be heavy consumers of any given genre. However, attention to science/environmental news in particular was strongly associated with science documentary viewing, demonstrating that a match between different types of media content may enhance the likelihood of one form of media driving individuals to other forms of media. In addition to these findings, the results suggest that individuals with a proclivity for viewing partisan news sources are also highly likely to view science

documentaries. This may be driven by the fact that both news and documentaries provide a means of achieving information acquisition and surveillance goals. Other convergent findings from this study indicate that in real-world setting science documentaries are more likely to be viewed by males and by those with lower educational attainment.

Some interesting results also emerged from Study 1 about additional characteristics of science documentary audiences. Those who are high in science information efficacy and those who frequently like to discuss science issues were highly likely to view science documentaries. This suggests that as people become more competent and confident in their ability to understand science information they will also seek out and consume more of this information through science documentaries. Similarly, those who enjoy discussing science issues may seek out science documentaries as a source of information for discussion.

Study 2 explored the influence of differences in message goal and message structure on documentary effects. Although differences in message structure (expository vs. participatory) did not appear to influence the effects of science documentaries, differences in message goal yielded outcomes in the predicted direction. Advocacy documentaries were found to be more effective at shifting policy preferences, which makes intuitive sense as the fundamental goal of these documentaries is to promote change, whereas the fundamental goal of expository films is didactic (teaching information). However, the differences in message goal and message structure did not have the impact on narrative involvement proposed by the model, suggesting that future research should focus not on testing whether narratives or non-narratives produce

differences in narrative involvement and instead on concrete message design strategies that can be used purposefully to increase narrative involvement.

Perhaps the most promising result of Study 2 is that the relationship between the advocacy conditions and narrative involvement was moderated by initial risk perceptions such that those with low initial risk perceptions were more affected by the advocacy documentaries. This suggests that a successful strategy documentary filmmakers can use to reach audiences predisposed to resist or disagree with science/environmental messages would to try to create advocacy documentaries that generate higher levels of narrative involvement. By leveraging the narrative persuasion mediators, filmmakers may be able to more effectively reach audiences for whom their messages are psychologically distant (i.e., low involvement) and/or value-incongruent. As the goal of advocacy documentaries is not only to promote individual change but also to be shared with as many people as possible to promote societal change, messages that stimulate viewers to identify with "characters" (real or fictional) onscreen and that draw the viewer into the "story" world of the documentary are especially effective at reaching broad audiences who either do not care about environmental issues and/or for audiences who hold anti-scientific consensus beliefs/attitudes about environmental issues. It is plausible from the results of this study that documentaries that generate higher levels of narrative involvement may also be more likely to be shared and more likely to reach broad and resistant and/or uninterested audiences. As a result, documentaries that tell highly engaging stories are the most likely to instigate change as such messages are more likely to increase issue involvement and also are more likely to be accepted by a wide range of people.

Study 3 aimed to develop concrete message design recommendations that documentary filmmakers can use to make their messages as effective as possible. Unfortunately, the manipulation of framing (episodic vs. thematic) and the manipulation of close-ups (presence vs. absence) in this experiment did not work as predicted. Rather than influencing attitudes through empathy as a mediating variable, the use of an episodic frame directly increased pro-wolf attitudes at posttest. However, post hoc analyses revealed that the relationship between message frame and empathy is contingent on an audience member's preexisting attitudes towards wolves, such that those who initially feel more negatively towards wolves experience the greatest increases in empathy when shown episodic rather than thematic messages. Episodic framing focuses on telling the story of an individual rather than a group and is in some ways similar to narrative structure in that episodic frames tend to tell the "story" of an individual the audience can identify with more than do thematic frames. Future research testing the impact of episodic framing in different contexts (e.g., videos focusing on humans rather than wolves) is warranted to uncover whether or not the lack of manipulation influence was due to some other aspect of the experimental design, such as the choice to focus on an animal species or online administration of the survey experiment.

Study 2 also found an interaction between science documentary use and the degree to which close-ups influence empathy. Although the effect was weak, it appears that the use of more close-ups was *less* effective for audiences who do not view documentaries frequently than was the use of fewer close-ups. This counterintuitive finding warrants further examination in future studies to see whether or not this effect was an artifact of the specific messages and subjects used in this study.

Limitations and Future Directions

Each study in the present research had a few limitations. The limitations of each study are described below, followed by a discussion of the limitations and challenges related to stimulus selection across the three studies.

Study 1

Study 1 was a secondary data analysis of three datasets originally collected for other purposes. As such, the variables in the Study 1 models were limited to those collected in each dataset. Most notably, Dataset 2 did not contain direct measures of documentary use and proxy measures of attention to different television networks was used to indicate attention to documentaries. As a result, the variance explained by the model in Dataset 2 is half that of Datasets 1 and 3.

This proxy measure of documentary use was weak because it was broad, dichotomous, and did not recognize that people may watch very different types of content within each channel. For example, a person who reports watching the Discovery Channel *might* be viewing exclusively science documentaries on this channel; however, the person is equally likely to only watch shows like *Gold Rush* and *Naked and Afraid* or other shows that would not be considered science documentaries. The imprecision of this measure does not allow for differentiation between different types of viewers in this study.

Despite these limitations, Study 1 provides valuable insight into who is watching science documentaries. Additionally, the shortcomings of this study point to the necessity of developing more refined measures of documentary use (discussed further

below in the "Stimulus Selection" section) as a way to further advance this body of research.

Future research should also explore the motivations with which people approach science documentaries. For example, do individuals choose to watch these films because they want to be entertained, because they want to be informed, or for some combination of these (and potentially other) reasons? Research on how persuasion operates across receiver goals and message genres (e.g., Slater, 1997) should be incorporated to explain why science documentaries may be more or less effective for different individuals.

Study 2

A majority of the limitations in Study 2 can be attributed to difficulties with stimulus selection; these challenges are discussed in the "Stimulus Selection" section below. In addition to these issues, Study 2 was limited by the use of a relatively homogenous (compared to the national population) student sample. As a result of using a student sample, overall variance in many of the measures may have been reduced, weakening the predictive power of the variables in the model. In the future, if possible, research about documentary effects and environmental hazards should utilize a more representative sample of the U.S. population in order to get a better picture of how the variables in the model function in broader society. Although the results of this study do not speak to selective exposure and who is actually watching science documentaries (addressed in Study 1), using a more heterogenous pool of participants would likely yield different results from those of the student sample. However, how closely a sample represents the population is of relatively low concern when evaluating communication processes (Hayes, 2005). Still, because national attitudes around science and

environmental issues may be different from those popular on college campuses, this study would have been strengthened by testing the model and hypotheses using a more representative sample.

The interaction between prior risk perceptions and narrative involvement in this study provides a fruitful avenue for future research to parse out the relative influence of low involvement and message disagreement on risk perceptions. In other words, what is driving the relationship between initial risk perceptions and narrative involvement – are the conditional effects of narrative involvement due to differences in issue involvement, differences in value-congruence of the message, or some combination of the two? This could be accomplished by including pretest measures specific to issue involvement in addition to the pretest measures about risk beliefs and policy preferences. More specific measures of audience values would also allow for a better assessment of value-congruence of the messages rather than using political ideology as a proxy for value-congruence (i.e., support environmental regulation treated as value-incongruent for conservatives). By using more refined measures to determine whether the audience simply does not care about the issue (low involvement) or whether the audience actively disagrees with the message, future research can provide more concrete recommendations about message design strategies based on how the audience relates to the issue and the reason for the audience's low risk perceptions.

Study 3

There are multiple limitations to this study that may explain why the manipulation was ineffective. First, the videos were only about three minutes long, which may have reduced audience connection with the animals on screen because these connections were

not made over an hour-plus long film as would happen when viewing a full-length science documentary. Future research should test the proposed model and manipulations in this study using longer stimuli that more closely resemble full-length wildlife films.

Another reason for the lack of results in this study may be ceiling effects. Although wolves are one of the most controversial species, pro-wolf attitudes were fairly high even at the pretest. It may be that the manipulations *could* have behaved in the predicted way had pre-existing participant attitudes towards wolves been more negative, allowing for more room for changes in the dependent variable (and in empathy) as a result of the manipulations.

A third limitation of this study is that it was administered using an online survey. Although the use of Qualtrics panels for this experiment strengthened the findings by using a more diverse and representative sample than would be obtained through college students, conducting this type of research online greatly reduces experimental controls. There is no way to know how closely the participants focused on the videos while watching – it is quite possible that many of the participants were multi-tasking or distracted as the video played, which might have reduced the effectiveness of the messages. Ideally, a study like this would be conducted in person so that the researcher can observe the participants as they view the videos and can remove spurious influences on the study's outcome.

A final potential limitation to this study is that it tested the boundary conditions of message design by looking at how message strategies impact attitudes towards animals rather than people. The key mediator asked participants to take the perspective of the wolves in the video, which may be more difficult for people to do than is taking the

perspective of a fellow human. In previous research, Cao (2012) found that close-ups increase empathy towards specific humans shown on videos. Had the present study been conducted using humans as the target for empathy, the pattern of results may have more closely mirrored those earlier findings. One future direction for this line of research within the context of environmental issues would be to test the effectiveness of the manipulations while focusing on the negative consequences environmental problems such as climate change have for *humans* rather than for animals. This might also be more effective as using humans as a target for empathy reduces the psychological distance between the subject and the viewer.

Stimulus Selection

The hypotheses in Study 2 and Study 3 seem to have failed largely due to the stimuli and manipulations in each experiment failing to produce the predicted (or any significant) variation in narrative involvement and empathy, respectively. Conducting research that involves messages as stimuli is fraught with potential pitfalls because even messages of specific type vary greatly from one another (Slater, Peter, & Valkenburg, 2015). When discussing the potential issues with stimulus selection, it is important to differentiate between two terms: message variability and message heterogeneity. Message variability is of interest to researchers and encompasses those message differences that a researcher intentionally manipulates and/or measures. Message heterogeneity refers to the wide-ranging variation between any given messages that is not of theoretical interest. Message heterogeneity can be considered research "noise" because it can produce unintended effects and lead to problems such as a lack of

generalizability and mistaken assumptions about what is driving effects, especially for studies with only one instance of each experimental category.

Stimulus selection issues likely played a major role in the shortcomings of Studies 2 and 3, so it is important to discuss why and how stimulus selection produced such problems in order to critically examine the outcomes of these studies. There are three primary, interrelated reasons why the selected stimuli and manipulations may have failed to produce intended (or any) effects: (a) theoretical assumptions and predictions were incorrect; (b) the manipulations failed to adequately exhibit the qualities that would make the theoretical assumptions and predictions accurate; and/or (c) issues with how the outcome variables were measured.

Regarding theoretical assumptions and predictions, the results of Study 2 suggest that the typology of documentaries developed from film studies approaches (e.g., Nichols, 2001) may not adequately/accurately describe the documentaries that currently exist in a meaningful way. This suggests that the current research may have been overly-ambitious in beginning with a typology rather than by developing one through content analysis. Because social science documentary research is still at an exploratory stage, this field of study would benefit greatly from a more systematic approach to identifying message features and classifying films based on these qualities. Performing a content analysis before selecting stimuli and conducting an experiment offers many benefits and would greatly strengthen this research (Slater et al., 2015). Content analysis allows researchers to better-identify not only how to appropriately categorize stimuli into groups for message variability but would also likely produce insight about other message design features that may be of theoretical interest. It would also be a more objective

categorization than more subjective selections done by researchers to approximate the categories of interest. In sum, content analysis allows researchers to operationalize message features for study to produce more valid outcomes. Performing a content analysis would not only improve understanding of how science documentaries fit into the dimensions included in this study (narrative structure and message goal) but should also provide and operationalize previously unnoticed message design factors that may be of theoretical interest.

In many ways, doing such a content analysis is similar to taking a systematic/analytic grounded theory approach to inductively develop an understanding of the documentary genre. The aim of grounded theory is to use, code, and categorize messages to develop concepts in order to generate a theory, in contrast to more deductive approaches like hypothesis testing (Creswell, 2007). Taking such a bottom-up approach will provide more insight into the documentary genre than what would have been gained had Study 2 worked as predicted because it would not only provide information to better operationalize the categorizations used in this study but also because the process of performing the content analysis itself will likely lead to observations that can dictate research questions for future programmatic research on the documentary genre by turning different observed aspects of these films into message variables that can be empirically investigated (Slater et al., 2015). Performing a content analysis can provide increased clarity in research by allowing for more explicit definitions of what message aspects are of interest and which aspects reflect message heterogeneity.

In addition to the advantages mentioned above, the process of gathering a sufficient number of films for an adequate content analysis would create a library of

messages for future research that may be large enough to use random effects/multi-level modeling to generate validly generalizable conclusions (Slater et al., 2015). Instead of rudimentary "stimulus sampling" done in the present research (i.e., using two films for each category), random effects modeling involves randomly selecting stimuli from a large population of messages. If such a procedure is followed and differences persist between categories but not within categories, it can be said with a reasonable degree of certainty that the categories are conceptually distinct and so differences in effects are due to differences based on the defined variable of interest rather than on specific "quirks" of the particular messages selected and can thus be generalized to other films that fit the categories of interest. In this approach, each individual stimulus can be treated as nested within its message category and message heterogeneity can be statistically addressed. Multi-level modeling subverts potential message heterogeneity issues/effects by allowing the researcher to statistically analyze the impact of message heterogeneity and to act accordingly. If message heterogeneity is low, intra-class coefficients in the study are more likely to be high and the random differences between selected stimuli can be ignored. Random effects/multi-level modeling allows researchers to draw more valid conclusions by providing evidence that observed message effects are due to the variables of interest rather than to other differences between stimuli that have nothing to do with the study. When the random sample is sufficiently large, external validity and potential generalizability is enhanced because the messages will essentially reflect real world within-category variation. Essentially, the using this random effects/multi-level modeling would reduce the statistical noise created by heterogeneity within the genre by canceling out effects of unintended message variation.

One of the primary difficulties in conducting Study 2 was finding documentary films that match the proposed typology. As discussed, one of the major barriers to more thorough social science research on documentaries is the extreme heterogeneity within this genre. Finding films that fit the narrative structure and message goal categories was largely an exercise in finding films that fit the typology in Table 4 "closely enough" because documentaries do not fit neatly into these specific categories without possible overlap. Even finding a broad workable message population was somewhat difficult; harder still was selecting ideal exemplars for each category. The success or failure of studying messages hinges on the ability to select messages that adequately represent the larger classes of messages one wants to study because if the intentional message variability in the study fails to do so conclusions drawn from the results of the study may be meaningless (Slater et al., 2015).

Developing better categorization and operationalization as discussed above would also likely help in creating categories that are more mutually exclusive than those used in this study. However, the challenges associated with using existing stimuli rather than creating carefully controlled messages for an experiment are not unique to the current research and cannot all be resolved through more thorough theoretical development. The tradeoffs involved in deciding to use existing stimuli versus creating stimuli must always be conscientiously considered when doing any research involving media messages.

Existing documentaries were used in Study 2 despite the lack of experimenter control over the message pitfalls because for external validity purposes it is most valuable to test models using examples of the kinds of stimuli that exist within the real world. It would not have been feasible to create documentaries for this experiment that matched

the quality of the environmental documentaries that exist in the media landscape. For example, to create a participatory documentary for this study one would need to go into the field with an on-camera personality and essentially create a feature length documentary in order for the stimulus to contain the necessary signifiers for participants that the film is a "real" documentary. It was therefore essential to use existing films in this study, despite the fact that such films do not fit neatly into the typology in Table 4. If the messages used had been shorter and/or if the variables of interest in this study were easily manipulatable within a given film, another strategy that could have been used would be to experimentally manipulate the selected stimuli (Slater et al., 2015).

For example, if one were to test the effects of including information about how people can take action on efficacy, it would be easy to create two versions of the same film – one with this information included and one with it removed. Such a procedure could be followed for several films to create a large pool of messages within each category that can randomly be used in the experiment. Such an approach would not be possible when studying broader message structure constructs as was attempted in Study 2, although this may indicate that there were theoretical problems with this study as the constructs studied were not cleanly defined enough to perform such a manipulation in the present research. Future science documentary research may be strengthened by focusing first on more specific and easily manipulated message design features that will produce more statistically valid results via the use of random sampling.

One strategy that was used to overcome these potential pitfalls was stimulus sampling. By using multiple instances of each category, it was hoped that there would be no significant differences within each category but that significant differences between

the categories would emerge and (ideally) be in the directions predicted by the hypotheses (Wells & Windschitl, 1999). The stimuli used failed at achieving both goals – there were significant within-category differences as well as limited differences between categories. The within-category differences were controlled for in the analyses; however, it is hard to deny that the results may have been different had there been fewer within-category differences that needed to be controlled for. It is likely that these issues arose because the stimuli did not fit discretely into the typology in Table 4.

In the expository documentaries, for instance, the filmmaker was not totally absent from participating, although this participation was more about demonstrating and illustrating concepts for the audience than about participating in the issues/causes themselves. Additionally, advocacy documentaries **do** also teach and, depending on the perspective and prior attitudes of the audience member, expository documentaries could possibly be interpreted as explicitly persuasive. For example, if an audience member is pro-fracking, he/she might interpret *Fracking: Shattered Ground* as overly trying to change his/her opinion, despite the fact that this documentary is categorized as expository educational. This further highlights the importance of individual differences, as previously discussed.

The stimuli created for Study 3 may also have been problematic as the framing and close-up manipulations did not produce the predicted variation in empathy. Specifically, because the stimuli used footage from an existing film it was difficult to find shots that could be zoomed in appropriately without losing image quality. The reduction in quality for the close-up images may have produced unintended effects that influenced the manipulation. Although empathy (rather than narrative involvement) was used as the

mediator for this study, it is worth noting that previous research indicates that reduced production value and quality reduces transportation (Kreuter et al., 2007). The video quality therefore may have unintentionally influenced the study outcome. Essentially, the approach taken in Study 3 had the advantage of control over stimuli (because they were created by the researcher) but may not have met the quality level expected of "real" documentaries. Whereas Study 2 was challenged due to a lack of control over heterogeneity within categories, Study 3 may have been challenged by a lack of external validity to participants. The advantages and disadvantages of stimulus creation versus stimulus selection are demonstrated by the comparative strengths and shortcomings of Studies 2 and 3 in the present research. The validity of the results of Study 3 (had they been significant) are susceptible to challenge because it is arguable that such created stimuli are not representative of and therefore cannot be extended to real-world phenomena (Slater et al., 2015).

A final issue regarding stimulus creation is the challenge inherent in attempting to manipulate levels of narrative involvement. Previous research largely compares narratives to non-narratives and/or does not really focus on applicable strategies for generating narrative involvement. Narrative involvement research indicates that the use of non-chronological order (Wang & Calder, 2006), reduced writing quality (Donahue & Green, 2006), and instructing participants to focus on the surface features of the message reduce transportation (Brock & Green, 2000). While these can be seen as applicable recommendations for producers (e.g., don't tell stories in non-chronological order), this body of research does not (as far as the author has found) make specific recommendations about how to manipulate narrative involvement to the extent that the

present studies attempted. Whether or not this is even possible should be addressed in future research.

Lastly, for both Studies 2 and 3 it would have been prudent to use pretesting and manipulation checks to test whether or not the categorical distinctions and definitions were valid. Had pretesting been performed, some of the issues could have been counteracted because the researcher would have identified problems with the stimuli before conducting the full studies. In some ways, manipulation checks are a useful proxy for content analysis because they check the validity of the experimental manipulations (Slater et al., 2015). This would be a practical way to strengthen future research in the documentary domain should performing a full content analysis be prohibitively costly or time-consuming.

Despite these challenges to manipulating narrative involvement, narrative persuasion scholarship *does* support the overall conclusions of the present research regarding the importance of individual differences in driving media effects. For example, Mazzocco and colleagues (2010) found individual differences in transportability that produced differences in narrative persuasion outcomes (Mazzocco, Green, Sasota, & Jones, 2010). Additionally, Appel and Richter (2010) found that individuals who are higher in need for affect (i.e., individuals motivated to seek out emotion-evoking situations) are more likely to experience narrative involvement and also experience this narrative involvement more strongly. As previously discussed, it may be prudent to move from focusing on how to manipulate messages to produce narrative involvement to a greater focus on how the interaction of narrative structure and audience characteristics can be used to match message type to ideal message target.

The third primary reason why the narrative manipulations may have failed to produce the desired results is potential issues with the measures used in these studies. One measurement issue may have been with the way identification was measured in Study 2. Identification measures typically ask participants about identification with a specific character; because the expository stimuli did not really have any consistent "characters" throughout the films, all identification items asked if participants identified with "the people in the video." This non-specific measure may have caused participants to either (1) pick and choose which "character" to identify with when responding; and/or (2) prevented participants from being able to find a "character" with which to identify. In both cases, the identification measure likely does not capture what it is intended to. It may be necessary in future studies to either avoid using identification as an aspect of narrative involvement (although this would be flawed, based on overwhelming evidence about the importance of identification in narrative engagement) or to develop a measure of identification that can be used for videos with multiple characters.

Regarding the latter point, a promising future direction for narrative persuasion research that fits particularly well with the study of documentary narratives is examining the effects of conflicting stories. Documentary films, like news reports, often present multiple points of view on an issue. This occurs even in advocacy films, although the information that conflicts with the advocacy message is usually subsequently "disproven" and the presence of such conflicting information (i.e., two-sided messages) is often present only to increase the persuasive effects of the primary message (Stiff & Mongeau, 2003). Previous research indicates that when presenting with conflicting narratives, participants often rely on treatment-irrelevant similarities between the viewer and the

subject of the story (Simons & Green, 2013). This indicates that (a) individual differences are highly likely to play a crucial role in determining which conflicting story within a documentary becomes endorsed by the viewer; (b) an advocacy documentary's use of [point-counterpoint] persuasive techniques may backfire if the viewer strongly identifies with those presenting information that conflicts with the documentary's main message; and (c) additional research into how conflicting narratives influence narrative persuasion is a crucial future direction for documentary narrative persuasion research as presenting conflicting narratives is a staple of documentary films.

In addition to issues with whether or not the measures accurately reflected the constructs of interest, the studies may have failed to produce desired results due to a lack of variance in some of the key variables. For example, in Study 3 empathy was nearly identical across all four conditions and exhibited ceiling effects, i.e., if greater empathy had in fact been induced by the episodic and/or close-up condition it was impossible to detect due to high levels of empathy across all conditions. Although this problem resulted in hypothesis rejection, it *is* promising for wildlife conservationists – empathy towards wolves was high across individuals and message structures.

All three studies in the present research included measures of media attention/exposure; however, issues with these types of measures are most relevant to Study 1's dependent variable, documentary use. The results of this study indicate that a more refined measure of documentary use needs to be developed to better-reflect the existing media landscape. As previously discussed, what is even considered a "documentary" is open for debate. Should highly dramatized shows such as *Deadliest Catch*, which airs on the Discovery Channel, be considered science documentaries even

though they contain relatively little scientific information? In Study 1 Dataset 2, when proxy measures of television channel use were substituted for more specific measures of documentary use the explanatory power decreased by over 50%, which may provide some evidence for the fact that people watch a range of "highbrow" and "lowbrow" content on such channels and that the characteristics of viewers for these different types of content may also be quite different. The advantage of developing measures that allow for more specific types of documentary use is that doing so can turn unappealing heterogeneity into message variability and constructs of interest (Slater et al., 2015). For example, a measure with items specific to lowbrow and highbrow documentaries might reveal systematic differences in the audiences or effects of such messages. By developing a more refined measure of documentary use it would be possible to differentiate types of audiences based on types of content, which would provide more useful information for message creators because ideal message strategies may differ depending on the type of documentary content in question as well as on the audience's purpose for viewing. Using a more specific measure would also make it easier for participants to accurately report their media use, leading to more accurate results. Although Study 1 involved secondary data analysis, a research program focused on documentary message design and effects will require better measures to more accurately approximate this critical construct of interest. By developing an understanding what audience is watching a particular type of documentary, such research can provide actionable recommendations for media producers.

Conclusion

Science and environmental documentaries are an important means of science communication that has been largely overlooked by social science researchers. The aim of the current research was to increase our understanding of documentary audiences and effects with the goal of developing actionable strategies for filmmakers to use to make their messages as powerful as possible. Because documentary is a relatively utilitarian format (messages are designed to accomplish a goal, whether than be advocacy or education), message design strategies that allows filmmakers to leverage social science research in areas such as narrative persuasion is crucial.

Science and environmental issues are of critical importance to society and communicators must often convey information about these issues to resistant audiences. Understanding the characteristics of who is watching documentaries may be a better target for efforts to figure out how to use narrative persuasion research as these individual factors may have a much more powerful and predictable effect on documentary influence. These factors may also interact with message design structures such that certain types of messages will be more effective than others based on these personal characteristics. Similar to psychographic market research, the results of these studies suggest that it would be prudent for science documentary filmmakers to develop detailed profiles of their audiences in order to understand which messaging strategies to use to achieve their goals.

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Appendix A: Study 1 Dataset 1 Questionnaire

In addition to traditional socio-demographic measures and, the following items were used in Study 1 Dataset 1. Items marked with * were reverse coded.

Dependent variable

Documentary use (1 = never, 7 = all the time)

How often do you watch different types of nonfiction science or environmental TV shows, films, videos, or documentaries?

- Nature and wildlife shows or films (e.g., Shark Week, Planet Earth, March of the Penguins)
- Science and technology shows or films (e.g., Mythbusters, PBS Nova, How it's Made)
- Outdoor adventure shows or films (e.g., Man vs. Wild, Deadliest Catch, Whale Wars)
- Space and astronomy shows or films (e.g., Through the Wormhole, In the Universe, Cosmos)

Ideology, identity, and knowledge/beliefs

Ideology (1 = very liberal, 7 = very conservative)

- When thinking about economic issues, how would you best describe your political views?
- When thinking about social issues, how would you best describe your political views?

Environmentalist identity (1 = strongly disagree, 7 = strongly agree)

- I consider myself an environmentalist.
- I would never describe myself as an environmentalist to others. *
- In most situations, I'm very aware of being an environmentalist.
- Environmentalism is not an important reflection of who I am. *

Scientific literacy

Respondents used a five-point true/false scale to answer each question; accuracy was coded high such that 1 = *not accurate at all* and 5 = *very accurate*.

- The continents on which we live have been moving their locations for millions of years and will continue to move in the future. (true)
- Lasers work by focusing sound waves. (false)
- Electrons are smaller than atoms. (true)

- Tsunamis, also called tidal waves, are caused by unusually warm ocean currents. (false)
- It is the father's gene that decides whether the baby is a boy or girl. (true)
- All radioactivity is man-made. (false)
- Antibiotics will kill viruses as well as bacteria. (false)

Science information efficacy (1 = strongly disagree, 7 = strongly agree)

- I think I am better informed about science topics than most people.
- Other people seem to have an easier time understanding complicated science topics than I do. *
- I don't feel sure of myself when talking to others about science topics. *
- I feel confident that I can find the truth about scientific controversies.
- If I wanted to, I could figure out the facts behind most scientific controversies.
- There are objective facts behind most scientific controversies, and if you try hard enough you can find them.
- It is impossible to figure out the truth about scientific controversies. *

Media use behaviors

General TV use (hours)

During the typical week, how many hours and minutes of television content, either on TV or online (including both news and entertainment programs) do you watch **on the typical day?**

Entertainment TV use (1 = never, 7 = all the time)

When you watch TV, what types of entertainment shows do you watch?

- Crime or action dramas (e.g., CSI, Law and Order, NCIS, Castle, Criminal Minds, Nikita, etc.)
- Sitcoms or comedies (e.g., Big Bang Theory, Modern Family, The Office, Glee etc.)
- Reality shows (e.g., American Idol, Survivor, So You Think You Can Dance, etc.)
- Other dramas (e.g., House, Grey's Anatomy, Revenge, Mad Men, etc.)
- Fantasy or science fiction shows (e.g., Fringe, Grimm, Walking Dead, The Vampire Diaries, Once Upon A Time, etc.)

Newspaper use, TV news use, and attention to partisan news outlets (1 = never, 7 = all the time)

During a typical week, how often do you use each of the following sources to get news and opinions?

- Daily newspaper (either print or online)
- Local evening or nightly TV news
- National broadcast evening news on ABC, CBS, and NBC

- Fox News, either on TV or online
- CNN, either on TV or online
- MSNBC, either on TV or online
- Conservative blogs or websites (e.g., Drudge Report, Townhall.com)
- Liberal blogs or websites (e.g., Huffington Post, Dailykos.com)

Topical media use (1 = no attention at all, 7 = a great deal of attention)

When you are watching, reading, or listening to different news channels and shows, generally speaking, how much attention do you pay to news about the following topics?

- News about environmental issues
- News about science and technology
- News about national political issues
- News about the 2012 presidential campaign

Attitudes about science

The scales below were all measured on a seven-point Likert agreement scale (1 = *strongly disagree*, 7 = *strongly agree*).

Scientific relativism

- What counts as truth is defined by power.
- Scientific conclusions are shaped by politics.
- Scientific facts depend on their political context.
- Scientific truths are unbiased. *
- Scientific results are free from political influence. *
- The political situation does not change scientific facts. *

Scientific deference

- The public knows best about what policy decisions are needed more so than scientists. *
- Scientists should do what they think is best, even if they have to persuade people that it is right.
- Scientists, not the public, should make the decisions about which types of policies are needed.
- Scientists' opinions are more important than those of the public when making policy decisions.
- Scientists should not pay attention to the wishes of the public when the public is mistaken or does not understand their work.

Reliance on intuition

- I believe what I want to believe, no matter what the scientific evidence is.
- I trust my gut to tell me what's true and what's not.
- A scientific argument that doesn't feel right is probably wrong.

- Scientific evidence is more important than whether something feels right. *
- I rely on reason to figure out what the truth is. *
- I trust the scientific facts, not my instincts, to tell me what is right. *

Trust in the scientific community

- I have very little confidence in the scientific community. *
- I trust the scientific community to do what is right.
- Information from the scientific community is trustworthy.
- The scientific community is dishonest. *

Appendix B: Study 1 Dataset 2 Questionnaire

In addition to traditional socio-demographic measures and, the following items were used in Study 1 Dataset 2. Items marked with * were reverse coded.

Dependent variable

Documentary use (1 = yes, 0 = no)

Which of these channels have you watched at least once in the past 6 months?

- Animal Planet
- Discover Channel
- Discovery Health
- National Geographic Channel
- NatGeo Wild
- Outdoor Channel
- Planet Green
- Science Channel
- Discovery en Español

Ideology and identity

Ideology (1 = very liberal, 10 = very conservative)

Many people use the words "liberal" and "conservative" or "left" and "right" when they think about politics. According to your own political opinions, where would you place yourself on a liberal to conservative scale?

Environmentalist identity (1 = yes, 0 = no)

- Please indicate if you belong to any of the types of organizations in the list below: environmental groups.
- Do you actively participate in any of the following political movements?: Environmental Rights Movement

Media use behaviors

General TV use (1 = never, 5 = every day)

How often do you watch television?

Entertainment TV use (1 = never, 5 = three times a week or more)

Please indicate how often you typically watch each type of program on broadcast TV:

- Primetime sitcoms

- Primetime animated comedies
- Primetime dramas
- Primetime action/adventure series
- Primetime reality programs
- Primetime science fiction programs
- Primetime crime/investigation programs

TV news use (1 = never, 5 = three times a week or more)

Please indicate how often you typically watch each type of program on broadcast TV:

- Local EVENING news programs
- National EVENING news programs (ABC, CBS, NBC)

Attention to political news (1 = not at all interested, 4 = very interested)

- In general, how interested are you in politics and public affairs?
- To what extent were you interested in following the presidential election campaign of 2012?

Attention to science/environmental news (1 = no attention at all, 7 = a great deal of attention)

When you are watching, reading, or listening to different news channels, shows, or websites, how much attention do you pay to news about the following topics?

- News about the environment
- News about science and technology

Partisan news use (1 = yes, 0 = no)

Which of these channels have you watched at least once in the past 6 months?

- Fox News Channel
- CNN
- MSNBC

Attitudes about science

Support for environmental protection

Respondents were asked to rate this item on a ten-point bipolar matrix between the two statements listed below that was reverse coded with support for environmental protection high.

- We should protect the environment and try to make our cities and countryside more beautiful.
- We should encourage economic growth without environmental restrictions on businesses.

Trust in the scientific community (1 = strongly disagree, 7 = strongly agree)

- I have very little confidence in the scientific community. *
- Information from the scientific community is trustworthy.

- I trust the scientific community to do what is right.
- Science makes our way of life change too fast. *
- The scientific community contributes a great deal to the well-being of society.
- The scientific community has too much say over public policy. *

Appendix C: Study 1 Dataset 3 Questionnaire

In addition to traditional socio-demographic measures and, the following items were used in Study 1 Dataset 3. Items marked with * were reverse coded.

Dependent variable

Documentary use (1 = never, 7 = all the time)

How often do you watch different types of nonfiction science or environmental TV shows, films, videos, or documentaries?

- Nature and wildlife shows or films (e.g., Shark Week, Planet Earth, March of the Penguins)
- Science and technology shows or films (e.g., Mythbusters, PBS Nova, How it's Made)
- Outdoor adventure shows or films (e.g., Man vs. Wild, Deadliest Catch, Whale Wars)
- Space and astronomy shows or films (e.g., Through the Wormhole, In the Universe, Cosmos)

Ideology and knowledge/beliefs

Ideology (1 = very liberal, 7 = very conservative)

- When thinking about economic issues, how would you best describe your political views?
- When thinking about social issues, how would you best describe your political views?

Scientific literacy

Respondents answered a random selection of five of the following items. The respondent received a score for each item such that 1 = *accurate* and 0 = *inaccurate*; the five scores were added to create a summative index of scientific literacy.

- The center of the earth is very hot. (true)
- The continents on which we live have been moving their locations for millions of years and will continue to move in the future. (true)
- Lasers work by focusing sound waves. (false)
- Electrons are smaller than atoms. (true)
- Human beings, as we know them today, developed from earlier species of animals. (true)
- It is the father's gene that decides whether the baby is a boy or girl. (true)

- All radioactivity is man-made. (false)
- Antibiotics will kill viruses as well as bacteria. (false)
- The Earth goes around the Sun. (false)
- The universe began with a huge explosion. (true)

Media use behaviors

General TV use (1 = never watch, 25 = twelve or more hours per day)

During the typical week, how many hours and minutes of television content, either on TV or online (including both news and entertainment programs) do you watch **on the typical day?**

Entertainment TV use (1 = never, 7 = all the time)

When you watch TV, what types of entertainment shows do you watch?

- Crime or action dramas (e.g., CSI, Law and Order, NCIS, Blacklist, etc.)
- Sitcoms or comedies (e.g., Big Bang Theory, Modern Family, The Millers, Glee etc.)
- Reality shows (e.g., American Idol, Survivor, Dancing with the Stars, etc.)
- Other dramas (e.g., Empire, Mad Men, Scandal, Revenge, etc.)
- Fantasy or science fiction shows (e.g., Walking Dead, Game of Thrones, Grimm, Once Upon A Time, etc.)

Newspaper use, TV news use, and attention to partisan news outlets (1 = never, 7 = all the time)

During a typical week, how often do you use each of the following sources to get news and opinions?

- Daily newspaper (either print or online)
- The New York Times (either in print or online)
- The Wall Street Journal (either in print or online)
- Local evening or nightly TV news
- National broadcast evening news on ABC, CBS, and NBC
- Fox News, either on TV or online
- CNN, either on TV or online
- MSNBC, either on TV or online
- Conservative blogs or websites (e.g., Drudge Report, Townhall.com)
- Liberal blogs or websites (e.g., Huffington Post, Dailykos.com)
- Conservative talk radio shows (i.e., The Rush Limbaugh Show, Glen Beck Program, etc.)

Topical media use (1 = no attention at all, 7 = a great deal of attention)

When you are watching, reading, or listening to different news channels and shows, generally speaking, how much attention do you pay to news about the following topics?

- News about environmental issues
- News about science and technology
- News about national politics

Attitudes about science and discussion behaviors

Scientific deference (1 = strongly disagree, 7 = strongly agree)

- Scientists should listen to public concerns, even if it limits their research. *
- It is important for scientists to get research done even if they displease people by doing it.
- Scientists should do what they think is best, even if they have to persuade people that it is right.
- In making policy decisions, scientist's opinions are more important than those of the public.
- Information provided by scientists is trustworthy.
- I have very little confidence in what scientists say. *
- I trust scientists to do what is morally right.
- Scientists share my values.
- Scientists do what is best for society.
- When in doubt, I prefer to trust what scientists say.
- Scientists should ignore public concerns if the public does not understand their work.
- Scientists know what is best for the public.

Reservations about science (1 = strongly disagree, 7 = strongly agree)

- Science makes our way of life change too fast.
- On balance, the benefits of scientific research have outweighed the harmful results. *
- We depend too much on science and not enough on faith.
- It is not important for me to know about science in my daily life.
- Because of science and technology, there will be more opportunities for the next generations. *
- Science and technology are making our lives healthier, easier, and more comfortable. *
- Most scientists want to work on things that will make life better for the average person. *
- Scientific research these days doesn't pay enough attention to the moral values of society.
- Scientific research has created as many problems for society as it has solutions.
- Scientific research is essential for improving the quality of human lives. *

- New technology used in medicine allows people to live longer and better.*

Discussion behaviors (1 = never, 11 = very often)

We would like to know more about how often you discuss public affairs and science-related issues with others. How often do you do the following?

- Discuss public affairs or public issues with others, online or offline?
- Discuss science or science-related issues with others, online or offline?

Appendix D: Study 2 Video Stimuli Links

Expository educational condition

- *Fracking: Shattered Ground* (hydraulic fracking) – https://www.youtube.com/watch?v=roEcszmv_IQ
- *Future Earth: Addicted to Power* (oil drilling) – https://www.youtube.com/watch?v=sm_JIENm5Wc

Participatory educational condition

- *Frontline: Poisoned Waters* (water pollution) – https://www.youtube.com/watch?v=Vuc5PE0lh9c
- *Plasticized* (physical pollution) – https://www.youtube.com/watch?v=7aLsy5U7nkU

Expository advocacy condition

- *A Crude Awakening: The Oil Crash* (oil drilling) – https://www.youtube.com/watch?v=BxYkTojGAgk
- *The Last Mountain* (coal mining) – https://www.youtube.com/watch?v=CP5dG4tfkFw

Participatory advocacy condition

- *Gasland* (hydraulic fracking) – https://www.youtube.com/watch?v=fuhGWgjnmuw
- *Tapped* (water pollution) – https://www.youtube.com/watch?v=M4CaGzCLnQ4

Appendix E: Study 2 Questionnaire

In addition to traditional socio-demographic measures and, the following items were used in Study 2. A key to the conditions and sub-conditions is also provided below. Items marked with * were reverse coded. **Note:** [ISSUE] is used for some questionnaire items in place of whichever environmental problem was featured on the video the participant viewed.

Key

- EE – Expository educational
- PE – Participatory educational
- EA – Expository advocacy
- PA – Participatory advocacy
- FR – Hydraulic fracking
- OL – Oil drilling
- CO – Coal mining
- WP – Water pollution
- PP – Physical pollution

Sub-conditions

- Gasland (PA, FR)
- Fracking Shattered Ground (EE, FR)
- A Crude Awakening (EA, OL)
- Future Earth (EE, OL)
- The Last Mountain (EA, CO)
- Frontline Poisoned Waters Puget Sound (PE, WP)
- Tapped (PA, WP)
- Plasticized (PE, PP)

Conditions

- Expository educational (sub-conditions 2 and 4)
- Participatory educational (sub-conditions 6 and 8)
- Expository advocacy (sub-conditions 3 and 5)
- Participatory advocacy (sub-conditions 1 and 7)

Ideology and scientific literacy

Ideology (1 = very liberal, 7 = very conservative)

- When thinking about economic issues, how would you best describe your political views?
- When thinking about social issues, how would you best describe your political views?

Scientific literacy

Respondents used a five-point true/false scale to answer each question; accuracy was coded high such that 1 = *not accurate at all* and 5 = *very accurate*.

- The continents on which we live have been moving their locations for millions of years and will continue to move in the future. (true)
- Lasers work by focusing sound waves. (false)
- Electrons are smaller than atoms. (true)
- Tsunamis, also called tidal waves, are caused by unusually warm ocean currents. (false)
- It is the father's gene that decides whether the baby is a boy or girl. (true)
- All radioactivity is man-made. (false)
- Antibiotics will kill viruses as well as bacteria. (false)

Narrative involvement

Transportation (1 = strongly disagree, 7 = strongly agree)

- While watching the video, I could easily picture the events taking place.
- I could picture myself in the events portrayed in the video.
- I was mentally involved in the story while watching.
- After the video ended, I found it easy to put it out of my mind. *
- I wanted to learn how the story ended.
- The video affected me emotionally.
- The events in the video have changed my life.
- While viewing the video, I felt as if I was part of the action.

Identification (1 = strongly disagree, 7 = strongly agree)

- I think I have a good understanding of the people featured in the video.
- While viewing, I could feel the emotions the people featured in the video portrayed.
- I felt I could really get inside the heads of the people featured in the video.
- At key moments in the video, I felt I knew exactly what the people featured in the video were going through.
- When the people featured in the video succeeded I felt joy, but when they failed I was sad.
- The people featured in the video are like me.
- The people featured in the video share my values.
- I felt connected to the people featured in the video.

- The people featured in the video have the same problems and concerns as me.

Counterarguing and reactance

Counterarguing (1 = strongly disagree, 7 = strongly agree)

- I sometimes felt like I wanted to "argue back" to what was going on onscreen.
- I sometimes found myself thinking of ways I disagreed with how [ISSUE] was presented.
- I couldn't help thinking about ways that the information about [ISSUE] was inaccurate or misleading.
- I found myself looking for flaws in the way [ISSUE] was presented in the video.
- I felt like the video was trying to persuade me in a way.

Reactance (1 = strongly disagree, 7 = strongly agree)

- The video did not try to force its opinions on me. *
- The video tried to pressure me to think a certain way.
- The video tried to manipulate me.
- Clearly, the video was pushing an agenda.
- The video tried to make a decision for me.
- The video threatened my freedom to choose.
- The video tried to tell me how to live my life.

Affect and risk perception

Negative affect (1 = not at all, 10 = extremely)

When thinking about [ISSUE], how do you feel? Do you feel…

- Upset?
- Hostile?
- Ashamed?
- Nervous?
- Afraid?
- Worried?
- Concerned?
- Angry?

Risk perception (1 = no risk at all, 10 = extreme amount of risk)

How much risk does [ISSUE] pose to

- You, personally?
- Human health in general?
- Plants and animals?
- Your family?
- People in the United States?

Policy preferences

The wording of the policy preference items differed slightly based on which environmental issue was the subject of the documentary. These items were written to be as similar/comparable across issues as possible. Policy preferences were measured on a seven-point Likert agreement scale (1 = *strongly disagree*, 7 = *strongly agree*).

Hydraulic fracking

- Natural gas drilling companies should disclose what chemicals they put in the water injected underground for fracking.
- Natural gas companies should have to pay extra taxes on any wells that use fracking.
- The creation of new fracking wells should be halted until more testing and research is conducted on their safety.
- The government should regulate hydraulic fracking more closely.
- No new restrictions should be placed on hydraulic fracking. *****
- Government regulation of hydraulic fracking is necessary to protect the public.

Oil drilling

- Oil companies should disclose the environmental hazards posed by drilling for oil.
- Oil companies should have to pay extra taxes to drill in new areas for oil.
- The creation of new oil drilling sites should be halted until more testing and research is conducted on their safety.
- The government should regulate oil drilling more closely.
- No new restrictions should be placed on oil drilling. *****
- Government regulation of oil drilling is necessary to protect the public.

Coal mining

- Coal companies should disclose the environmental hazards posed by mountaintop coal mining.
- Coal companies should have to pay extra taxes to engage in mountaintop removal.
- Coal mining should be halted until more testing and research is conducted on the safety of mountaintop removal.
- The government should regulate coal mining more closely.
- No new restrictions should be placed on coal mining. *****
- Government regulation of coal mining is necessary to protect the public.

Water pollution

- Pharmaceutical and cosmetic companies should disclose the potential impacts of their products on water resources.

- Pharmaceutical and cosmetic companies should have to pay extra taxes to offset the costs of damage to public water resources.
- The creation of new pharmaceuticals and cosmetics should be halted until more testing and research is conducted on their safety.
- The government should regulate potential water pollutants more closely.
- No new restrictions should be placed on potential water pollutants. *
- Government regulation of water pollutants is necessary to protect the public.

Physical pollution

- Plastic companies should disclose the potential hazards their products pose to marine life.
- Companies that use plastic materials should have to pay extra taxes based on the amount of plastic used.
- Increased use of plastic packaging should be halted until more testing and research is conducted on its safety.
- The government should regulate the use of plastics more closely.
- No new restrictions should be placed on plastics. *
- Government regulation of plastics is necessary to protect the public.

Appendix F: Study 3 Video Stimuli Links

Episodic, no close-ups condition – https://www.youtube.com/watch?v=C57FOb_mP4c

Episodic, close-ups condition – https://www.youtube.com/watch?v=ehGnSFHHsRY

Thematic, no close-ups condition – https://www.youtube.com/watch?v=SLh4TQdmfbE

Thematic, close-ups condition – https://www.youtube.com/watch?v=_nSw2ZyU0Oc

Appendix G: Study 3 Episodic and Thematic Stimuli Scripts

Episodic frame condition

Sasha, a gray wolf, runs across the snowy Lamar Valley in Yellowstone Park. She is on a desperate hunt for food.

She and the alpha male, **Shadow**, have roamed this territory for many years. Their pack, consisting of the dominant pair and seven of their offspring, must hunt every two to three days to survive.

Every year, elk descend on the Lamar Valley for shelter from the harsh winter snow. These days the elk are few and far between, forcing the wolves to go without food for long stretches of time. **Sasha** and **Shadow** must beat the odds if their pack is to make it through the winter.

With an early morning howl, **Sasha** summons her pack to a hunt. The wolves leap forward, full of speed and stamina. With efficiency and skill, **Sasha, Shadow,** and the rest take down a young elk they managed to separate from its herd. The youngsters do most of the work, but when it's over everyone shares the rewards.

It's now January and time for the oldest offspring to split from the pack in search of mates. Historically, the wolves would spread out and roam for 40 to 70 miles to find mates. **Sasha**'s offspring are not so lucky. Their habitat is small and separated from other packs by roads and cities, so the young wolves will have a difficult time finding mates. Unfortunately, they may die in their search for mates or be forced to remain alone.

As **Sasha's** pack roams their territory, they must be careful to avoid coming too close to humans. If **Sasha's** pack approaches a farm in their desperation for food, local ranchers are likely to shoot at the wolves in order to protect their livestock. **Sasha** must also remain vigilant to avoid hunters in the area.

Sasha is pregnant with her newest litter of pups. After about two months she gives birth to a litter of 6 pups, who are born blind, deaf, and helpless. Although **Sasha** and **Shadow's** pups were born healthy, they are vulnerable and begin to die one by one as a virus sweeps through the valley. Scientists believe that the domestic dog disease parvovirus has spread to the wolf population.

Many things threaten the survival of **Sasha** and her family. The good news is that there is still time to save these magnificent animals. You can make a difference.

Thematic frame condition

Gray wolves once roamed North America but now are restricted to live in places like the Lamar Valley in Yellowstone Park. Unfortunately, destruction of their natural habitat by human land development forces wolves to struggle to find food.

Wolves must hunt every two to three days to survive, which has become increasingly difficult because wolves compete with human hunters for the same prey.

Every year, elk descend on the Lamar Valley for shelter from the harsh winter snow. These days, the elk are few and far between due to excessive hunting by humans. This forces wolves to go without food for long stretches of time, which can decrease their likelihood of survival.

With an early morning howl, the wolf pack is summoned to a hunt. The wolves leap forward, full of speed and stamina. With efficiency and skill, the wolves take down a young elk they managed to separate from its herd. In the hunt, the younger wolves do most of the work, but when it's over the pack shares the feast.

In January, adult wolf offspring split from their original pack in search of mates. Historically, the wolves would spread out and roam for 40 to 70 miles to find mates. Unfortunately, humans have fragmented wolves' habitats by building roads and developing land. This makes it difficult for wolves to travel in search of mates. As a result, wolves often either die in their search for mates or be forced to remain alone.

Wolves roaming their territory are also at risk when they come too close to humans. Because gray wolves are no longer protected by the Endangered Species Act, local ranchers are allowed to shoot them in order to protect livestock. This change also means that wolves can be legally hunted for sport.

Wolves typically begin breeding between 2 and 3 years of age and give birth to litters of four to six pups, which are born blind, deaf, and helpless. Alarmingly, however, many wolf pups die before reaching maturity due to the domestic dog disease parvovirus spreading to the wolf population. Scientists believe the virus jumped to wolves from dogs that human tourists brought with them when entering wolves' natural habitats.

Many things threaten the survival of gray wolves. The good news is that there is still time to save these magnificent animals. You can make a difference.

Appendix H: Study 3 Questionnaire

In addition to traditional socio-demographic measures and, the following items were used in Study 3. A key to the conditions is also provided below. Items marked with * were reverse coded.

Conditions

- Episodic, no close-ups
- Episodic, close-ups
- Thematic, no close-ups
- Thematic, close-ups

Dependent variable

Attitude towards wolves (1 = strongly disagree, 7 = strongly agree)

- Wolves help maintain healthy populations of elk and deer.
- Wolves compete with big game hunters for prime trophy animals. *
- Wolves are important members of the ecological world.
- We are better off without wolves. *
- The wolf is a killing machine. *

Ideology and identity

Ideology (1 = very liberal, 7 = very conservative)

- When thinking about economic issues, how would you best describe your political views?
- When thinking about social issues, how would you best describe your political views?

Environmentalist identity (1 = strongly disagree, 7 = strongly agree)

- I like to think of myself as an environmentalist.
- To engage in pro-environmental activities is an important part of who I am.
- I am not the type of person to by involved with pro-environmental activities. *
- Being an environmentalist is an important part of who I am.

Media use behaviors

Documentary use (1 = never, 7 = all the time)

How often do you watch different types of nonfiction science or environmental TV shows, films, videos, or documentaries?

- Nature and wildlife shows or films (e.g., Shark Week, Planet Earth, March of the Penguins)
- Science and technology shows or films (e.g., Mythbusters, PBS Nova, How it's Made)
- Outdoor adventure shows or films (e.g., Man vs. Wild, Deadliest Catch, Whale Wars)
- Space and astronomy shows or films (e.g., Through the Wormhole, In the Universe, Cosmos)

Attention to science/environmental news (1 = no attention at all, 7 = a great deal of attention)

When you are watching, reading, or listening to different news channels and shows, generally speaking, how much attention do you pay to news about the following topics?

- News about environmental issues
- News about science and technology

Empathy

Empathy was assessed using two different subscales that were combined into a single measure for the analyses.

Perspective-taking component of empathy (1 = strongly disagree, 7 = strongly agree)

- I felt what is was like to be in the wolves' situation.
- I tried to understand the wolves by imagining things from their perspective.
- I found it difficult to see things from the wolves' point of view. *
- I tried to imagine how I would feel if I was in the wolves' place.

Affective component of empathy (1 = not at all, 6 = extremely)

When thinking about the wolves in the video you just watched, how do you feel? Do you feel…?

- Sympathetic?
- Compassionate?
- Softhearted?
- Tender?
- Moved?