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Science denial as intergroup conflict: using social identity theory, intergroup emotions theory and intergroup threat theory to explain angry denial of science

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Using social identity theory, intergroup emotions theory and intergroup threat theory to explain angry denial of science

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ABSTRACT

Denial of scientific evidence is a fairly common phenomenon which has been documented in various areas such as climate change, evolution, effects of vaccinations, tobacco and violent video game effects. Science denial is often accompanied by anger and aggressive actions towards scientists, leading some authors to label it "war on science" (Lewandowsky, Oberauer & Gignac, 2013). Science denial can be explained, in part, by well-established processes affecting individuals such as belief perseverance, confirmation bias and cognitive dissonance. However, recent research suggests that group processes may also play a key role in denial (Lewandowsky et al., 2013; Nauroth et al., 2014). The current research takes this reasoning a step further and frames science denial in terms of intergroup conflict. I propose that the relationship between denialists and scientists can be understood in terms of intergroup relations (scientists are viewed as a hostile outgroup). Three sets of studies applied principles of social identity theory (Study 1A, 1B, 1C), intergroup threat theory (Study 2A, 2B, 2C) and intergroup emotions theory (Study 3) to explore the mechanisms that lead to science denial. Special attention is given to predictors of angry denial and aggressive actions towards scientists.

Keywords: science denial, intergroup relations, social identity theory, intergroup emotions theory and intergroup threat theory

CHAPTER 1: SCIENCE DENIAL – PREVALENT AND DANGEROUS

"With all of the hysteria, all of the fear, all of the phony science, could it be that man-made global warming is the greatest hoax ever perpetrated on the American people?"
James M. Inhofe, speech given to the US Senate Committee on the Environment and Public Works, 2003

"Is a gorilla your great grandpa? Maybe, if you believe the nonsense of evolution." Anonymous author from the website jesus-is-savior.com

"Unvaccinated children are much healthier than vaccinated children. You can line up the doctors from here to down the block refuting me, but I'm not gonna change my mind."
Sarah Pope, blogger, The Daily Show interview, 2014

"Lung cancer, indeed all cancer, is a *challenge*, an *unsolved problem*. Its etiology will probably long be an *open question*." Clarence Little, 1964, New England Journal of Medicine

"There is absolutely no evidence, none, that playing a violent video game leads to aggressive behavior."
Douglas Lowenstein, president of the Entertainment Software Association, CNN interview, 2000

Overwhelming scientific evidence supports the reality of anthropogenic climate change (Anderegg et al., 2010), evolutionary theory (Friedman, 2008), safety of vaccinations (Maglione et al., 2014), dangers of tobacco use (Landman & Glantz, 2009) and violent media effects on aggression (Anderson et al., 2003). Nonetheless, public opinion is not always congruent with the scientific consensus. Individuals and groups continue to doubt and deny scientific findings in these areas as well as in a number of other areas (the link between smoking and lung cancer, HIV and AIDS etc.).

Denial of science, sometimes also labeled "denialism" or "rejection of science" can be defined as dismissal of well-established scientific evidence for non-scientific reasons (Lewandowsky, Oberauer & Gignac, 2013; Diethelm & McKee, 2009; Jacques, 2012; McKee & Diethelm, 2010). It is important to distinguish denial from scientific skepticism. Genuine scientific skepticism is based on relevant theoretical predictions and empirical evidence. It is an integral part of the scientific method and leads to reliable and valid conclusions (Jacques, 2012;

Lewandowski et al., 2013). On the other hand, science denial is often unaffected by accurate scientific information, persevering even in the face of overwhelming empirical evidence and clear scientific consensus (Lewandowski et al., 2013; Nyhan et al., 2014).

In some cases, denialist beliefs are innocuous. For example, some of the members of the Flat Earth Society (which currently consists of over 500 people from the U.S., the U.K. and other countries) still sincerely believe that the Earth is a flat disc surrounded by a 150-foot wall of ice at its outer edge ("Our History", 2014). In other cases, science denial costs lives. In spite of clear scientific evidence supporting the effectiveness and safety of vaccinations (e.g. Maglione et al., 2014), unfounded concerns about potential harmful side-effects of vaccines led a number of parents in the U.S. and the U.K. to delay or refuse vaccination (Poland & Spier, 2010). Clusters of intentionally under-vaccinated children have triggered outbreaks of vaccine-preventable diseases such as pertussis (Atwell et al., 2013) and measles (Sugerman et al., 2010), causing a major public health risk. A tragic example of what can happen when science denial is governmentally supported can be observed in post-apartheid South Africa. President Mbeki championed a small group of AIDS denialists who claimed that AIDS is caused by poverty and malnutrition, not by HIV (Bateman, 2007; Natrass, 2008). Mbeki's government recommended local vegetables as a treatment for AIDS and banned the use of antiretroviral drugs in public hospitals, promoting the idea that antivirals are a part of a white conspiracy to reduce the black African population. These inappropriate policies guided by science denial are thought to be responsible for around 171,000 HIV infections and 343,000 deaths between 1999 and 2007 (Nattrass, 2008). Finally, research on the consequences of climate change suggests that anthropogenic climate change already claims more than 150,000 lives per year. According to the most recent report of the Intergovernmental Panel on Climate Change, these severe negative

consequences are likely to increase (IPCC, 2014). If climate change continues as predicted, health issues are expected to increase over the next few decades through increased risk of food- and water-borne diseases, heat waves and fires, and under-nutrition because of decreased food production in poor regions. Furthermore, climate change is likely to pose a risk by increasing the incidence of violent conflicts directly by causing long-term increases in aggression as well as indirectly by causing economic and political instability as well as exacerbating other risk factors for violence (Anderson & DeLisi, 2011; IPCC, 2014). Examples such as these leave no doubt that science denial is dangerous – it can endanger lives of both denialists and non-denialists.

An intriguing aspect of science denial is that it is often accompanied by anger and aggression towards scientists. Researchers from a wide range of disciplines have reported being targeted by similar kinds of personal and professional attacks, including complaints, legal threats, intimidation, cyber-bullying and public abuse (Lewandowski, Mann et al., 2013; Mann, 2012). For example, several respected Australian climate scientists have received hostile e-mail messages from climate change denialists which contained insults (“Loudmouth, arrogant, conceited, ignorant wanker."; as cited in Hamilton, 2010), accusations of fraud ("It's so obvious you are an activist going along with the climate change lie to protect your very lucrative employment contract."; as cited in Hamilton, 2010) and even direct threats ("If we see you continue, we will get extremely organised and precise against you."; as cited in Hamilton, 2010). The same kinds of messages have been posted on blogs, forums and in online articles (Hamilton, 2010). Similar insults, accusations and threats have also been directed at researchers who study media violence effects, and especially violent video game effects (Anderson, Gentile & Buckley, 2007). Such repeated harassment with the intent to harm clearly fits the definition of cyberbullying (Li, 2007). Other attacks on scientists have been more direct. Respected American

climate scientist Michael Mann was sent a letter containing white powder resembling Anthrax and, perhaps even worse, faced a campaign to have his NSF grants revoked (Mann, 2012). Renowned cognitive psychology professor Elizabeth Loftus faced formal complaints and a legal suit after casting doubt on a case study of supposed repressed memories of childhood sexual abuse (Loftus, 2003). Other aggressive strategies used by denialists have included extensive FOI requests (Nature, 2010), reanalysis of data by using inappropriate statistical methods to "disprove" inconvenient findings (Ferguson, 2007; Sims, Maxwell, Bauld, & Gilmore, 2010) and even pressuring journal editors not to publish manuscripts that show disliked results (Lewandowski, Mann et al., 2013). Some of these aggressive strategies are highly organized and are reminiscent of tactics used by the tobacco industry to discredit researchers and cast doubt on the evidence that smoking causes cancer (Landman & Glantz, 2009; Nature, 2010). Other aggressive actions (such as insulting e-mail messages) seem more impulsive, have the immediate goal to hurt scientists personally and seem to be rooted in denialists' feelings of anger and hostility in response to threatening research findings (Lewandowsky et al., 2013; Nauroth et al., 2014). Both types of attacks can have far-reaching negative consequences: personal attacks cause emotional distress and take up time, interfering with researchers' work, whereas organized professional attacks have the potential to derail the scientific process by delaying or stopping publication of manuscripts (Lewandowski, Mann et al., 2013; Loftus, 2003).

What factors and processes lead to science denial? According to the public irrationality thesis (PIT; Kahan, 2013), denial stems from a lack of comprehension of scientific methods and evidence among the general public. The deficit-model of science communication assumes that increased communication about scientific issues will lead to a shift in public opinion toward scientific consensus (Hart & Nisbet, 2011). However, a number of studies suggest that this is not

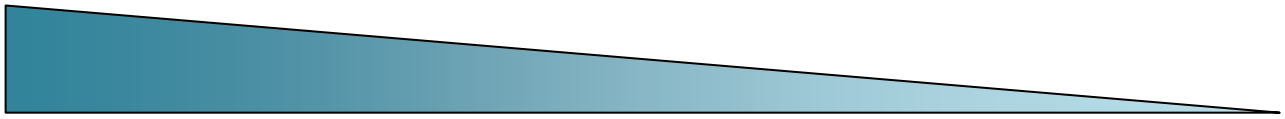
always the case. In fact, providing scientific evidence sometimes backfires, causing denialists to become even more entrenched in their initial beliefs and behaviors (Hart & Nisbet, 2011). For example, Nyhan et al. (2014) tested interventions intended to reduce vaccine misperceptions among parents and increase vaccination rates. The pro-vaccine messages did not work as planned – some of the messages actually decreased intent to vaccinate among parents who held the most negative attitudes towards vaccination.

This research demonstrates that science denial is not a simple product of deficits in information or understanding of scientific methodology. Instead, more complex psychological processes are at play. Several areas of research in social and cognitive psychology help explain the roots of denial and elucidate why simply bombarding denialists with accurate scientific information does not lead to attitude change. A taxonomy of factors and processes leading to denial is shown in Table 1.1. Causes of denial are grouped into three broad categories: (1) individual-level processes, (2) group-level processes, and (3) intergroup-level processes. Most research relevant to science denial has focused on individual-level factors, such as belief perseverance (Anderson, Lepper & Ross, 1980), confirmation bias (Nickerson, 1998) and cognitive dissonance (Festinger, 1957). More recently, several researchers have pointed to group-level processes as a key source of science denial (Lewandowsky et al., 2013; Nauroth et al., 2014). Finally, the proposed set of studies takes this reasoning a step further and frames science denial in terms of intergroup relationships and intergroup conflict.

In the next three sections, a brief overview will be given of specific individual-level processes, group-level processes and intergroup-level processes that may lead to science denial.

Table 1.1. Factors and mechanisms leading to science denial

Individual	Group	Intergroup
Belief perseverance	Threatened social identity	Intergroup emotions
Confirmation bias, myside bias	Values and ideology	Intergroup threat
Cognitive dissonance	Cultural cognition	Intergroup conflict
Reactance	System justification	
"Forbidden fruit" effects	Social dominance orientation	
Boomerang effects (aka "backfire effects")		
Defensiveness, the psychological immune system		
Self-affirmation		
Conspiratorial thinking		
Scientific expertise, training in research methods and rational thinking		
Empirical evidence:		
Rich research literature, well-explored processes	Small research literature, no clear evidence of causal relationships	Almost nonexistent research literature, no clear evidence that intergroup processes play a role in science denial



Substantial **Almost nonexistent**

EMPIRICAL EVIDENCE

CHAPTER 2: ESTABLISHED INDIVIDUAL-LEVEL MECHANISMS LEADING TO SCIENCE DENIAL

We first consider individual-level processes that lead to science denial. A rich research literature in the fields of cognitive and social psychology highlights a number of key factors and processes that contribute to rejection and denial of scientific information. This review of individual-level processes is not meant to be extensive – the goal is to give an overview of several related individual-level processes that we view as key to understanding science denial. The following key factors and processes will be discussed: (1) belief perseverance, (2) confirmation biases and myside bias, (3) reactance, boomerang effects and "forbidden fruit effects", (4) cognitive dissonance, (5) defensiveness, the psychological immune system and self-affirmation, (6) conspiratorial thinking, and (7) training in research methods and rational thinking. Illustrations are given both from empirical studies and from real-life examples of science denial.

1. Belief perseverance. People tend to cling strongly to their prior beliefs even when such beliefs are no longer warranted (Anderson, 1982; Ross & Anderson, 1982). Initial perceptions, opinions and attitudes persevere even in the face of evidence that contradicts or disconfirms the basis of those beliefs (Anderson & Kellam, 1992). In a classic demonstration of belief perseverance, Ross, Lepper and Hubbard (1975) asked participants to judge the genuineness of suicide notes and gave them bogus feedback concerning their success at the task. Participants who received success feedback continued to evaluate themselves favorably even after they were told the initial feedback was fictitious. Belief perseverance can occur even when people's theories are based on weak, inadequate evidence and when people feel no strong commitment to the issue (Anderson, Lepper & Ross, 1980; Anderson & Kellam, 1992). For example, Anderson, Lepper and Ross, (1980) gave participants information suggesting that a positive or negative

association exists between risk taking and job performance as a firefighter. Participants continued to believe that a true relationship exists between risk preference and job performance even when they were told that the initial information was fabricated. Even weak data can give rise to unshakeable beliefs. Paradoxically, stronger belief perseverance occurs after exposure to weak but vivid and concrete case history data rather than stronger but abstract statistical summaries (Anderson, 1983). These effects are mediated, at least in part, by the accessibility of causal explanations (Anderson, New & Speer, 1985) and formulation of causal scripts (Anderson, 1982, 1983). After being given the initial information, people spontaneously generate causal explanations for it. Causal explanations can then become independent of the data on which they were originally based, and fuel people's beliefs even once the initial evidence is refuted (Anderson, 1982, 1983; Anderson, Lepper & Ross, 1980; McFarland, Cheam & Buehler, 2007). Several studies point to effective ways of combating belief perseverance, including discussing the perseverance process with participants (process debriefing; Ross et al., 1975), manipulating self-awareness (Davies, 1982), prompting participants to consider the opposite position (Lord, Lepper & Preston, 1984) or to generate causal theories in both possible directions (Anderson, 1982).

Unfortunately, it seems that false beliefs occurring outside the laboratory are much harder to change. A tragic real-life example of belief perseverance occurred when Andrew Wakefield and colleagues (1998) published a paper suggesting that measles-mumps-rubella (MMR) vaccine causes autism. Numerous subsequent studies using larger samples and stronger methodology disproved this finding (Gerber & Offit, 2009; Taylor et al., 1999). Furthermore, an award-winning investigation by Sunday Times reporter Brian Deer revealed evidence of fraud – Wakefield misreported findings and had failed to disclose considerable financial conflicts of

interest (Deer, 2004). Finally, the Wakefield article was retracted from the Lancet (The Editors of the Lancet, 2010). In spite of these developments, panicked parents in the UK and in the US have continued to fear that vaccinations may increase the risk of autism, leading them to delay or stop vaccinating their children (Poland & Spier, 2010). A single fraudulent publication led to widespread risk to public health.

2. Confirmation bias, myside bias. A set of phenomena closely related to belief perseverance are confirmation biases. People have a tendency to search for, perceive, interpret and use information that confirms their beliefs, while ignoring disconfirming information (Klayman & Ha, 1987; Kleiman & Hassin, 2013; Markman & Gentner, 2001; Snyder & Swann, 1978; Wason, 1960). Confirmation biases can help fuel belief perseverance by prompting people to find evidence that selectively supports prior views, while overlooking evidence that supports a different position. In a classic demonstration of these processes, Lord, Ross & Lepper (1979) showed supporters and opponents of capital punishment two supposed studies, one that proved and one that disproved their existing belief. Both proponents and opponents of capital punishment rated the results and procedures that confirmed their own beliefs to be more convincing and better conducted. Reading this mixed evidence made them more confident in their beliefs and led to polarization of their attitudes instead of convergence.

A subtype of confirmation biases especially relevant to science denial is myside bias – the tendency to evaluate evidence and test hypotheses in a way that is biased towards one's own attitudes and opinions (Stanovich, West & Toplak, 2013). Unfortunately, it seems that myside bias is one of the rare cognitive processes that are completely independent of intelligence (Stanovich & West, 2008; Stanovich, West & Toplak, 2013). This might explain, in part, why intelligence does not serve as a protective factor against science denial.

3. Reactance. When people feel that their freedom to engage in a behavior is threatened, they experience an aversive state of arousal (reactance) and are motivated to restore that freedom (Brehm, 1966, 1972, 1989; Brehm & Brehm, 1981; Wicklund, 1974). Reactance can be experienced consciously, but can also occur automatically, without conscious awareness or intention (Chartrand, Dalton & Fitzsimons, 2007). The strength of reactance depends on the importance of that particular freedom to the individual.

Psychological reactance leads people to perceive the threatened option as more attractive (Brehm, 1989). For example, Bushman and Stack (1996) examined effects of warning labels for violent television program and found a forbidden fruit effect. Across three experiments, warning labels increased college students' interest in violent television programs (Bushman & Stack, 1996). This effect was amplified when the source of the label was an authoritative source (U.S. surgeon general) and among individuals high in trait reactance. The forbidden fruit effect of warning labels on attraction to violent television was later replicated among children and adolescents (Bushman, 2006). Similar effects were found when examining effects of restrictive age labels and violent content warnings on attraction to violent video games (Bijvank et al., 2009). Together, these findings show clear evidence that, when warning labels are perceived as an attempt at censorship, they lead to a state of psychological reactance and increase attraction to media violence.

Psychological reactance also leads to behavioral change. People attempt to reaffirm their freedom by acting in opposition to a perceived threat to freedom. Thus, attempts at persuasion can backfire. For example, in an experiment by Gromet, Kunreuther and Larrick (2013), conservatives were less willing to purchase an energy-efficient light bulb when it had an environmental label than when it was unlabeled. Results by the previously mentioned study of

pro-vaccination messages by Nyhan et al. (2014) can also be interpreted within the framework of reactance theory. It is possible that anti-vaccination parents experienced persuasive messages as a threat to their personal freedom and responded by reducing their intentions to vaccinate.

4. Cognitive dissonance. Classic research within the framework of cognitive dissonance theory (Festinger, 1957) is highly relevant to understanding science denial. For example, a number of studies examined cognitive dissonance among smokers and found that smokers reduce the dissonance produced by the realization that they are engaging in a risky behavior by underestimating risks of smoking and questioning the validity of studies linking smoking with negative health consequences (Feather, 1962, 1963; Johnson, 1968; Lawton & Goldman, 1961; Pervin & Yatko, 1965). One might hope that, in more recent decades, increased public awareness of risks associated with smoking would have made science denial an untenable means of dissonance reduction. Unfortunately, newer studies in this area demonstrate that this is not the case – in spite of increased awareness of scientific evidence, smokers still tend to underestimate the health risks associated with smoking (Gibbons et al., 1997; Gibbons, McGovern & Lando, 1991).

5. Defensiveness, the psychological immune system and self-affirmation.

People are motivated to maintain the perceived worth and integrity of the self and respond defensively to information and events that threaten a valued self-image (Kunda, 1987; McQueen & Klein, 2006; Sherman & Cohen, 2006). Research has shown the existence of defensive processing in a variety of contexts: making inferences (Sherman, Nelson and Steele, 2000), evaluations of others (Cohen, Aronson & Steele, 2000), responses to threatening health information (Harris & Napper, 2005), negotiation (Cohen & al., 2007) etc. This large body of research suggests that people have a "psychological immune system" that uses various cognitive

strategies and distortions, enabling people to interpret a situation in a way that makes it less threatening to personal worth and well-being (Sherman & Cohen, 2006).

It is likely that defensive processing contributes significantly to science denial. Clearest evidence of this comes from research examining responses to threatening health information (Harris & Napper, 2005; Reed & Aspinwall, 1998). In one set of such studies, sexually active students responded to AIDS-prevention films by lowering their perceptions of risk for sexually transmitted diseases (Morris & Swann, 1996). Highest threat was experienced in response to messages that depicted HIV-positive individuals similar to viewers. Authors concluded that AIDS prevention films may trigger denial, especially when they hit "too close to home."

How can such defensiveness be reduced? Promising results have been obtained by researchers working within the framework of self-affirmation theory (Aronson, Cohen, & Nail, 1999; Sherman & Cohen, 2002; Steele, 1988). This line of research has shown that people are more willing to examine and accept threatening information when their self–worth is strengthened by an affirmation of another part of their identity. Self-affirmation enables people to cope with threatening information and maintain their self-worth without resorting to defensive responses (Steele, 1988). For example, Cohen, Aronson and Steele (2000) designed a set of experiments to replicate results of the classic attitude polarization study by Lord et al. (1979) and attempt to reduce defensiveness by using self-affirmation. Proponents and opponents of capital punishment read a fabricated pro- or anti-capital punishment article demonstrating results opposite to their beliefs. Prior to reading the article, half the participants affirmed another part of their identity by describing an important value unrelated to their political views. Control group participants judged the study to be methodologically flawed, viewed the authors as biased and did not change their beliefs about capital punishment. Self-affirmation reduced these defensive

responses, leading participants to view the article as more convincing and to change their attitudes towards capital punishment (Cohen, Aronson and Steele, 2000).

Thus, self-affirmation may be a very promising means of reducing science denial among highly defensive individuals. On the other hand, it is important to note that self-affirmation can sometimes backfire and lead to more biased hypothesis testing and stronger confirmation bias (Munro & Stansbury, 2009).

6. Conspiratorial thinking. Conspiratorial thinking, or conspiracist ideation, can be defined as an effort to explain an event as a result of secret machinations of powerful people or organizations (Lewandowsky, Oberauer, & Gignac, 2013; Sunstein & Vermeule, 2009). A number of authors have recently pointed to conspiracist ideation as a key individual difference variable that predicts science denial (Diethelm & McKee, 2009; Lewandowsky, Cook, Oberauer, & Marriott, 2013; Lewandowsky, Gignac, & Oberauer, 2013; Lewandowsky, Oberauer, & Gignac, 2013). Endorsement of conspiracy theories predicts opposition to a number of well-established scientific findings, including doubts about the safety of GM foods and vaccinations, disbelief in climate change, rejection of the link between tobacco and cancer and the link between HIV and AIDS (Lewandowsky, Gignac, & Oberauer, 2013; Lewandowsky, Oberauer & Gignac, 2013). These effects are of substantial magnitude, suggesting that conspiracist ideation plays a key role in science denial (e.g., in one study, conspiracist ideation explained 33% of the variance in climate change skepticism; Lewandowsky, Oberauer & Gignac, 2013).

Several mechanisms have been proposed that may underlie the relationship between conspiracist ideation and science denial. Whereas scientists use disconfirming evidence to reject

hypotheses and revise theories, such information is often viewed as confirmation of a conspiracy theory by its followers (Lewandowsky, Cook et al., 2013). The peer-review process is interpreted as a system of censorship (Diethelm & McKee, 2009; Lewandowsky, Cook et al., 2013). Because of such processes, it may seem as though changing conspiracist misconceptions is virtually impossible. Because of this, researchers recommend battling conspiracist ideation via indirect means, such as using self-affirmation to reduce defensiveness prior to persuasion attempts (Lewandowsky et al., 2012; Lewandowsky, Oberauer & Gignac, 2013; Sherman & Cohen, 2006).

7. Scientific expertise, training in research methods and rational thinking. Several studies show that increasing people's knowledge of research methodology and statistical reasoning through graduate training can increase their ability to use statistical and methodological reasoning about everyday life events (Lehman, Lampert & Nisbett, 1988; Nisbett, Fong, Lehman, & Cheng, 1987). One could hope that such improvements in reasoning and accurate judgment of scientific information will also decrease the risk of science denial. In support of this hypothesis, it seems that experienced scientists show an increased ability to reject hypotheses in response to disconfirming evidence (Dunbar, 1995). Unfortunately, it also seems that scientific reasoning skills are not a "cure all" for science denial. For example, science comprehension is unrelated to people's assessments of climate change risk (Kahan, 2013).

CHAPTER 3: GROUP-LEVEL MECHANISMS LEADING TO SCIENCE DENIAL

In the preceding chapter, a diverse set of individual-level factors were discussed that may lead to science denial. Well-researched processes such as belief perseverance, cognitive dissonance and reactance offer significant insights into why people reject well-established scientific information. However, several authors have pointed out that individual-level explanations are only a part of the picture (Kahan, 2010; Nauroth et al., 2014). Recent studies suggest that group-level processes may also play a key role in science denial (Kahan, 2010; Lewandowsky et al., 2013; Nauroth et al., 2014).

1. Social identity processes. According to Social Identify Theory (Tajfel & Turner, 1986), individuals have personal identities which differentiate the self from others as well as social identities which are based on group memberships, differentiating "us" from "them." Social identity can be defined as "the individual's knowledge that he belongs to certain social groups together with some emotional and value significance to him of this group membership" (Tajfel, 1972, p. 292). Ingroup favoritism is a key feature of social identification (Brewer, 2007). When a group is associated with the self, ingroup primes automatically activate positive evaluations and affect (Perdue, Dovidio, Gurtman, & Tyler, 1990). These effects occur not only in the case of enduring and important group memberships (e.g. gender; Rudman, Greenwald, & McGhee, 2001), but also in the case of minimal groups (Otten & Wentura, 1999). Social identity serves several functions. A valued social identity may represent a source of self-esteem (Tajfel & Turner, 1979). Furthermore, social identification may help reduce feelings of uncertainty about one's identity and self concept (Hogg, 2007, 2009; Hogg et al., 2007). When individuals experience extreme uncertainty, they are more likely to identify strongly with highly distinctive

groups. This process helps explain, in part, why people are sometimes attracted to extremist groups (Hogg & Adelman, 2013; Hogg, Kruglanski & Van den Bos, 2013).

When a valued social identity is threatened, group members may respond with anger and hostility (Ellemers, Spears, & Doosje, 2002; McCoy & Major, 2003), take collective action to protect the group (Van Zomeren, Spears, & Leach, 2008), and aggress against the source of the threat (Branscombe & Wann, 1992). Such responses may be especially strong among highly identified group members (Ellemers, Spears, & Doosje, 1997).

Nauroth and colleagues (2014) explored the role of such responses to social identity threat in science denial. In this set of studies, video gamers were asked to evaluate research demonstrating that violent video games increase aggression. Highly identified video gamers were more likely to devalue the research (e.g. by viewing the methodology as useless, judging the scientists to be biased etc.). This effect was mediated by anger and perceived stigmatization of gamers as a group. These findings demonstrate that, in some cases, social identification plays a key role in science denial. Nauroth and colleagues (2014) hypothesize that such defensive responses to threatening research may have significant downstream consequences. For example, gamers who feel stigmatized by researchers may be more likely to engage in collective action to protect their group (e.g. by holding protests, posting science-discrediting commentary on the Internet etc.).

In contrast, people seem to respond favorably to scientific findings that affirm a valued social identity. For example, in a series of studies by Morton et al. (2006), participants responded more positively to research that affirmed their gender identity. This effect was stronger among participants with scientific training, suggesting that scientific training does not inoculate against such biases.

2. Ideology, cultural values and cultural cognition. People's attitudes and responses to new information are strongly affected by ingroup attitudes, ideology and by socially shared values (Cohen, 2003; Jost, Nosek & Gosling, 2008; Pool, Wood & Leck, 1998). People align their attitudes with attitudes of valued groups to form an accurate understanding of reality, to achieve a variety of social goals and to maintain self-esteem (Deutsch & Gerard, 1955; Pool et al., 1998; Wood, 2000). Group values (such as those related to equality versus authority, individualism versus community) shape individuals' perceptions and beliefs (Kahan, 2010). This process, labeled cultural cognition, can help explain why different groups have different responses to scientific information and why social identification sometimes fosters science denial.

Several studies show clear evidence of the role that ideology and cultural worldviews play in science denial. For example, correlational studies show that endorsement of free-market ideology predicts rejection of climate science as well as rejection of other well-supported scientific findings (e.g. effects of smoking on lung cancer and effects of HIV on AIDS; Lewandowsky, Gignac, & Oberauer, 2013; Lewandowsky, Oberauer & Gignac, 2013). Endorsement of hierarchical worldviews and authority are especially closely related to rejection of climate change. Environmentalism is negatively related both to social dominance orientation and to right-wing authoritarianism (Milfont, Richter, Sibley, Wilson & Fischer, 2013; Peterson, Doty, & Winter; 1993; Schultz & Stone, 1994). Effects of right-wing authoritarianism and social dominance on attitudes towards environmentalism seem to occur through somewhat different processes. Individuals high in right-wing authoritarianism show more hostility towards the environmental movement than towards polluters because they view it as a threat to the nation's status as a first-rate power (Peterson, Doty, & Winter; 1993). On the other hand, individuals high

in social dominance tend to view humans as dominant over nature and, in turn, such views foster anti-environmental attitudes and climate change denial (Milfont et al., 2013). Another factor that plays an important role in these effects is system justification. According to system justification theory, people's need to preserve a sense of certainty and stability motivates them to view the system as legitimate, fair and beneficial as well as to support and preserve the status quo (Jost, Banaji & Nosek, 2004; Jost & Hunyady, 2002, 2005; Jost, Pietrzak, Liviatan et al., 2009). System justification tendencies have been found to predict climate change denial and opposition to pro-environmental changes, which are viewed as a threat to the status quo (Feygina, Jost and Goldsmith, 2010). It seems likely that system justification motivation plays a role in other forms of science denial as well, especially when scientific findings support the need for social change (e.g. research findings suggesting that the death penalty is an ineffective deterrent and should, therefore, be banned; research findings showing that sexual orientation is not a choice, suggesting that same-sex couples deserve equal rights as heterosexual couples etc.).

In addition to predicting science denial, ideology and cultural cognition moderate effectiveness of attempts at science communication. In an experimental study by Kahan and colleagues (2008), exposing participants to information about nanotechnology had no significant main effect on their attitudes towards nanotechnology. However, a large and significant interaction effect was found between information exposure and cultural worldviews. Exposure to information about nanotechnology made hierarchical individualists (who respect authority and view society as stratified) 25% more likely to view benefits of nanotechnology as greater than risks. On the other hand, exposure to the same information made egalitarian communitarians (who oppose social stratification and are group-oriented) 38% less likely to view benefits of nanotechnology as greater than risks. Finally, cultural cognition affects not only what people

believe but also whom they believe. For example, in a study by Kahan and colleagues (2010), participants were more likely to view experts as credible and to be persuaded by them if they believed that the experts shared their cultural values. For example, when a hierarchical and individualistic expert defended the HPV vaccine as safe, participants who shared those values were more likely to adopt a more positive attitude towards the vaccine. Egalitarian participants were more easily persuaded by an egalitarian expert.

This line of research provides the basis for developing more effective methods of science communication. It suggests that persuasion attempts will be most effective when information is presented in ways that affirm people's cultural values and ideologies instead of threatening them (Cohen, Aronson & Steele, 2000; Cohen et al., 2008; Kahan, 1010). For example, an effective way to persuade individualistic people who endorse free-market ideology that climate change is real might be to emphasize its effects on business and economy. In line with this view, Feygina, Jost and Goldsmith (2010) were able to successfully persuade individuals high in system justification to support environmentalism by representing pro-environmental changes as a patriotic means of protecting the country's natural resources and preserving the American way of life. Once environmental policies were represented as system-sanctioned, the negative effects of system justification on attitudes towards environmentalism were successfully mitigated. Another useful strategy may be to involve a diverse set of experts as public advocates, ensuring they are viewed as credible by people with different worldviews (Kahan, 2010; Kahan et al., 2010).

CHAPTER 4: THE MISSING PIECE: SCIENCE DENIAL RESULTING FROM INTERGROUP PROCESSES

"Citizens experience scientific debates as contests between warring cultural factions." (Kahan, 2010)

Nauroth and colleagues (2013) pointed to a key limitation of the science denial literature – the fact that most research focuses solely on individual-level factors. They presented a persuasive argument that, to gain a complete picture of denial, we need to consider factors at a group level.

We take this reasoning a step further and argue that many forms of science denial can be understood in terms of intergroup processes and intergroup conflict. An intergroup perspective may be especially useful when searching for the roots of angry denial and aggression towards scientists. At first, the anger and hostile behaviors that often go hand-in-hand with science denial may seem puzzling. However, these emotional reactions and behaviors are no longer surprising when one considers these phenomena from an intergroup conflict perspective.

Among some denialists, scientists are viewed as a hostile outgroup which derogates and threatens the ingroup (Lewandowski et al., 2013; Nauroth et al., 2014). In such cases, it seems that ingroup identification leads to outgroup hate. For example, in the set of studies by Nauroth et al. (2014), highly identified gamers not only rated games as innocuous (protecting a positive group image), but also perceived themselves to be stigmatized by scientists, derogated scientists and expressed anger in response to disliked research.

Two theoretical perspectives from the area of intergroup conflict are discussed which offer valuable insights into possible origins of angry science denial and aggression towards scientists: (1) intergroup emotions theory (Mackie, Devos & Smith, 2000; Smith, Seger & Mackie, 2007),

and (2) intergroup threat theory (Stephan & Stephan, 2000; Stephan, Ybarra & Rios Morrison, 2009).

Intergroup emotions theory. Traditional theories of emotion, such as appraisal theories, conceptualize emotion as an individual phenomenon which occurs when a person appraises an event as harmful or helpful to their goals or needs (Frijda, 1986; Smith & Ellsworth, 1985). Intergroup emotions theory provides a novel conceptualization of emotions by combining appraisal theories with social identity theory and the idea of a socially extended self (Mackie, Devos & Smith, 2000; Mackie & Smith, 1998, 2014; Smith, 1999; Smith, Seger & Mackie, 2007). When people identify with a group, the ingroup becomes a part of the self and group membership gains emotional significance (Smith, 1999; Mackie, Smith & Ray, 2008). When social identity is salient, group-relevant events elicit intergroup emotions (e.g. football fans experiencing elation after their team wins; Mackie, Devos & Smith, 2000).

Such group-level emotions can be distinguished from a person's individual-level emotions (Smith, Seger & Mackie, 2007). Although a certain degree of overlap exists between individual-level and group-level emotions, profiles of group-level emotions differ reliably from profiles of individual-level emotions (Smith, Seger & Mackie, 2007). Group members do not need to be personally involved in events to experience group-level emotions. For example, people sometimes experience collective guilt for acts their nation committed long before they were born (Doosje, Branscombe, Spears, & Manstead, 1998). Group-level emotions tend to be socially shared within the ingroup – people's emotions converge towards those prototypical of their group just as attitudes do (Yzerbyt, Dumont, Gordijn, & Wigboldus, 2002; Smith, Seger & Mackie, 2007). Strength of group-level emotions depends on the level of social identification. People who are highly identified with the ingroup tend to experience and express stronger group

emotions than weak identifiers (Smith, Seger & Mackie, 2007). For example, shortly after September 11, 2001, American citizens high in national identification displayed stronger anger and fear about a hypothetical terrorist attack on the United States than weakly identified group members did (Mackie, Silver & Smith, 2004). In the area of science denial, Nauroth et al. (2014) found that strongly identified video gamers experienced greater anger in response to research showing video game violence increases aggression, suggesting that this may be a group-level emotion.

Group-level emotions motivate and regulate intergroup attitudes and behaviors (Mackie, Devos & Smith, 2000; Smith, Seger & Mackie, 2007). Within the framework of intergroup emotions theory, stereotypes are viewed as appraisals of outgroup characteristics relevant to the ingroup (Mackie & Smith, 1998). Different types of ingroup and outgroup appraisals lead to different emotions. In turn, intergroup emotions give rise to specific action tendencies and behaviors towards outgroups (Mackie, Devos & Smith, 2000; Mackie & Smith, 2014; Smith, Seger & Mackie, 2007). For example, when an outgroup is appraised as threatening and the ingroup is appraised as weak, such appraisals are expected to elicit intergroup anxiety and avoidance (Brewer, 2007; Smith, 1993). On the other hand, when an outgroup is appraised as threatening and the ingroup is appraised as strong, ingroup members are expected to experience anger and a desire to confront the outgroup. These hypotheses have received empirical support. For example, Mackie, Devos and Smith (2000) demonstrated that value conflict between an ingroup and outgroup elicit distinct emotional responses of anger and fear. Appraisals of ingroup strength relative to the outgroup predict the magnitude of anger towards outgroup members. Anger, in turn, predicts intentions to confront, oppose and attack outgroup members.

Intergroup emotions theory (Mackie, Devos & Smith, 2000; Mackie & Smith 2014) provides a valuable conceptual framework for understanding angry science denial. When emotional reactions denialists express towards research findings and researchers are examined at an individual level, distinct emotional responses can be difficult to explain. It would seem surprising that denialists have heated emotional reactions to research findings and public policy that has no impact on their personal well-being. For example, many adult video gamers expressed strong anger and contempt in response to the Brown vs. EMA Supreme Court case although the bill only intended to ban the sale of mature-rated violent video games to children lacking parental permission. It also seems unclear why denialists sometimes respond to disliked research and researchers with fear, contempt, indifference or anger.

Intergroup emotions theory suggests a clear explanation of why individual denialists may have strong emotional reactions to events that do not involve them personally – research and researchers should engender such responses if they are viewed as group-relevant. Emotional responses should be especially strong among highly indentified denialists who have intergrated the ingroup into their self-concept. Intergroup emotions theory also provides clear hypotheses concerning the conditions that should give rise to distinct intergroup emotions and action tendencies. If denialists view researchers as strong and their ingroup as weak, they should be more likely to respond to threatening research with fear and avoidance. In contrast, perceptions of the ingroup as strong and researchers as weak should lead to anger and intentions to confront researchers.

Intergroup threat theory. When ingroup members perceive that outgroup members are in a position to harm them, they experience intergroup threat (Stephan & Stephan, 2000; Stephan, Ybarra & Rios Morrison, 2009). Realistic threats jeopardize the physical or material well-being of the ingroup. In contrast, symbolic threats endanger the ingroup worldview. They arise from perceived group differences in morals, values, standards, beliefs and attitudes (Stephan et al., 2002). In the words of Gordon Allport, "We are the values that we hold, we cannot help but defend them with pride and affection, rejecting every group that opposes them" (Allport, 1954, p.74).

A clear and consistent research literature supports the basic propositions of intergroup threat theory. For example, Stephan and colleagues (2002) examined the role of intergroup threat in interracial attitudes of White and Black students. They found that perceived intergroup threat mediated effects of intergroup contact, stereotyping, status inequality and other key predictors of negative interracial attitudes in both groups. Such effects have been extensively replicated. A meta-analytic review by Riek, Mania and Gaertner (2006) examined effects of intergroup threat in 95 independent samples. Different types of intergroup threat were significantly associated with negative attitudes towards outgroups (effects ranging from $r+ = 0.21$ for esteem threats, $r+ = 0.42$ for realistic threats, $r+ = 0.45$ for symbolic threats to $r+ = 0.46$ for intergroup anxiety).

Intergroup threat theory is compatible with the framework of intergroup emotions theory and contributes to predicting discrete emotional reactions towards outgroups (Cottrell & Neuberg, 2005; Neuberg & Cottrell, 2002). For example, threats to the ingroup members' physical safety are expected to elicit fear (accompanied by tendencies towards self-protection) and anger (accompanied by tendencies to aggress against the outgroup; Cottrell & Neuberg, 2005). On the other hand, if the outgroup is perceived to be a physical or moral contaminant, disgust is likely to

occur, motivating avoidance of the outgroup (Cottrell & Neuberg, 2005). An overview of emotions elicited by specific types of threat appraisals is given in Table 1.2. These predictions have also received empirical support. For example, Cotrell and Neuberg (2005) demonstrated that different groups evoke different threat profiles, leading to different emotional reactions. European Americans viewed African Americans as a threat to safety, gay men as a threat to health and Fundamentalist Christians as a threat to freedom. Physical and safety threats predicted fear, contamination threats predicted disgust whereas threats to freedom predicted anger.

Table 1.2. Hypothesized connections between perceived threats to the ingroup and elicited emotions.

Primary emotional reaction	Eliciting threat perceptions	Associated motivations	Secondary emotional reactions
Anger	Obstacles to in-group:	Remove obstacles:	
	Threat to group economic resources	Reclaim economic control	Envy, fear
	Threat to group property	Reclaim or secure property	Fear
	Threat to personal freedoms and rights of group members	Protect/reclaim compromised liberties	Disgust
	Threat to reciprocity relations (by choice)	Obtain object or effort not properly exchanged	Disgust
	Threat to social coordination	Restore effective group functioning	Fear
	Threat to trust relations	Minimize damage caused by violation	Fear
Disgust	Contamination to in-group:	Minimize contamination:	
	Threat to group health via contagion	Prevent harmful diseases	Fear, pity, anger
	Threat to group values	Maintain and confirm value system	Anger, fear
Fear	Endangered group physical safety	Protect self and valued others	Anger
Pity	Threat to reciprocity relations (because of inability)	Return to a proper exchange relationship	Anger/resentment
Guilt	Threat to perception of in-group's morality	Confirm standing as a moral group	Anger

From Neuberg, S. L., & Cottrell, C. A. (2002). Intergroup emotions: A biocultural approach. In D. M. Mackie & E. R. Smith (Eds.), From prejudice to intergroup emotions: Differentiated reactions to social groups (pp. 272). New York: Psychology Press. Copyright 2002 by Psychology Press.

It is likely that intergroup threat plays a key role in angry science denial. Effects of ingroup identification on science denial, anger and aggression towards scientists are likely to be mediated, at least in part, by perceived intergroup threat. The type of threat perceived by denialists is likely to differ between groups. For example, parents who oppose vaccinations may view vaccines and pro-vaccine researchers as a realistic threat to their children's health and safety. On the other hand, research in the field of evolutionary biology may constitute a symbolic threat to those who believe in literal creationism. Finally, it seems that gamers view violent video game research as a threat to the public image of their group and perceive research findings as stigmatizing (Nauroth et al., 2014).

Science denial as intergroup conflict – an integration. Proposed relationships of social identification and intergroup threat perceptions with science denial, anger and aggression towards scientists are illustrated in Figure 1.1.

Based on the predictions of social identity theory (Tajfel & Turner, 1986), I expect that, when denialists' social identity is salient (because of stable individual differences in identification or because of situational cues), threats to social identity will increase science denial. Intergroup emotions theory (Mackie, Devos & Smith, 2000, Mackie & Smith, 2014) and intergroup threat theory (Stephan & Stephan, 2000) provide clear predictions concerning the processes that mediate this relationship. When denialists' perceive research or researchers as harmful to their ingroup, distinct types of intergroup threat can arise (realistic, symbolic, image). In turn, threat appraisals give rise to specific intergroup emotions. Anger is a common response to different types of intergroup threat (Cotrell & Neuberg, 2005; Neuberg & Cotrell, 2002), and is especially likely to occur when the ingroup is seen as stronger than the outgroup (Mackie, Devos & Smith, 2000; Mackie & Smith, 2014). Such angry reactions are likely to be a key precursor to aggressive behavior towards scientists (Mackie, Devos & Smith, 2000).

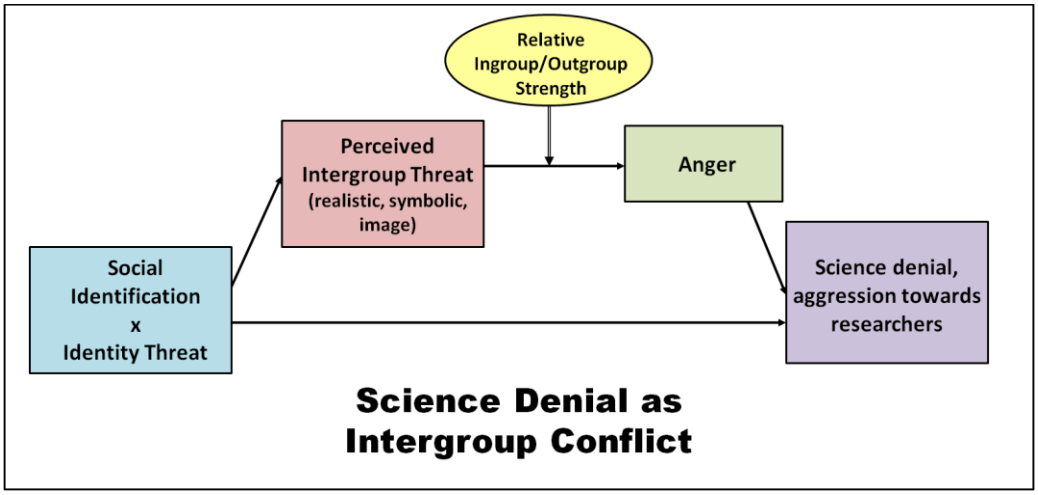


Figure 1.1. Illustration of hypothesized relationships between social identity, intergroup threat, intergroup emotions and science denial.

CHAPTER 5: OVERVIEW OF PRESENT STUDIES

The current set of studies frames science denial in terms of intergroup conflict, testing the basic predictions shown in Figure 1. I propose that the relationship between denialists and scientists can be understood in terms of intergroup relations (scientists are viewed as a hostile outgroup). Three studies applied principles of social identity theory (Study 1), intergroup threat theory (Study 2) and intergroup emotions theory (Study 3) to explore the mechanisms that lead to science denial.

In Study 1, I examined whether social identification has causal effects on science denial. The aim was to experimentally replicate correlational findings of social identification as a predictor of science denial (Munro & Munro, 2014; Nauroth et al., 2014).

Study 2 examined the role of intergroup threat in science denial, anger and aggression towards scientists. Exposure to research findings that have negative implications for the ingroup is expected to increase denialists' perceptions of intergroup threat. Threat perceptions were expected to mediate between exposure to threatening research findings and key outcomes (denial, anger and aggression towards scientists).

Study 3 tested the predictions of intergroup emotions theory concerning the role of relative ingroup-outgroup strength in angry science denial and aggression towards scientists. Competing hypotheses were tested concerning effects of priming participants to view scientists as a strong outgroup on science denial, anger and aggression towards scientists.

CHAPTER 6: STUDY 1: SOCIAL IDENTITY AND SCIENCE DENIAL

Based on the predictions of social identity theory (Tajfel & Turner, 1986), I expect that, when a person's social identity is salient (because of stable individual differences in identification or because of situational cues), scientific findings that constitute threats to social identity will engender science denial. Indeed, recent research by Nauroth et al. (2014) demonstrates that high social identification is associated with denial of scientific findings when those findings threaten a valued social identity (highly identified video gamers are more likely to deny research findings concerning the effects of video game violence on aggression). These results suggest that social identity plays a key role in science denial. However, no published studies have tested whether this effect is causal.

The main goal of Study 1 was to experimentally test whether activating a valued social identity causes increased science denial. I hypothesized that social identity priming would lead participants to derogate research that threatens the valued ingroup. Three experiments tested this hypothesis. Study 1A tested effects of priming political conservatives' social identity on climate change denial. Study 1B tested effects of priming political liberals' social identity on denial of research on vaccination safety. Finally, Study 1C tested effects of priming video game players' social identity on denial of research demonstrating violent video game effects on aggression.

A secondary goal of Study 1 was to compare effects of social identity priming with effects of affirming a valued personal identity. Past research suggests that affirming a valued personal identity mitigates denial and defensiveness in the face of threatening information (Cohen, Aronson, & Steele, 2000; Harris & Napper, 2005; Sherman & Cohen, 2002). Therefore, Study 1C compared effects of a self-affirmation manipulation and effects of social identity priming on science denial.

Study 1A

Method

Participants

A total of 112 politically conservative participants were recruited through six online blogs and forums. Two participants did not follow survey instructions and seven participants had missing data on over 90% of the variables so their responses were excluded from further analyses, leaving a sample of 103 participants (34% female, mean age 29 years, ranging from 18 to 75 years). The sampling and flow of subjects in Study 1A is shown in Figure 2.1.

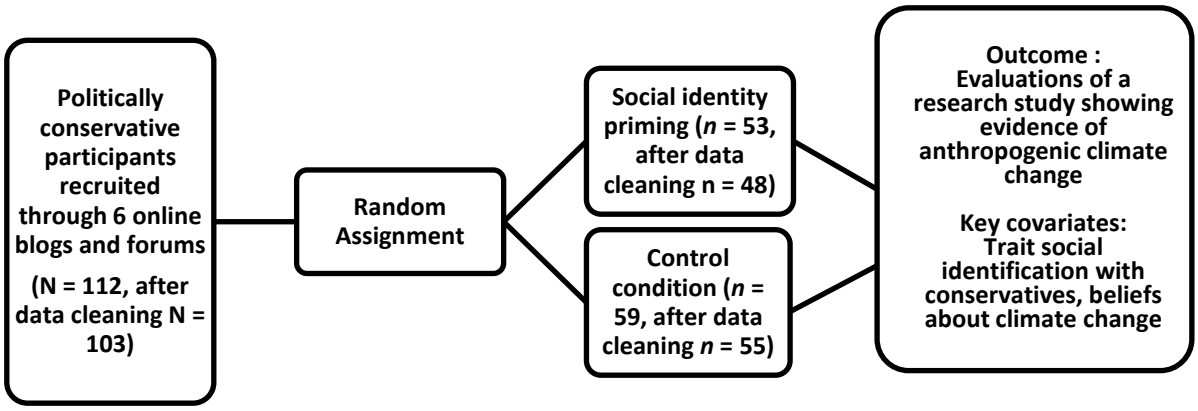


Figure 2.1. Graphic illustration of Study 1A.

Pre-experimental Measures

Beliefs about "controversial" scientific topics. Participants completed a 12-item scale measuring their overall attitudes towards six "controversial" scientific issues (violent video game effects, evolution, climate change, capital punishment, origins of sexual orientation and vaccination safety). The two items measuring climate change were "Climate change is a hoax"

and “Human CO2 emissions cause climate change” (reverse-coded). Items were rated on a Likert scale from 1 (“Strongly disagree”) to 7 (“Strongly agree”).

Demographics. Also assessed were sex, age, political orientation, religious affiliation.

Experimental Conditions

Participants in the social identity priming condition (n = 48) completed a brief 8-item true-or-false questionnaire prompting them to think about themselves as conservatives (adapted from Leonardelli & Brewer, 2001). Example items are “It is important to me to view myself as a conservative”, “I can identify with other conservatives.”

Participants in the control condition (n = 55) did not complete the identity priming questionnaire.

Post-experimental Measures

Research summary evaluations. Immediately after the experimental manipulation, participants read a paragraph describing the results of a published scientific study supporting the reality of anthropogenic climate change (Huber & Knutti, 2012):

“Dr. Markus Huber and Dr. Reto Knutti conducted a study examining causes of climate change (natural versus anthropogenic - caused by human activity). They examined various contributions to the observed global warming between 1850 and 1950. This study employed a novel approach based on the principle of conservation of energy, without assumptions about spatial warming patterns.

Based on a massive collection of simulations, authors found that greenhouse gasses contributed 0.85C of warming since the mid-twentieth century. Authors noted that natural variability cannot account for the observed global warming. Authors suggest that, in fact,

greenhouse gases have very likely caused more warming than has been observed, due to the offsetting cooling effect from human aerosol emissions.

Researchers concluded that these findings confirm that humans are the dominant cause of the observed warming over the past 150 years, and particularly over the past 50 years."

Participants then rated the research using a 5-item scale based on items from Nauroth et al. (2014). Example items are "This kind of research is not very meaningful" and "These researchers just find what they want to find." Items were rated on a Likert scale from 1 ("Not at all true") to 6 ("Very much true").

Social identification. Trait social identification with political conservatives was measured using a brief 5-item measure (adapted from Doosje, Ellemers, & Spears, 1995; Nauroth et al., 2014). An example item is "When I talk about conservatives, I usually say 'we' rather than 'they'." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree"). Trait social identification was measured after the experimental manipulation because measuring trait identification at the beginning of the study would lower the effectiveness of the priming manipulation.

Educational history. Participants reported the highest level of education they attained as well as the number of research methods courses and statistics courses they had taken.

Debriefing. Participants rated whether they were confused by any of the questions in the survey and described what they thought about the study. Finally, participants were thanked and debriefed.

Results

Preliminary Analyses

To compute scale scores, mean scores were computed on the items measuring research summary evaluations (5 items, $\alpha = 0.89$), initial beliefs about climate change (2 items, $\alpha = 0.77$)

and trait social identification with political conservatives (5 items, $\alpha = 0.88$). As expected, trait conservative identification was positively associated with beliefs that anthropogenic climate change is a hoax ($r = 0.49$, $p < 0.01$). Negative evaluations of the research article supporting anthropogenic climate change were significantly associated both with initial beliefs that anthropogenic climate change is a hoax ($r = 0.75$, $p < 0.01$) and with trait conservative identification ($r = 0.36$, $p < 0.01$).

Experimental groups did not differ in terms of age ($t(101) = 0.75$, $p > 0.05$), sex ($\chi^2(1, N = 101) = 0.60$, $p > 0.05$), education ($t(99) = 0.75$, $p > 0.05$), initial beliefs about climate change ($t(101) = 0.03$, $p > 0.05$) or trait social identification ($t(100) = -0.32$, $p > 0.05$).

Main Analyses

To examine effects of the experimental manipulation on science denial, an ANCOVA was run with research summary evaluations as the outcome and with initial beliefs about climate change, trait social identification, sex and education as covariates (shown in Table 2.1).

Table 2.1. Analysis of covariance of research summary evaluations, with initial beliefs about climate change trait conservative social identification, sex and education as covariates.

Source	*Df*	*MS*	*F*	*p*	Partial η^2
Social identity priming	1	4.17	4.23	.043	.043
Initial beliefs	1	36.02	36.48	.000	.280
Social identification	1	3.15	3.19	.077	.033
Sex	1	3.96	4.01	.048	.041
Education	1	2.62	2.66	.107	.027

A significant effect was found of social identity priming on research summary evaluations ($F(1, 94) = 4.23$, $p < .05$, partial $\eta^2 = .04$). Participants whose social identity as

political conservatives was primed were more willing to derogate the research presented in the summary (adj M = 3.54, 95% CI [3.25, 3.84]) than participants in the no-manipulation control condition (adj M = 3.13, 95% CI [2.86, 3.39]). These results suggest that making participants' group identity as political conservatives salient caused an increase in climate change denial.

In addition, significant effects were found of initial beliefs about climate change (F(1, 94) = 36.02, p < .01, partial η^2 = .28, B = 1.34, SE = .22) and sex (F(1, 94) = 4.01, p < .05, partial η^2 = .04, B = 0.42, SE = .21). Participants who initially believed that climate change is a hoax were more willing to derogate the research summary than participants who believed that climate change is real. Men derogated the research summary significantly more than women. Education and trait social identification did not significantly predict research evaluations (ps > 0.05).

Next, interactions of the experimental manipulation with initial beliefs about climate change, trait social identification and education were added to the model. No significant interactive effects were found (all ps > 0.05).

Discussion

The current results provide the first experimental evidence that social identification can cause increased science denial. Past research has shown correlational evidence that social identity predicts science denial when research evidence reflects badly on one's ingroup (e.g. gamers' social identification is significantly correlated with denial of research showing violent video game effects on aggression, Nauroth et al., 2014). However, this study provides the first experimental test of a causal relationship between social identification and science denial.

No evidence was found of interactions between social identity priming and key individual difference variables (trait social identification, beliefs supporting science denial or educational

status). However, the low sample size in the current study may have limited our ability to detect small interaction effects.

Study 1B

The main goal of Study 1B was to replicate results from Study 1A in a new population (political liberals) and in a new domain of science denial. Given the substantial prevalence of vaccine refusal in predominantly politically liberal areas communities with high income and educational status (Atwell et al., 2013; Sugerman et al., 2010), attitudes towards vaccination safety research were examined as the outcome.

Method

Participants

A total of 374 politically liberal participants were recruited through eleven online blogs and forums. Three participants did not follow survey instructions and nineteen participants had missing data on over 90% of the variables so their responses were excluded from further analyses, leaving a sample of 356 participants (41% female, mean age 24 years, ranging from 18 to 65 years). The sampling and flow of subjects in Study 1B is shown in Figure 2.2.

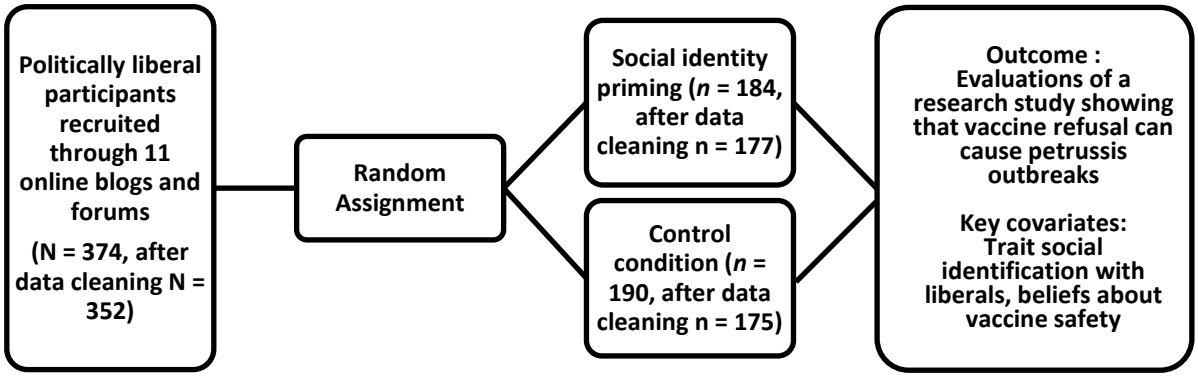


Figure 2.2. Graphic illustration of Study 1B.

Pre-experimental Measures

Beliefs about "controversial" scientific topics. Participants completed a 12-item scale measuring their overall attitudes towards six "controversial" scientific issues (violent video game effects, evolution, climate change, capital punishment, origins of sexual orientation and vaccination safety). The two items measuring beliefs about vaccination safety were "Vaccinations are dangerous and should be avoided" and "Vaccinations are safe and useful" (reverse-coded). Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree").

Demographics. Also assessed were sex, age, political orientation, religious affiliation.

Experimental Conditions

Participants in the social identity priming condition (N = 177) completed a brief 8-item true-or-false questionnaire prompting them to think about themselves as liberals (adapted from Leonardelli & Brewer, 2001). Example items are "It is important to me to view myself as a liberal", "I can identify with other liberals."

Participants in the control condition (N = 175) did not complete the identity priming questionnaire.

Post-experimental Measures

Research summary evaluations. Immediately after the experimental manipulation, participants read a paragraph describing the results of a published scientific study highlighting the dangers of avoiding vaccination (Atwell et al., 2013):

"Jessica Atwell and her colleagues conducted a study examining factors that contributed to the whooping cough outbreak in California. In 2010, 9120 pertussis cases with 10 deaths were

reported in California — the highest numbers since 1947. Although waning immunity has been proposed as a major cause, clustering of unvaccinated children might also have played a role.

To examine this possibility, researchers analyzed spatial clustering of nonmedical vaccination exemptions (such as for religious or philosophical reasons) for children entering kindergarten from 2005 through 2010 and space-time clustering of pertussis cases with onset in 2010 in California. Researchers found that non-immunized children were more than twice as likely to be in a pertussis cluster. This association remained significant after adjustment for sociodemographic variables.

Researchers concluded that vaccine refusal may have contributed to California's 2010 pertussis outbreak. They warned that communities with large numbers of intentionally unvaccinated or undervaccinated persons can lead to pertussis outbreaks."

Participants then rated the research using a 9-item scale based on items from Nauroth et al. (2014). Example items are "This kind of research is not very meaningful" and "These researchers just find what they want to find." Items were rated on a Likert scale from 1 ("Not at all true") to 6 ("Very much true").

Social identification. Trait social identification with political liberals was measured using a brief 5-item measure (adapted from Doosje, Ellemers, & Spears, 1995; Nauroth et al., 2014). An example item is "When I talk about liberals, I usually say 'we' rather than 'they'." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree"). Trait social identification was measured after the experimental manipulation because measuring trait identification at the beginning of the study would lower the effectiveness of the priming manipulation.

Educational history. Participants reported the highest level of education they attained as well as the number of research methods courses and statistics courses they had taken.

Debriefing. Participants rated whether they were confused by any of the questions in the survey and described what they thought about the study. Finally, participants were thanked and debriefed.

Results

Preliminary Analyses

To compute scale scores, mean scores were computed on the items measuring research summary evaluations (9 items, $\alpha = 0.71$), initial beliefs about vaccination safety (2 items, $\alpha = 0.69$) and trait social identification with political liberals (5 items, $\alpha = 0.82$). Trait social identification with liberals was weakly, but significantly associated with beliefs that vaccines are dangerous ($r = 0.11$, $p < 0.05$).

Experimental groups did not differ in terms of age ($t(350) = 0.51$, $p > 0.05$), sex ($\chi^2(1, N = 346) = 0.11$, $p > 0.05$), education ($t(347) = -0.16$, $p > 0.05$), initial beliefs about vaccination safety ($t(350) = -0.71$, $p > 0.05$) or trait social identification ($t(350) = -1.88$, $p > 0.05$).

Main Analyses

To examine effects of the experimental manipulation on science denial, an ANCOVA was run with research summary evaluations as the outcome and with initial beliefs about vaccination safety, trait social identification, sex and education as covariates (shown in Table 2.2).

A significant effect was found of social identity priming on research summary evaluations ($F(1, 343) = 5.09$, $p < .03$, partial $\eta^2 = .02$). Participants whose social identity as political liberals was primed were more willing to derogate the research presented in the

summary (adj M = 1.67, 95% CI [1.61, 1.74]) than participants in the no-manipulation control condition (adj M = 1.56, 95% CI [1.50, 1.63]).

Table 2.2. Analysis of covariance of research summary evaluations, with initial beliefs about vaccination safety, trait liberal social identification, sex and education as covariates.

Source	*df*	*MS*	*F*	*p*	Partial η^2
Social identity priming	1	1.05	5.09	.025	.015
Initial beliefs	1	13.56	65.77	.000	.161
Social identification	1	0.88	4.28	.039	.012
Sex	1	0.05	0.26	.609	.001
Education	1	0.16	0.80	.373	.002

In addition, significant effects were found of initial beliefs about vaccination safety (F(1, 343) = 65.77, p < .01, partial η^2 = .16, B = 0.33, SE = .04) and social identification with political liberals (F(1, 343) = 4.28, p < .05, partial η^2 = .01, B = 0.04, SE = .02). Participants who initially believed that vaccines are dangerous were more willing to derogate the research summary than participants who believed that vaccines are safe. Participants high in liberal identification were more willing to derogate the research summary than participants low in liberal identification. Education and sex did not significantly predict research evaluations (ps > 0.05).

Next, interactions of the experimental manipulation with initial beliefs about vaccination safety, trait social identification and education were added to the model. Neither trait social identification nor education significantly moderated the effects of the experimental manipulation (ps > 0.05). A significant interaction effect was found between the experimental manipulation and initial beliefs about vaccination safety (F(1, 340) = 6.01, p < .02, partial η^2 = .02). The effect of social identity priming was significant at +1 SD on beliefs that vaccines are dangerous

($M_{PRIMING}$ = 1.96, 95% CI [1.84, 2.06], $M_{CONTROL}$ = 1.72, 95% CI [1.63, 1.81], $F(1, 340) = 11.17$, $p < .01$), but was non-significant at -1 SD on beliefs that vaccines are dangerous ($M_{PRIMING}$ = 1.40, 95% CI [1.30, 1.50], $M_{CONTROL}$ = 1.41, 95% CI [1.32, 1.50], $F(1, 340) = 0.34$, $p = 0.85$). These results are shown in Figure 2.3.

These results show that making participants' group identity as political liberals salient causes an increase in science denial regarding vaccination. Priming participants' group identity as political liberals made them more likely to derogate research demonstrating dangerous consequences of vaccine refusal and this effect was especially strong for participants who initially believed that vaccines are unsafe.

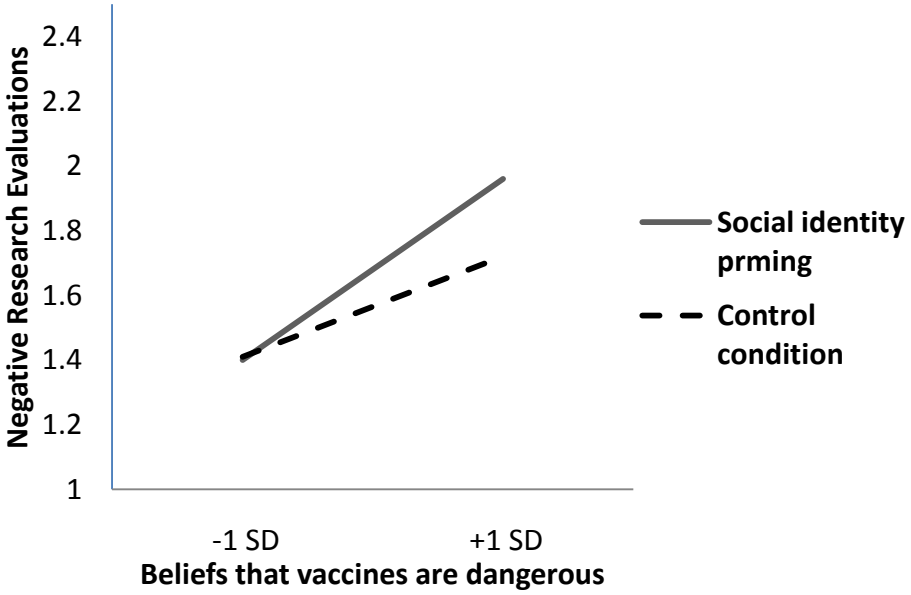


Figure 2.3. Negative evaluations of scientific research highlighting the importance of vaccination as a function of beliefs about vaccination safety and social identity priming.

Discussion

These findings replicate the effect of social identification on science denial found in Study 1A in a new population (political liberals) and in a new domain of science denial (anti-vaccination attitudes).

The larger sample size in this study provided more power to detect potential interaction effects between the experimental manipulation of social identification and key individual difference variables. It seems that effects of social identity on denial differ depending on one's initial beliefs – effects of social identity primes are especially strong among participants who already hold beliefs favoring science denial.

Study 1C

Method

Participants

A total of 225 video game players were recruited through fifteen online blogs and forums. Seven participants did not follow survey instructions in an attention check question and twenty-one participants had missing data on over 90% of the variables so their responses were excluded from further analyses, leaving a sample of 197 participants (24.5% female, mean age 22 years, ranging from 18 to 76 years). The sampling and flow of subjects in Study 1C is shown in Figure 2.4.

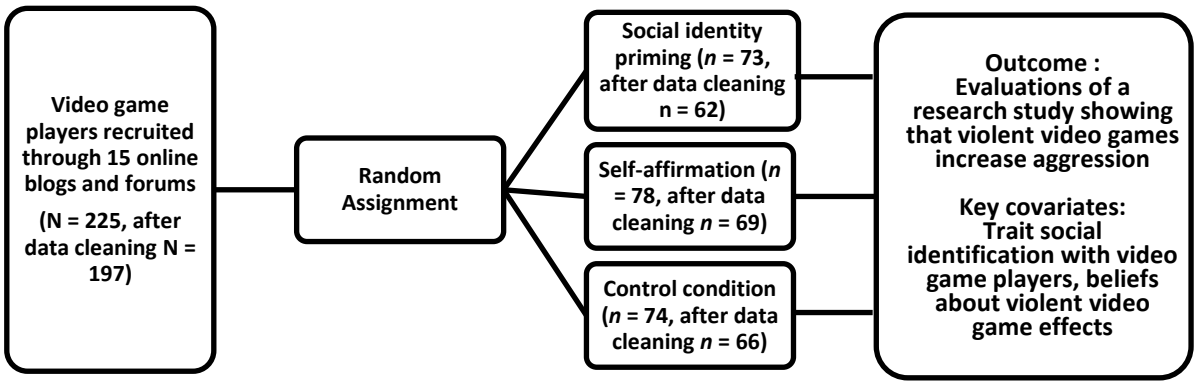


Figure 2.4. Graphic illustration of Study 1C.

Pre-experimental Measures

Beliefs about "controversial" scientific topics. Participants completed a 12-item scale measuring their overall attitudes towards six "controversial" scientific issues (violent video game effects, evolution, climate change, capital punishment, origins of sexual orientation and vaccination safety). The two items measuring beliefs about violent video game effects were

"Violent video games increase aggressive behavior" and "Violent video games increase aggressive thoughts and feelings." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree").

Demographics. Also assessed were sex, age, political orientation, religious affiliation.

Experimental Conditions

Participants in the social identity priming condition (n = 62) completed a brief 8-item true-or-false questionnaire prompting them to think about themselves as video game players (adapted from Leonardelli & Brewer, 2001). Example items are "It is important to me to view myself as a video game player", "I can identify with other video game players."

Participants in the self-affirmation condition (n = 69) completed a brief 12-item questionnaire prompting them to think about their personal values and affirming their personal identity (adapted from Napper, Harris & Epton, 2009). Example items are "I value my ability to think critically", "I really enjoy being part of a group."

Participants in the control condition (n = 66) did not complete the identity priming questionnaire or the self-affirmation questionnaire.

Post-experimental Measures

Research summary evaluations. Immediately after the experimental manipulation, participants read a paragraph describing the results of a published scientific study demonstrating violent video game effects on aggression (summary adapted directly from Nauroth et al., 2014, p. 109):

"In an experiment conducted by Craig Anderson and colleagues participants were randomly assigned to one of two conditions. In one condition participants played a violent video game. Participants in the other condition played a non-violent video game. After playing the

video game all participants were asked to participate in a reaction time task in which they competed (ostensibly) against an opponent seated in another room. Whenever participants won a round, they had the opportunity to punish the opponent. The punishment consisted of a very unpleasant noise; participants were asked to calibrate the sound's duration and its volume; these settings served as measures of participants' aggressive tendencies. Comparing the average duration and volume settings between the two conditions showed that those who had played the violent video game reacted more aggressively than those who played the non-violent video game. The authors of the study concluded that consuming violent video games leads to an increase in aggression. The authors stated that violent video games provide a forum for learning and practicing aggressive reactions."

Participants then rated the research using a 9-item scale based on items from Nauroth et al. (2014). Example items are "This kind of research is not very meaningful" and "These researchers just find what they want to find." Items were rated on a Likert scale from 1 ("Not at all true") to 6 ("Very much true").

Social identification. Trait social identification with video game players was measured using a brief 5-item measure (adapted from Doosje, Ellemers, & Spears, 1995; Nauroth et al., 2014). An example item is "When I talk about video game players, I usually say 'we' rather than 'they'." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree"). Trait social identification was measured after the experimental manipulation because measuring trait identification at the beginning of the study would lower the effectiveness of the priming manipulation.

Educational history. Participants reported the highest level of education they attained as well as the number of research methods courses and statistics courses they had taken.

Debriefing. Participants rated whether they were confused by any of the questions in the survey and described what they thought about the study. Finally, participants were thanked and debriefed.

Results

Preliminary Analyses

To compute scale scores, mean scores were computed on the items measuring research summary evaluations (9 items, $\alpha = 0.86$), initial beliefs about violent video game effects (2 items, $\alpha = 0.92$) and trait social identification with video game players (5 items, $\alpha = 0.91$). As expected, trait social identification with video game players was positively associated with beliefs that violent video games do not cause aggression ($r = 0.30$, $p < 0.01$). Negative evaluations of the research article showing violent video game effects on aggression were significantly associated both with initial beliefs that violent video games do not increase aggression ($r = 0.31$, $p < 0.01$) and with trait social identification with video game players ($r = 0.21$, $p < 0.01$). Experimental groups did not differ in terms of age ($F(2, 194) = 0.78$, $p > .05$), sex ($\chi^2(1, N = 197) = 5.74$, $p > 0.05$), education ($F(2, 194) = 2.62$, $p > .05$), initial beliefs about video game effects ($F(2, 194) = 0.14$, $p > .05$) or trait social identification ($F(2, 194) = 1.33$, $p > .05$).

Main Analyses

To examine effects of the experimental manipulation on science denial, an ANCOVA was run with research summary evaluations as the outcome and with initial beliefs about violent video game effects, trait social identification, sex and education as covariates (Table 2.3).

Table 2.3. Analysis of covariance of research summary evaluations, with initial beliefs about violent video game effects, trait liberal social identification, sex and education as covariates.

Source	*df*	*MS*	*F*	*p*	Partial η^2
Social identity priming	2	3.49	5.05	.007	.051
Initial beliefs	1	18.93	27.37	.000	.127
Social identification	1	0.00	0.00	.954	.000
Sex	1	2.10	3.03	.083	.016
Education	1	0.01	0.01	.930	.000
Initial beliefs x Social identity priming	2	4.08	5.89	.003	.059

A significant main effect was found of the experimental manipulation ($F(2, 188) = 5.05$, $p < .01$, partial $\eta^2 = .05$). LSD pairwise comparisons showed no significant differences between experimental conditions (adj $M_{SOCIAL\ IDENTITY\ PRIMING} = 3.23$, 95% CI [3.00, 3.47], $M_{SELF\text{-}AFFIRMATION} = 2.98$, 95% CI [2.77, 3.18], $M_{CONTROL} = 3.15$, 95% CI [2.94, 3.37], LSD *p*s > 0.05), but a planned contrast revealed that participants in the social identity priming condition gave significantly more negative research evaluations compared to participants in the other two conditions ($F(1, 188) = 9.01$, $p < .01$). Initial beliefs about violent video game effects significantly predicted research evaluations ($F(1, 188) = 18.93$, $p < .01$, partial $\eta^2 = .13$). Participants who initially believed that video games do not influence aggression were more willing to derogate the research summary than participants who believed that violent video games increase aggression. Sex, education and trait social identification did not significantly predict research evaluations (ps > 0.05).

A significant interaction effect was found between the experimental manipulation and initial beliefs about violent video game effects ($F(2, 188) = 5.89$, $p < .01$, partial $\eta^2 = .06$). The effect of social identity priming was significant at +1 SD on beliefs that violent video game

effects on aggression do not exist ($F(2, 188) = 4.32$, $p < .02$), but was non-significant at -1 SD on beliefs that violent video game effects on aggression do not exist ($F(2, 188) = 1.40$, $p = .25$).

Pairwise comparisons at +1 SD on beliefs that violent video game effects on aggression do not exist demonstrated that participants whose social identity as video game players was primed were more willing to derogate the research study (adj $M = 3.89$, 95% CI [3.54, 4.25]) than participants in the self-affirmation condition (adj $M = 3.29$, 95% CI [3.02, 3.56]; LSD $p < 0.01$) and in the control condition (adj $M = 3.28$, 95% CI [2.99, 3.58]; LSD $p < 0.01$). The latter two were not significantly different (LSD $p = 0.37$). These results are shown in Figure 2.5.

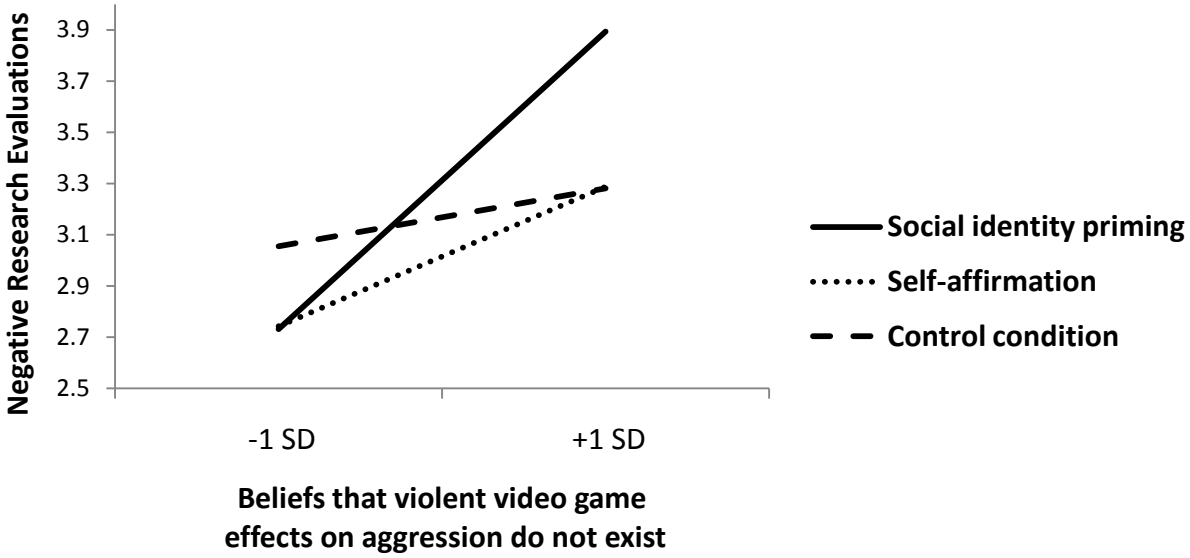


Figure 2.5. Negative evaluations of scientific research demonstrating violent video game effects on aggression as a function of beliefs about violent video game effects and experimental manipulations of social identity priming versus self-affirmation.

Discussion

These results demonstrate that making participants' group identity as video game players salient increases denial of research showing violent video game effects on aggression. When participants initially doubted the existence of violent video game effects, priming their social identity as video game players made them more likely to derogate a research study showing that violent video game effects increase aggression.

These findings replicate the effect of social identification on science denial found in Study 1B in a new population (video game players) and in a new domain of science denial (denial of research showing violent video game effects on aggression). As in Study 1B, participants' initial beliefs moderated the effect of social identity priming. Priming participants' social identity as video game players increased science denial among participants who initially

believed that violent video games have no effect aggression, but not among participants who initially believed that violent video games do increase aggression.

Surprisingly, self-affirmation did not result in a reduction in science denial. This null finding is at odds with past research demonstrating clear effects of self-affirmation on reduced defensiveness (including research using this specific manipulation Klein, Harris & Napper, 2008; Napper, Harris & Epton, 2009). The lack of significant effects of self-affirmation in the current study is possibly due to the fact that participants' attitudes towards the video game research article were not extreme and may not have induced sufficient threat for the self-affirmation effects to be detectable. Alternatively, the effectiveness of the self-affirmation manipulation may have been undermined the fact that the manipulation was administered online. Finally, it is possible that self-affirmation does not actually ameliorate defensiveness and denial in the domain of violent video game effects as it does in the domain of threatening health information (Harris & Napper, 2005; Reed & Aspinwall, 1998; Napper, Harris & Epton, 2009).

Meta-analytic Review

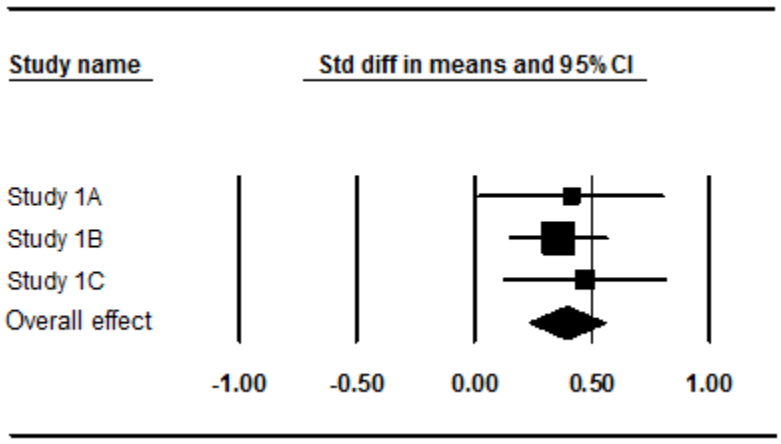
Results from Study 1A, 1B and 1C clearly demonstrate that priming a threatened social identity increases science denial. However, findings concerning the role of initial beliefs as a moderator of these effects were somewhat inconsistent. Significant interactive effects of initial beliefs and the experimental manipulation of social identity on science denial were found in Study 1B ($F(1, 340) = 6.01$, $p < .02$, partial $\eta^2 = .02$) and Study 1C ($F(1, 340) = 6.01$, $p < .02$, partial $\eta^2 = .02$). A interactive effect in the same direction was found in Study 1A, but did not reach statistical significance ($F(1, 93) = 0.313$, $p = .577$, partial $\eta^2 = .00$).

To resolve this inconsistency and clarify the effects of initial beliefs as a moderator, meta-analytic procedures were used to examine effects across the three studies (as recommended by

Bonett, 2009; Cummings, 2012, 2014). Separate meta-analyses were conducted combining effect sizes observed at +1 SD versus -1SD on initial beliefs favoring science denial (beliefs that climate change is a hoax in Study 1A, beliefs that vaccinations are dangerous and should be avoided in Study 1B and beliefs that violent video games do not affect aggression in Study 1C). Forest plots showing effect sizes and confidence intervals are shown in Figure 2.6 and results are shown in Table 2.4.

The overall effect of social identity priming on denial at +1 SD on initial beliefs favoring science denial was significant and of moderate to large magnitude ($d+ = 0.39$, $p < 0.01$, 95% CI [0.23 - 0.56]). On the other hand, the overall effect of social identity priming on denial at -1 SD on initial beliefs favoring science denial was not significant ($d+ = 0.0$, $p = 0.96$, 95% CI [-0.17 - 0.16]).

A. Effects found at +1 SD of initial beliefs favoring science denial



B. Effects found at -1 SD of initial beliefs favoring science denial

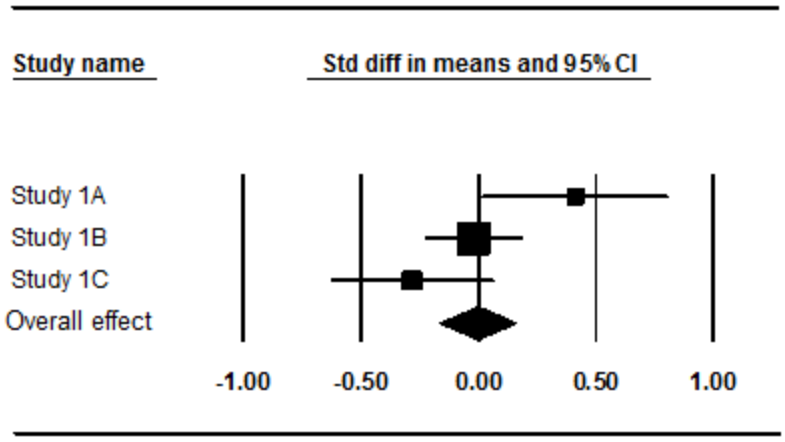


Figure 2.6. Forest plots showing results of a meta-analysis of effects of social identity priming on science denial in Study 1A, 1B and 1C.

Table 2.4. Meta-analysis of effects of social identity priming on science denial in Study 1A, 1B and 1C.

A. Effects found at +1 SD of initial beliefs favoring science denial

			Effect size and 95% CI			Test of null (two-tailed)		Heterogeneity		
Study	Outcomes	N	Point Estimate (d)	LL	UL	z	P	Q (df)	P	I^2
Study 1A	Conservatives derogating climate change research	100	0.41	0.01	0.81	2.03	0.04			
Study 1B	Liberals derogating pro-vaccination research	349	0.36	0.15	0.57	3.31	0.00			
Study 1C	Video gamers derogating violent video game research	128	0.47	0.12	0.82	2.62	0.01			
Overall d_+ Fixed effects model		577	0.39	0.23	0.56	4.66	0.00	0.30(2)	0.86	0
Overall d_+ Random effects model		577	0.39	0.23	0.56	4.66	0.00			

B. Effects found at -1 SD of initial beliefs favoring science denial

			Effect size and 95% CI			Test of null (two-tailed)		Heterogeneity		
Study	Outcomes	N	Point Estimate (d)	LL	UL	z	P	Q (df)	p	I^2
Study 1A	Conservatives derogating climate change research	100	0.41	0.01	0.81	2.03	0.04			
Study 1B	Liberals derogating pro-vaccination research	349	-0.02	-0.23	0.19	-0.18	0.85			
Study 1C	Video gamers derogating violent video game research	128	-0.28	-0.63	0.07	-1.58	0.11			
Overall d_+ Fixed effects model		577	0.00	-0.17	0.16	-0.05	0.96	6.67(2)	0.04	70.03
Overall d_+ Random effects model		577	0.02	-0.31	0.35	-0.05	0.90	0.00		

Table 2.5. Descriptive statistics for initial beliefs about scientific findings in Study 1.

A. Study 1A (sample of 103 politically conservative participants)

					Percentiles		
	Variable	Items	Scale Range	*M(SD)*	25	50	75
1.	Violent video games do not increase aggression	2	1-7	4.85(1.72)	3.5	5.0	6.0
2.	Climate change is a hoax	2	1-7	3.42(1.79)	2.0	3.5	4.5
3.	Capital punishment deters crime	2	1-7	4.67(1.82)	3.5	5.0	6.0
4.	Vaccinations are dangerous	2	1-7	1.64(1.12)	1.0	1.0	2.0
5.	Sexual orientation is a choice	2	1-7	3.17(2.0)	1.0	3.0	4.5
6.	Evolution is not real	2	1-7	3.68(1.66)	2.5	3.5	4.5

B. Study 1B (sample of 352 politically liberal participants)

					Percentiles		
	Variable	Items	Scale Range	*M(SD)*	25	50	75
1.	Violent video games do not increase aggression	2	1-7	4.98(1.55)	4.00	5.50	6.00
2.	Climate change is a hoax	2	1-7	1.44(0.84)	1.00	1.00	1.50
3.	Capital punishment deters crime	2	1-7	2.37(1.50)	1.00	2.00	3.50
4.	Vaccinations are dangerous	2	1-7	1.25(0.60)	1.00	1.00	1.50
5.	Sexual orientation is a choice	2	1-7	1.39(0.93)	1.00	1.00	1.50
6.	Evolution is not real	2	1-7	2.21(1.43)	1.00	1.75	3.00

C. Study 1C (sample of 197 video game players)

					Percentiles		
	Variable	Items	Scale Range	*M(SD)*	25	50	75
1.	Violent video games do not increase aggression	2	1-7	5.41(1.30)	4.5	5.5	6.5
2.	Climate change is a hoax	2	1-7	2.12(1.33)	1.0	1.5	2.5
3.	Capital punishment deters crime	2	1-7	3.36(1.73)	1.5	3.5	4.5
4.	Vaccinations are dangerous	2	1-7	1.59(0.98)	1.0	1.0	2.0
5.	Sexual orientation is a choice	2	1-7	1.98(1.46)	1.0	1.0	2.5
6.	Evolution is not real	2	1-7	3.15(1.78)	2.0	2.5	4.0

CHAPTER 7: STUDY 2: INTERGROUP THREAT AND SCIENCE DENIAL

Study 2 draws on the predictions of intergroup threat theory (Stephan & Stephan, 2000) to further explain processes leading to science denial and aggression towards scientists. Intergroup threat theory holds that intergroup bias and conflict ensue when ingroup members perceive outgroup members as a danger to their group. In line with these predictions, short-term manipulations of intergroup threat have been found to have significant effects on prejudice and aggressive responses towards outgroup members (Brambilla et al., 2013; Riek, Mania & Gaertner, 2006; Rios Morrison & Ybarra, 2008).

The main goal of Study 2 was to examine the effects of intergroup threat on participants' responses to disliked research and researchers. I hypothesized that high intergroup threat (measured or manipulated) will lead to more negative responses towards research findings and researchers. Given the role of ingroup identification in intergroup aggression, I hypothesized that effects of intergroup threat on anger and negative behaviors towards researchers will be stronger among highly identified group members. Finally, given the close link between anger and intergroup aggression (Mackie & Smith, 2014), anger was examined as a potential mediator of the relationship between intergroup threat and aggression towards scientists.

Study 2A was a preliminary correlational study that examined perceived intergroup threat as a predictor of science denial, anger and negative behavioral intentions towards researchers. Study 2B was an experimental study that tested effects of manipulating intergroup threat on negative research evaluations. Finally, Study 2C examined actual behaviors – effects of manipulating intergroup threat on signing anti-science petitions (mediated by anger).

Study 2A

A preliminary correlational study examined associations between intergroup threat, science denial, anger and negative behavioral intentions towards researchers. Two domains of science denial were examined: politically conservative participants rated research findings on the topic of climate change, whereas video game players rated research findings on the topic of violent video game effects on aggression.

Method

Participants

A total of 204 participants were recruited through nine online blogs and forums. A total of 81 politically conservative participants volunteered to rate research examining climate change, whereas a total of 123 video game players volunteered to rate research examining violent video game effects. Three participants did not follow survey instructions in an attention check question and sixteen participants had missing data on over 90% of the variables so their responses were excluded from further analyses, leaving a sample of 185 participants (33.9% female, mean age 22 years, ranging from 18 to 75 years). The sampling and flow of subjects in Study 2A is shown in Figure 3.1.

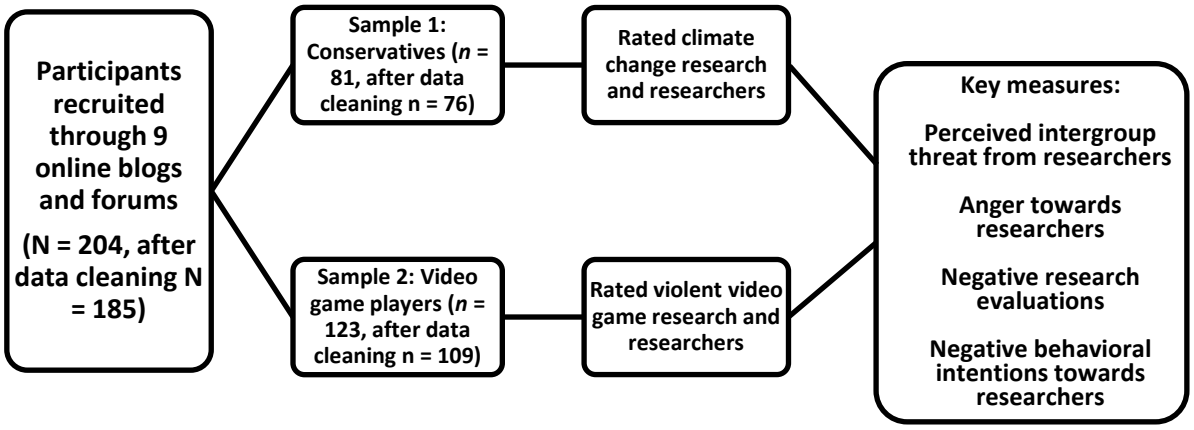


Figure 3.1. Graphic illustration of Study 2A.

Measures

Research summary. Participants who volunteered to rate climate change research read a paragraph describing the results of a published scientific study supporting the reality of anthropogenic climate change (Huber & Knutti, 2012):

"Dr. Markus Huber and Dr. Reto Knutti conducted a study examining causes of climate change (natural versus anthropogenic - caused by human activity). They examined various contributions to the observed global warming between 1850 and 1950. This study employed a novel approach based on the principle of conservation of energy, without assumptions about spatial warming patterns.

Based on a massive collection of simulations, authors found that greenhouse gasses contributed 0.85C of warming since the mid-twentieth century. Authors noted that natural variability cannot account for the observed global warming. Authors suggest that, in fact, greenhouse gases have very likely caused more warming than has been observed, due to the offsetting cooling effect from human aerosol emissions.

Researchers concluded that these findings confirm that humans are the dominant cause of the observed warming over the past 150 years, and particularly over the past 50 years."

Participants who volunteered to rate video game research read a paragraph describing the results of a published scientific study demonstrating violent video game effects on aggression (summary adapted directly from Nauroth et al., 2014, p. 109):

"In an experiment conducted by Craig Anderson and colleagues participants were randomly assigned to one of two conditions. In one condition participants played a violent video game. Participants in the other condition played a non-violent video game. After playing the video game all participants were asked to participate in a reaction time task in which they competed (ostensibly) against an opponent seated in another room. Whenever participants won a round, they had the opportunity to punish the opponent. The punishment consisted of a very unpleasant noise; participants were asked to calibrate the sound's duration and its volume; these settings served as measures of participants' aggressive tendencies. Comparing the average duration and volume settings between the two conditions showed that those who had played the violent video game reacted more aggressively than those who played the non-violent video game. The authors of the study concluded that consuming violent video games leads to an increase in aggression. The authors stated that violent video games provide a forum for learning and practicing aggressive reactions."

Intergroup threat. Participants rated to what extent they perceive researchers as threatening on a scale from 1 ("Not at all") to 7 ("Extremely").

Research summary evaluations. Participants rated the research using a 9-item scale based on items from Nauroth et al. (2014). Example items are "This kind of research is not very

meaningful" and "These researchers just find what they want to find." Items were rated on a Likert scale from 1 ("Not at all true") to 6 ("Very much true").

Anger towards researchers. Four items measuring anger were adapted from Mackie, Devos & Smith (2000). Participants rated the extent to which they feel angry, hostile, furious and irritated towards video game researchers. Items were rated on a scale from 1 ("Not at all") to 7 ("Extremely").

Negative behavioral intentions towards researchers. A 5-item scale was used to measure negative behavioral intentions towards researchers. Example items are "I would be willing to sign a petition to cut federal funding for this kind of research" and "I would be willing to endorse a negative review of this research study online." Items were rated on a scale from 1 ("Not at all") to 7 ("Extremely").

Beliefs about "controversial" scientific topics. Participants completed a 12-item scale measuring their overall attitudes towards six "controversial" scientific issues (violent video game effects, evolution, climate change, capital punishment, origins of sexual orientation and vaccination safety). The two items measuring beliefs about violent video game effects were "Violent video games increase aggressive behavior" and "Violent video games increase aggressive thoughts and feelings." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree").

Social identification. Parallel versions of the 5-item social identification questionnaire were used to measure social identification among video game players and among conservatives (adapted from Doosje, Ellemers, & Spears, 1995; Nauroth et al., 2014). An example item is "When I talk about video game players / conservatives, I usually say 'we' rather than 'they'." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree").

Educational history. Participants reported the highest level of education they attained as well as the number of research methods courses and statistics courses they had taken.

Demographics. Also assessed were sex, age, political orientation, religious affiliation.

Debriefing. Participants rated whether they were confused by any of the questions in the survey and described what they thought about the study. Finally, participants were thanked and debriefed.

Results

Preliminary Analyses

To compute scale scores, mean scores were computed on the items measuring research summary evaluations (9 items, $\alpha_{CONSERVATIVES} = 0.89$, $\alpha_{GAMERS} = 0.83$), anger (4 items, $\alpha_{CONSERVATIVES} = 0.96$, $\alpha_{GAMERS} = 0.91$), negative behavioral intentions towards researchers ($\alpha_{CONSERVATIVES} = 0.98$, $\alpha_{GAMERS} = 0.89$) and trait social identification (5 items, $\alpha_{CONSERVATIVES} = 0.89$, $\alpha_{GAMERS} = 0.92$).

Main Analyses

Bivariate correlations between main measures are shown in Table 2.1. As expected, intergroup threat was positively associated with negative evaluations of climate change research among conservatives ($r = 0.54$, $p < 0.01$) and with negative evaluations of violent video game research among video game players ($r = 0.30$, $p < 0.01$). In both samples, intergroup threat was also associated with negative behavioral intentions towards researchers ($r_{CONSERVATIVES} = 0.79$, $p < 0.01$; $r_{GAMERS} = 0.50$, $p < 0.01$) and with anger ($r_{CONSERVATIVES} = 0.95$, $p < 0.01$; $r_{GAMERS} = 0.80$, $p < 0.01$).

Next, path analyses were conducted with Mplus 6.1 (Muthén & Muthén, 2010) to examine intergroup threat as a predictor of negative research evaluations, anger and negative

behavioral intentions towards scientists. Results are shown in Figure 3.2. Across both samples, intergroup threat predicted significantly more negative research evaluations, anger and negative behavioral intentions towards scientists and these effects remained significant after statistically controlling social identification, sex and education. These results suggest that intergroup threat may contribute to the emergence of science denial, anger and negative behaviors towards researchers.

Table 3.1. Bivariate correlations between main measures in Study 2A.

A. Sample 1: Politically conservative participants who doubt the existence of climate change (n = 76)

		M	*SD*	1	2	3	4	5	6	7
1.	Perceived intergroup threat from climate change researchers	2.66	2.01	-						
2.	Negative research summary evaluation of a study showing anthropogenic climate change	3.25	1.23	.54**	-					
3.	Anger	2.77	2.04	.95**	.65**	-				
4.	Negative behavioral intentions towards researchers	2.81	2.04	.79**	.56**	.85**	-			
5.	Social identification with political conservatives	4.94	1.23	.37**	.35**	.40**	.37**	-		
6.	Sex	1.62	0.49	-.19	-.20	-.18	-.07	-.15	-	
7.	Age	4.51	1.10	-.30**	-.02	-.23	-.24*	-.09	-.15	-
8.	Education	7.71	1.06	.08	-.13	.04	.12	.07	.20	-.21

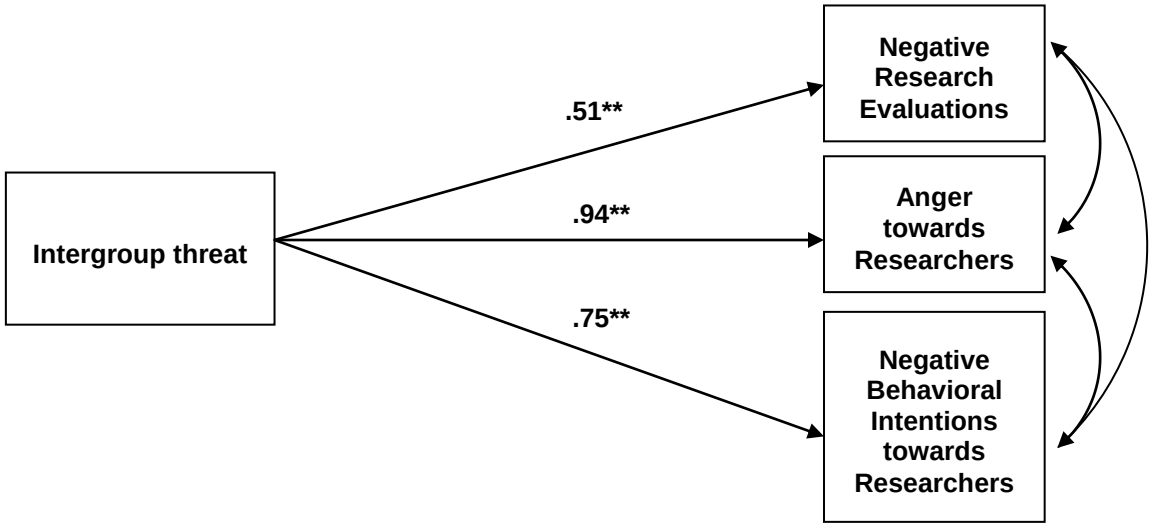
* $p < .05$, ** $p < .01$.

B. Sample 2: Video game players who doubt the existence of violent video game effects (n = 109)

		M	*SD*	1	2	3	4	5	6	7
1.	Perceived intergroup threat from video game researchers	1.78	1.17	-						
2.	Negative research summary evaluation of a study showing violent video game effects	2.94	0.90	.30**	-					
3.	Anger	2.08	1.29	.80**	.40**	-				
4.	Negative behavioral intentions towards researchers	2.33	1.32	.50**	.38**	.62**	-			
5.	Social identification with video game players	3.19	2.01	.23*	.20*	.30**	.16	-		
6.	Sex	1.68	0.49	.06	.13	.18	.15	.44**	-	
7.	Age	3.08	0.61	-.08	-.04	.05	-.09	-.13	-.11	-
8.	Education	6.45	0.95	-.07	-.14	-.04	-.16	-.02	.10	.09

* $p < .05$, ** $p < .01$.

A. Sample of 76 conservatives rating climate change research and researchers.



B. Sample of 109 video game players rating violent video game research and researchers.

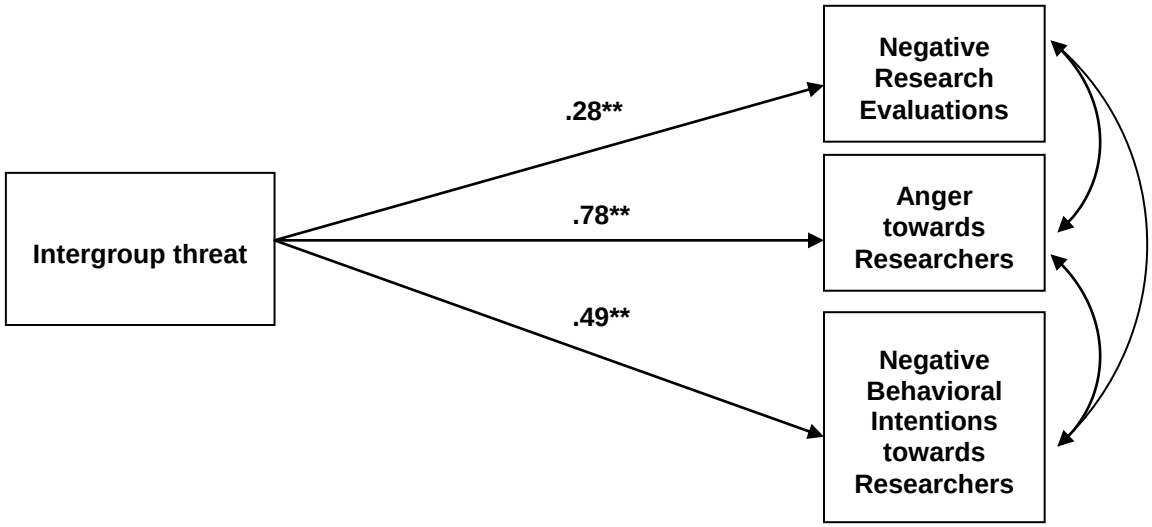


Figure 3.2. Multigroup path model examining intergroup threat as a predictor of science denial and negative behavioral intentions towards scientists. Social identification, sex and education are included as covariates. Standardized coefficients are shown; * $p < .02$, ** $p < .01$.

Discussion

Study 2A offers preliminary evidence that intergroup threat plays a role in the emergence of science denial, anger and aggression towards scientists. Participants' perceptions of intergroup threat from scientists predicted negative research evaluations, anger and aggression towards researchers. Among conservatives, appraisals of intergroup threat from scientists predicted significantly more negative evaluations of climate change research, more anger and more negative behavioral intentions towards researchers who study climate change. Among video game players, appraisals of intergroup threat from scientists predicted significantly more negative evaluations of violent video game effects research, more anger and more negative behavioral intentions towards researchers who study violent video game effects.

These results support the predictions of intergroup threat theory (Stephan & Stephan, 2000; Riek, Mania & Gaertner, 2006) and suggest that intergroup threat significantly contributes to science denial, anger and aggression towards scientists.

Of course, these correlational data do not offer strong evidence of causality. Therefore, Study 2B and Study 2C employed an experimental design to test causal effects of intergroup threat on science denial, anger and aggression towards scientists.

Study 2B

In Study 2B, an experimental design was used to test causal effects of intergroup threat on negative research evaluations. Social identification and beliefs about research findings were examined as potential moderators.

Method

Participants

A total of 151 video game players were recruited through four online blogs and forums. Seven participants did not follow survey instructions in an attention check question and twenty-one participants had missing data on over 90% of the variables so their responses were excluded from further analyses, leaving a sample of 123 participants (21% female, mean age 20 years, ranging from 18 to 67 years). The sampling and flow of subjects in Study 2B is shown in Figure 3.3.

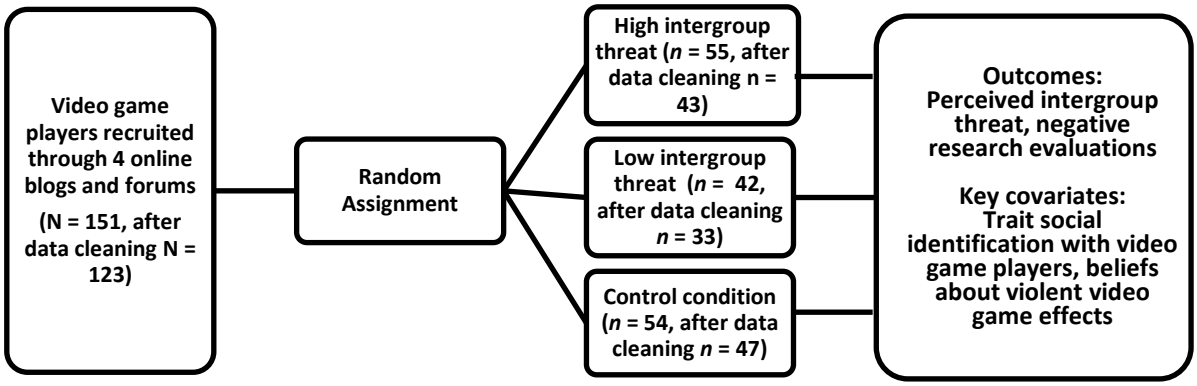


Figure 3.3. Graphic illustration of Study 2B.

Pre-experimental Measures

Beliefs about "controversial" scientific topics. Participants completed a 12-item scale measuring their overall attitudes towards six "controversial" scientific issues (violent video game effects, evolution, climate change, capital punishment, origins of sexual orientation and vaccination safety). The two items measuring beliefs about violent video game effects were "Violent video games increase aggressive behavior" and "Violent video games increase aggressive thoughts and feelings." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree").

Social identification. Trait social identification with video game players was measured using a brief 5-item measure (adapted from Doosje, Ellemers, & Spears, 1995; Nauroth et al., 2014). An example item is "When I talk about video game players, I usually say 'we' rather than 'they'." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree").

Demographics. Also assessed were sex, age, political orientation, religious affiliation.

Experimental Conditions

Participants in the high intergroup threat condition (n = 43) read a brief news article citing Dr. Brad Bushman who described his research demonstrating violent video game effects on aggression and commented on a potential link between violent video game play and school shootings.

Participants in the low intergroup threat condition (n = 33) read a brief news article citing Dr. Daphne Bavelier and Dr. Shawn Green who described their research demonstrating that playing action video games improves visual acuity.

Participants in the control condition (n = 47) did not read the high-threat article or the low-threat article.

Post-experimental Measures

Intergroup threat appraisals. Immediately after the experimental manipulation, participants completed a 7-item measure of intergroup threat (adapted from Brambilla et al., 2013; Cottrell & Neuberg, 2005; Matthews, 2011; Riek, 2007; Riek, Mania, Gaertner, McDonald & Lamoreaux, 2010). Example items are. "Researchers who study video game effects threaten our personal freedom" and "Researchers who study video game effects cause video game players to be stigmatized." The items were rated on a scale from 1 ("Not at all") to 7 ("Extremely").

Research summary and evaluations. Participants read a paragraph describing the results of a published scientific study demonstrating violent video game effects on aggression (summary adapted directly from Nauroth et al., 2014, p. 109):

"In an experiment conducted by Craig Anderson and colleagues participants were randomly assigned to one of two conditions. In one condition participants played a violent video game. Participants in the other condition played a non-violent video game. After playing the video game all participants were asked to participate in a reaction time task in which they competed (ostensibly) against an opponent seated in another room. Whenever participants won a round, they had the opportunity to punish the opponent. The punishment consisted of a very unpleasant noise; participants were asked to calibrate the sound's duration and its volume; these settings served as measures of participants' aggressive tendencies. Comparing the average duration and volume settings between the two conditions showed that those who had played the violent video game reacted more aggressively than those who played the non-violent video game. The authors of the study concluded that consuming violent video games leads to an increase in aggression. The authors stated that violent video games provide a forum for learning and practicing aggressive reactions."

Participants rated the research using a 9-item scale based on items from Nauroth et al. (2014). Example items are "This kind of research is not very meaningful" and "These researchers just find what they want to find." Items were rated on a Likert scale from 1 ("Not at all true") to 6 ("Very much true").

Educational history. Participants reported the highest level of education they attained as well as the number of research methods courses and statistics courses they had taken.

Debriefing. Participants rated whether they were confused by any of the questions in the survey and described what they thought about the study. Finally, participants were thanked and debriefed.

Results

Preliminary Analyses

To compute scale scores, mean scores were computed on the items measuring initial beliefs about violent video game effects (2 items, $\alpha = 0.85$), trait social identification with video game players (5 items, $\alpha = 0.88$), intergroup threat appraisals (7 items, $\alpha = 0.91$) and research summary evaluations (9 items, $\alpha = 0.89$).

As expected, trait social identification with video game players was positively associated with negative research evaluations ($r = 0.22$, $p < 0.01$) and higher perceived intergroup threat ($r = 0.19$, $p < 0.01$). Intergroup threat appraisals were strongly positively associated with negative research evaluations ($r = 0.55$, $p < 0.01$).

Experimental groups did not differ in terms of age ($F(2, 120) = 0.13$, $p > .05$), sex ($\chi^2(2, N = 123) = 6.40$, $p > 0.05$), education ($F(2, 120) = 0.10$, $p > .05$), initial beliefs about video game effects ($F(2, 120) = 0.24$, $p > .05$) or social identification ($F(2, 120) = 0.44$, $p > .05$).

Main Analyses

Effectiveness of the manipulation. An ANOVA demonstrated that, as intended, the experimental manipulation significantly influenced participants' appraisals of intergroup threat ($F(2, 120) = 5.73$, $p < .01$, partial $\eta^2 = .09$). Pairwise comparisons revealed that scientists were appraised as more threatening in the high intergroup threat condition (adj $M = 3.46$, 95% CI [3.08, 3.83]) than in the low intergroup threat condition (adj $M = 2.60$, 95% CI [2.17, 3.03]) and the control condition (adj $M = 2.71$, 95% CI [2.36, 3.07]). Thus, the manipulation of intergroup threat was successful.

Effects on science denial. To examine effects of the experimental manipulation on science denial, an ANCOVA was run with research summary evaluations as the outcome and with initial beliefs about video game effects, trait social identification, sex and education as covariates (shown in Table 3.2).

Table 3.2. Analysis of covariance of negative research summary evaluations, with initial beliefs about violent video game effects, social identification with video game players, sex and education as covariates.

Source	*df*	*MS*	*F*	*p*	Partial η^2
Intergroup threat manipulation	2	3.08	3.65	.03	.06
Initial beliefs	1	42.47	50.24	.00	.30
Social identification	1	2.41	2.85	.09	.02
Sex	1	.00	.00	.96	.00
Education	1	.26	.30	.58	.00

A significant effect was found of the experimental manipulation of intergroup threat on research summary evaluations ($F(2, 116) = 3.67$, $p < .05$, partial $\eta^2 = .06$). Pairwise comparisons demonstrated that participants in the high threat condition were more willing to derogate the research presented in the summary (adj $M = 3.89$, 95% CI [3.62, 4.18]) than participants in the low-threat condition (adj $M = 3.42$, 95% CI [3.10, 3.74]) and participants in the control condition (adj $M = 3.43$, 95% CI [3.17, 3.70]). The latter two were not significantly different (LSD $p = 0.94$). A planned contrast confirmed that participants in the high threat condition gave significantly more negative research evaluations compared to participants in the other two conditions ($F(1, 116) = 7.24$, $p < .01$).

Initial beliefs about violent video game effects significantly predicted research evaluations ($F(1, 116) = 50.24$, $p < .01$, partial $\eta^2 = .30$, $B = 0.43$, $SE = .06$). Participants who initially believed that video games do not influence aggression were more willing to derogate the research summary than participants who believed that violent video games increase aggression. In addition, there was a marginally significant effect of social identification ($F(1, 116) = 2.85$, $p = .09$, partial $\eta^2 = .02$, $B = 0.10$, $SE = .06$). Sex and education did not significantly predict research evaluations (ps > 0.05).

Next, interactions of the experimental manipulation with initial beliefs about video game effects and trait social identification were added to the model. No significant interactive effects were found (all ps > 0.05).

Discussion

The main goal of Study 2B was to experimentally replicate effects of intergroup threat on science denial found in Study 2A. I expected that a high intergroup threat manipulation would increase science denial relative to a low intergroup threat manipulation and a no-manipulation

control condition. As expected, experimentally heightening perceived intergroup threat from researchers made video game players more willing to derogate a research study showing violent video game effects on aggression. This study is the first to demonstrate causal effects of intergroup threat on science denial.

Study 2C

Method

In Study 2C, an experimental design was used to test causal effects of intergroup threat on actual behavior (signing anti-science petitions). Anger was examined as a key mediator and social identification and beliefs about research findings were examined as potential moderators.

Participants

A total of 188 video game players were recruited through six online blogs and forums. Two participants did not follow survey instructions in an attention check question and six participants had missing data on over 90% of the variables so their responses were excluded from further analyses, leaving a sample of 180 participants (20% female, mean age 21 years, ranging from 18 to 54 years). The sampling and flow of subjects in Study 2C is shown in Figure 3.4.

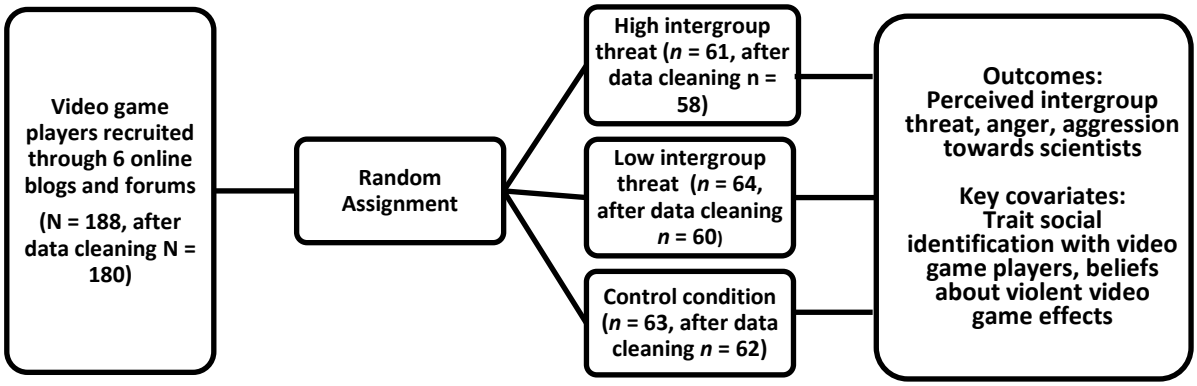


Figure 3.4. Graphic illustration of Study 2C.

Pre-experimental Measures

Beliefs about "controversial" scientific topics. Participants completed a 12-item scale measuring their overall attitudes towards six "controversial" scientific issues (violent video game effects, evolution, climate change, capital punishment, origins of sexual orientation and vaccination safety). The two items measuring beliefs about violent video game effects were "Violent video games increase aggressive behavior" and "Violent video games increase aggressive thoughts and feelings." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree").

Social identification. Trait social identification with video game players was measured using a brief 5-item measure (adapted from Doosje, Ellemers, & Spears, 1995; Nauroth et al., 2014). An example item is "When I talk about video game players, I usually say 'we' rather than 'they'." Items were rated on a Likert scale from 1 ("Strongly disagree") to 7 ("Strongly agree").

Demographics. Also assessed were sex, age, political orientation, religious affiliation.

Experimental Conditions

Participants in the high intergroup threat condition (n = 58) read a brief news article citing Dr. Brad Bushman who described his research demonstrating violent video game effects on aggression and commented on a potential link between violent video game play and school shootings.

Participants in the low intergroup threat condition (n = 60) read a brief news article citing Dr. Daphne Bavelier and Dr. Shawn Green who described their research demonstrating that playing action video games improves visual acuity.

Participants in the control condition (n = 62) did not read the high-threat article or the low-threat article.

Post-experimental Measures

Intergroup threat appraisals. Immediately after the experimental manipulation, participants completed an 8-item measure of intergroup threat (adapted from Brambilla et al., 2013; Cottrell & Neuberg, 2005; Matthews, 2011; Riek, 2007; Riek, Mania, Gaertner, McDonald & Lamoreaux, 2010). Example items are. "Researchers who study video game effects threaten our personal freedom", "Too much money is spent on research grants that benefit researchers who study video game effects" and "Researchers who study video game effects cause video game players to be stigmatized." The items were rated on a scale from 1 ("Not at all") to 7 ("Extremely").

Anger towards researchers. Four items measuring anger were adapted from Mackie, Devos & Smith (2000). Participants rated the extent to which they feel angry, hostile, furious and irritated towards video game researchers. Items were rated on a scale from 1 ("Not at all") to 7 ("Extremely").

Signing anti-science petitions. Participants were given an opportunity to sign two online petitions (one in support and one against giving more funding to research examining violent video game effects). For each petition they signed, participants also had an opportunity to enter their ZIP code and e-mail contacts of friends who might want to participate in the petition. Petition scores were computed so that participants got a point for each piece of information they gave (their signature, ZIP code and for each e-mail contact they gave for friends).

Educational history. Participants reported the highest level of education they attained as well as the number of research methods courses and statistics courses they had taken.

Debriefing. Participants rated whether they were confused by any of the questions in the survey and described what they thought about the study. Finally, participants were thanked and debriefed.

Results

Preliminary Analyses

To compute scale scores, mean scores were computed on the items measuring initial beliefs about violent video game effects (2 items, $\alpha = 0.91$), trait social identification with video game players (5 items, $\alpha = 0.90$), anger (4 items, $\alpha = 0.88$) and intergroup threat (8 items, $\alpha = 0.91$). Scores in the petitions for and against giving more funding to violent video game research were summed so that a higher score indicates supporting funding cuts and failing to support increased funding.

As expected, trait social identification with video game players was positively associated with beliefs that violent video games do not cause aggression ($r = 0.28$, $p < 0.01$), higher perceived intergroup threat ($r = 0.31$, $p < 0.01$) and anger ($r = 0.35$, $p < 0.01$). Intergroup threat appraisals were positively associated with anger ($r = 0.72$, $p < 0.01$) and willingness to sign anti-science petitions ($r = 0.37$, $p < 0.01$).

Experimental groups did not differ in terms of age ($F(2, 170) = 0.20$, $p > .05$), sex ($\chi^2(2, N = 197) = 5.74$, $p > 0.05$), education ($F(2, 169) = 2.82$, $p > .05$), initial beliefs about video game effects ($F(2, 177) = 1.10$, $p > .05$) or social identification ($F(2, 177) = 0.43$, $p > .05$).

Main Analyses

Effectiveness of the manipulation. An ANOVA demonstrated that, as intended, the experimental manipulation significantly influenced participants' appraisals of intergroup threat ($F(2, 177) = 14.25$, $p < .01$, partial $\eta^2 = .14$). Pairwise comparisons revealed that scientists were appraised as more threatening in the high intergroup threat condition (adj $M = 3.31$, 95% CI

[3.02, 3.59]) than in the low intergroup threat condition (adj M = 2.37, 95% CI [2.08, 2.65]) and the control condition (adj M = 2.34, 95% CI [2.06, 2.62]). Thus, the manipulation of intergroup threat was successful.

Anger towards researchers. To examine effects of the experimental manipulation of intergroup threat on anger towards researchers, an ANCOVA was run with initial beliefs about violent video game effects, trait social identification, sex and education as covariates (Table 3.3).

The intergroup threat manipulation did not have a significant main effect on anger (F(2, 159) = 1.04, p > .05, partial η^2 = .01). A planned contrast comparing anger among participants in the high threat condition with participants in the other two conditions did not show a significant difference (F(1, 159) = 1.88, p = 0.17). Social identification with video game players predicted higher anger towards researchers (F(1, 159) = 14.19, p < .01, partial η^2 = .08, B = 0.07, SE = .05). Education level predicted lower anger towards researchers (F(1, 159) = 10.71, p < .01, partial η^2 = .06, B = -0.18, SE = .05). Men reported more anger than women (F(1, 159) = 4.87, p < .03, partial η^2 = .03, B = 0.41, SE = .19). Initial beliefs did not significantly predict anger (p > 0.05).

Table 3.3. Analysis of covariance of anger towards researchers, with initial beliefs about violent video game effects, social identification with video game players, sex and education as covariates.

Source	*df*	*MS*	*F*	*p*	Partial η^2
Intergroup threat manipulation	2	1.23	1.04	.355	.01
Initial beliefs	1	0.58	0.49	.484	.00
Social identification	1	16.73	14.19	.000	.08
Sex	1	5.74	4.87	.029	.03
Education	1	12.62	10.71	.001	.06
Initial beliefs x Threat manipulation	2	0.11	0.10	.912	.00
Social identification x Threat manipulation	2	6.05	5.13	.007	.06

A significant interaction effect was found between the experimental manipulation and social identification ($F(2, 159) = 5.13$, $p < .01$, partial $\eta^2 = .06$). The effect of the intergroup threat manipulation was significant at +1 SD on social identification ($F(2, 159) = 17.26$, $p < .01$), but was non-significant at -1 SD on social identification ($F(2, 159) = 0.72$, $p = .49$).

Pairwise comparisons at +1 SD on social identification demonstrated that participants in the high intergroup threat condition expressed more anger towards video game researchers (adj $M = 4.18$, 95% CI [3.77, 4.59]) than participants in the low threat condition (adj $M = 2.61$, 95% CI [2.20, 3.02]) and participants in the control condition (adj $M = 2.72$, 95% CI [2.24, 3.19]). The latter two were not significantly different (LSD $p = 0.73$). These results are shown in Figure 3.5.

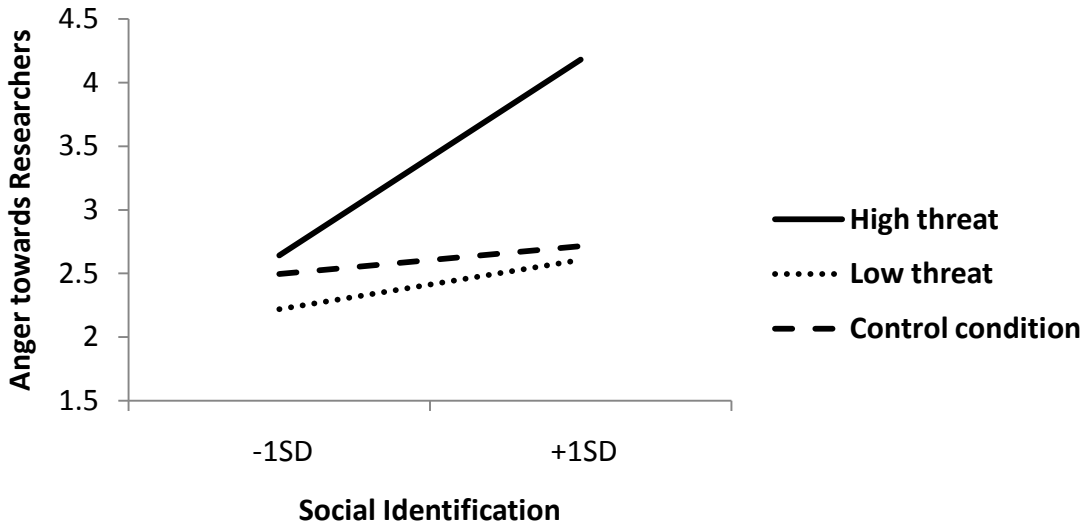


Figure 3.5. Anger towards video game researchers as a function of video game players' social identification and the experimental manipulation of intergroup threat.

Signing anti-science petitions. Next, I explored effects of the experimental manipulation on willingness to sign anti-science petitions. An ANCOVA was run with intergroup threat appraisals as the outcome and with initial beliefs about violent video game effects, trait social identification, sex and education as covariates (Table 3.4).

The intergroup threat manipulation did not have a significant main effect on petition signing ($F(2, 133) = 0.72$, $p > .05$, partial $\eta^2 = .01$). A planned comparing petition signing among participants in the high threat condition with participants in the other two conditions did not show a significant difference ($F(1, 133) = 1.21$, $p = 0.27$). Education level predicted lower willingness to sign anti-science petitions ($F(1, 133) = 8.61$, $p < .01$, partial $\eta^2 = .06$, $B = -0.07$, $SE = .03$). Social identification, initial beliefs and sex did not significantly predict petition signing ($ps > 0.05$).

Table 3.4. Analysis of covariance of support given to anti-science petitions, with initial beliefs about violent video game effects, social identification with video game players, sex and education as covariates.

Source	*df*	*MS*	*F*	*p*	Partial η^2
Intergroup threat manipulation	2	0.15	0.72	.489	.011
Initial beliefs	1	0.59	2.87	.092	.021
Social identification	1	0.01	0.04	.845	.000
Sex	1	0.02	0.08	.783	.001
Education	1	1.78	8.61	.004	.061
Initial beliefs x Threat manipulation	2	0.06	0.28	.759	.004
Social identification x Threat manipulation	2	1.11	5.38	.006	.075

A significant interaction effect was found between the experimental manipulation and social identification ($F(2, 133) = 5.38$, $p < .01$, partial $\eta^2 = .08$). The effect of the intergroup threat manipulation was significant at +1 SD on social identification ($F(2, 133) = 6.74$, $p < .01$), but was non-significant at -1 SD on social identification ($F(2, 133) = 0.49$, $p = .61$).

Pairwise comparisons at +1 SD on social identification demonstrated that participants who read the news article discussing violent video game effects on aggression gave significantly more support to anti-science petitions (adj $M = 0.21$, 95% CI [0.03, 0.40]) than participants who read the low-threat news article (adj $M = -0.12$, 95% CI [-0.30, -0.06]) and participants in the control condition (adj $M = -0.29$, 95% CI [-0.49, -0.08]). The latter two were not significantly different (LSD $p = 0.23$). These results are shown in Figure 3.6.

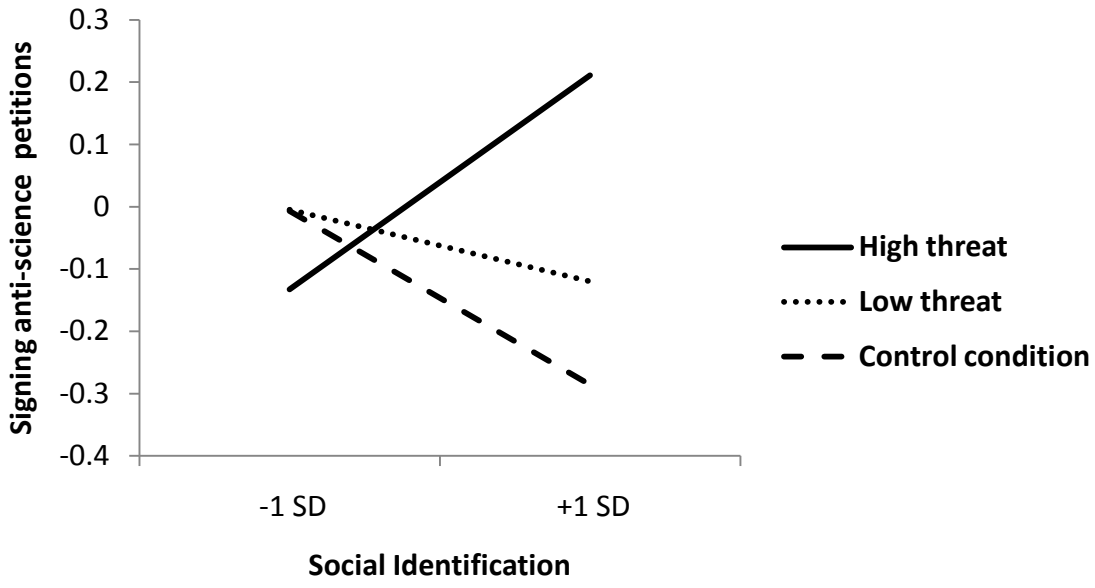


Figure 3.6. Support given to anti-science petitions versus pro-science petitions as a function of video game players' social identification and the experimental manipulation of intergroup threat (values above 0 indicate more support given to anti-science petitions, whereas values below 0 indicate more support given to pro-science petitions).

Mediation test – social identification as a continuous moderator. To test the mediating role of anger in the effects of the experimental manipulation of intergroup threat on signing anti-science petitions, path analyses were conducted with Mplus 6.1 (Muthén & Muthén, 2010). Experimental conditions were included in the model as categorical variables with the control condition as the reference category. Social identification was included as a continuous moderator. Anger was included as a mediator and total petition scores were included as the outcome. Initial beliefs about violent video game effects, sex and education were included as covariates. Results are shown in Figure 3.7. Significant interactive effects were found of the high intergroup threat manipulation and social identification on anger ($\beta = 0.73$, $p < 0.01$) and signing anti-science petitions ($\beta = 0.50$, $p < 0.02$). Furthermore, a significant indirect effect was found of the interaction between the high intergroup threat manipulation and social identification on signing anti-science petitions through anger (standardized effect = 0.23, $p < 0.01$).

Mediation test – social identification as a categorical moderator. As an alternative data-analytic approach to examining interactive effects of intergroup threat and social identification, a multigroup path model was run with intergroup threat as a predictor of anger towards researchers and signing anti-science petitions among participants high versus low in social identification as a gamer (scoring above or below 4 on the 7-point social identification scale). Experimental conditions were included in the model as categorical variables with the control condition as the reference category. Initial beliefs about violent video game effects, sex and education were included as covariates. Results are shown in Figure 3.8. Among participants high in social identification as a gamer, the high intergroup threat manipulation had a significant indirect effect on signing anti-science petitions through anger (standardized effect = 0.19, $p < 0.01$). However, no significant effects of the high intergroup threat manipulation on anger or petition signing were

found among participants low in social identification (ps > 0.05). These results are consistent with those of the previous model examining social identification as a continuous moderator and suggest that intergroup threat increases anger and aggression among participants high in social identification, but not among participants low in social identification.

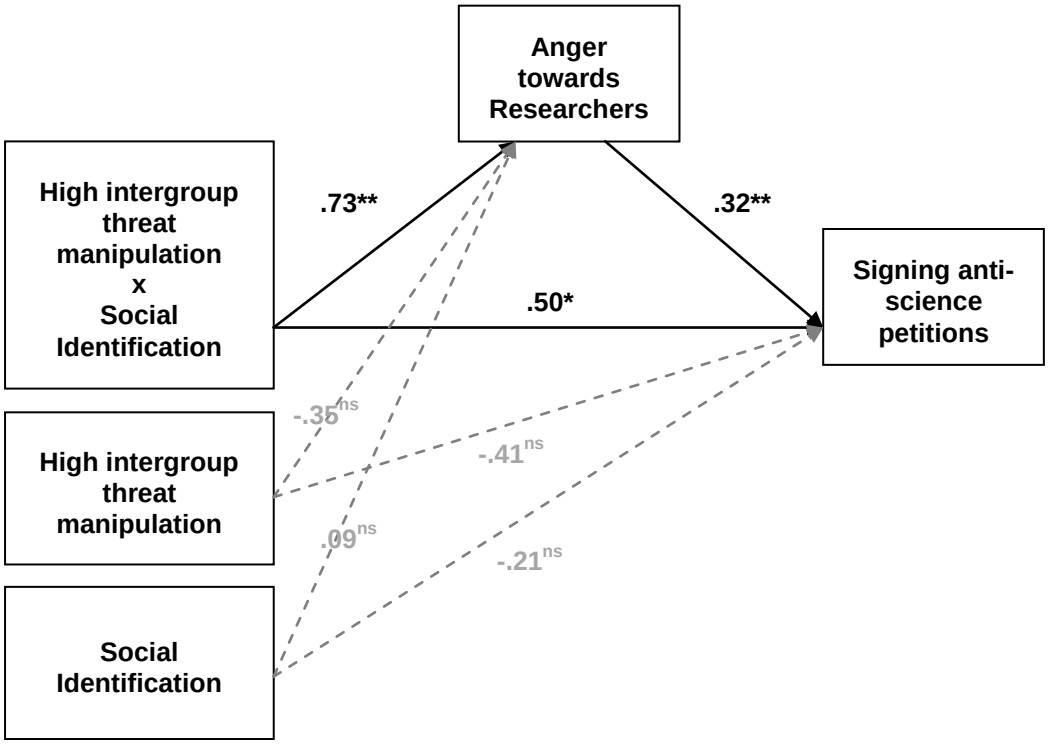
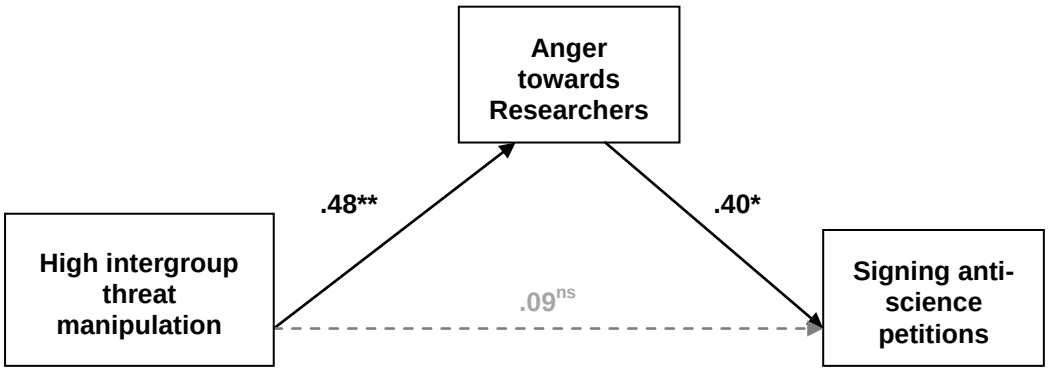


Figure 3.7. Path model examining effects of intergroup threat and ingroup identification signing anti-science petitions. Beliefs about violent video game effects, sex and education are included as covariates. Standardized coefficients are shown; * $p < .02$, ** $p < .01$.

A. Participants high in trait social identification as a gamer.



B. Participants low in trait social identification as a gamer.

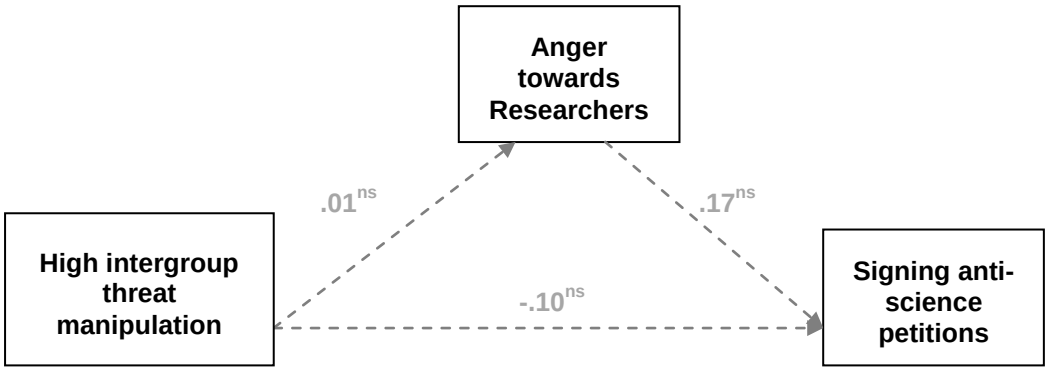


Figure 3.8. Multigroup path model examining intergroup threat as a predictor of anger towards researchers and signing anti-science petitions among participants high versus low in social identification as a gamer. Initial beliefs about violent video game effects, sex and education are included as covariates. Standardized coefficients are shown; ** $p < .01$, * $p < .05$, $^{+}$ $p < .10$.

Discussion

The main goal of Study 2C was to experimentally replicate effects of intergroup threat on anger and aggression towards scientists found in Study 2A. I expected that a high intergroup threat manipulation would increase anger and aggression towards scientists relative to a low intergroup threat manipulation and a no-manipulation control condition. Significant interactive effects were found of the high intergroup threat manipulation and social identification on anger towards scientists and on anti-science behavior. Experimentally heightening intergroup threat made highly identified video game players express more anger towards researchers who study violent video game effects and made them more willing to sign anti-science petitions, but had little or no effect on video game players who were low in social identification. Mediation analyses revealed that anger mediates the effect of high intergroup threat on signing anti-science petitions. This study is the first to demonstrate causal effects of intergroup threat on anger and aggression towards scientists.

CHAPTER 8: STUDY 3: INTERGROUP STRENGTH, INTERGROUP EMOTIONS AND SCIENCE DENIAL

Study 1 and Study 2 demonstrated that social identification with a threatened group and perceptions of intergroup threat contribute to science denial, anger and aggression towards scientists. These effects seem to emerge most strongly among group members high in social identification (Study 1B, Study 1C, Study 2C). Intergroup emotions theory offers a potential solution – a way to mitigate science denial, anger and aggression towards scientists even among highly identified group members. IET predicts that appraisals of intergroup strength play a key role in intergroup aggression (Mackie & Smith, 2014). Indeed, a body of research examining effects of intergroup strength shows that outgroups that are viewed as strong engender less anger and aggression (Mackie, Devos & Smith, 2000; Mackie & Smith, 2014; Otten, 2009). This applies not only to physical or economic strength, but also other types of strength (e.g. public support given to a group, Devos, Mackie & Smith, 2000). Therefore, if scientists are viewed as a strong group that has public support, this should reduce anger and aggression towards them (the **"strength as deterrence" hypothesis**). On the other hand, results from Study 2 suggest that, if increasing intergroup strength also leads to increased intergroup threat, it may intensify anger and aggression instead (the **"strength as threat" hypothesis**).

To test these competing hypotheses, I experimentally manipulated perceived strength of scientists versus denialists and observed effects on science denial, anger and aggression towards scientists. Social identification and beliefs about scientific findings were examined as potential moderators. Given the key role of intergroup threat in science denial, appraisals of intergroup threat from scientists were measured as a key covariate.

Method

Participants

A total of 304 participants were recruited through Amazon Mturk for $1.00. Four participants did not follow survey instructions in an attention check question and two participants had missing data on over 90% of the variables so their responses were excluded from further analyses, leaving a sample of 298 participants (103 in the Strong Scientists condition, 97 in the Strong Denialists condition and 98 in the control condition). Participants were 46% female, 18 to 74 years old. The sampling and flow of subjects in Study 3 is shown in Figure 4.1.

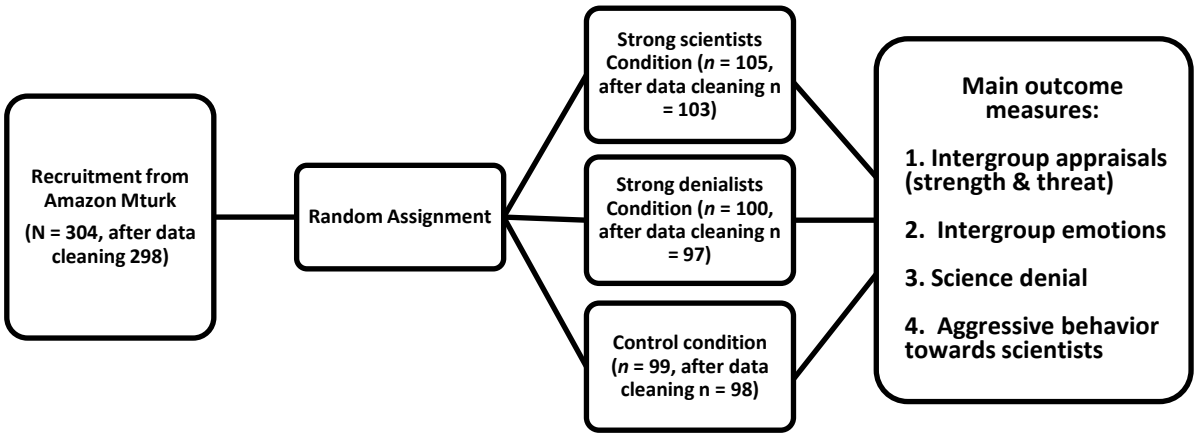


Figure 4.1. Graphic illustration of Study 3.

Pre-experimental Measures

Beliefs about "controversial" scientific topics. Participants completed a 12-item scale measuring their overall attitudes towards six "controversial" scientific issues (violent video game effects, evolution, climate change, capital punishment, origins of sexual orientation and vaccination safety). The two items measuring beliefs about vaccination safety were "Vaccinations are dangerous and should be avoided" and "Vaccinations are safe and useful"

(reverse-coded). Items were rated on a Likert scale from 1 (“Strongly disagree”) to 7 (“Strongly agree”).

Social identification. Trait social identification with video game players was measured using a brief 5-item measure (adapted from Doosje, Ellemers, & Spears, 1995; Nauroth et al., 2014). An example item is “When I talk about video game players, I usually say ‘we’ rather than ‘they’.” Items were rated on a Likert scale from 1 (“Strongly disagree”) to 7 (“Strongly agree”).

Demographics. Also assessed were sex, age, political orientation, religious affiliation.

Experimental Conditions

The procedures for developing the relative intergroup strength manipulation were adapted from Mackie, Devos and Smith (2000). The goal of the manipulation is to give participants an impression that denialists are widely publically supported and are, therefore, in a strong position relative to scientists or that the groups’ positions are reversed. In the two experimental conditions, participants read a list of 19 headlines taken from actual online news stories (e.g. “Science is Clear: Violent Video Games Cause Aggression”, “"Do Games Like 'Grand Theft Auto V' Cause Real-World Violence? No”). In the strong outgroup condition (Strong Scientists), 16 headlines supported scientists and only 3 supported denialists. In the strong ingroup condition (Strong Denialists), 16 headlines supported denialists and only 3 supported scientists. To reinforce the manipulation, participants also rated the extent to which each headline supports each position on a Likert scale from 1 to 7 (1 “Supports the position that violent video games DO NOT cause aggression”, 7 “Supports the position that violent video games DO cause aggression”).

Post-experimental Measures

Intergroup strength appraisals. Participants rated to what extent they perceive that members of the general public side with violent video game researchers versus denialists (rated on a scale from 1 "Public opinion is in favor of the conclusion that violent video games do NOT cause aggression" to 7 "Public opinion is in favor of the conclusion that violent video games DO cause aggression").

Intergroup threat appraisals. Participants rated to what extent they perceive researchers as threatening on a scale from 1 ("Not at all") to 7 ("Extremely").

Research summary. Participants read a paragraph describing the results of a published scientific study demonstrating violent video game effects on aggression (summary adapted directly from Nauroth et al., 2014, p. 109):

"In an experiment conducted by Craig Anderson and colleagues participants were randomly assigned to one of two conditions. In one condition participants played a violent video game. Participants in the other condition played a non-violent video game. After playing the video game all participants were asked to participate in a reaction time task in which they competed (ostensibly) against an opponent seated in another room. Whenever participants won a round, they had the opportunity to punish the opponent. The punishment consisted of a very unpleasant noise; participants were asked to calibrate the sound's duration and its volume; these settings served as measures of participants' aggressive tendencies. Comparing the average duration and volume settings between the two conditions showed that those who had played the violent video game reacted more aggressively than those who played the non-violent video game. The authors of the study concluded that consuming violent video games leads to an

increase in aggression. The authors stated that violent video games provide a forum for learning and practicing aggressive reactions."

Research summary evaluations. Participants rated the research using a 6-item scale based on items from Nauroth et al. (2014). Participants rated the overall quality of the research (3 items, for example "This research yielded reliable results") as well as bias exhibited by researchers (3 items, for example "These researchers just find what they want to find"). Items were rated on a Likert scale from 1 ("Not at all true") to 6 ("Very much true").

Emotions towards scientists. A 14-item scale adapted from Mackie, Devos & Smith (2000) was used to measure intergroup emotions towards researchers who conducted the study. An example item is "To what extent do you admire the researchers who conducted the study?". A four-item subscale was used to measure anger (participants rated to what extent they feel hostile, irritated, angry and furious towards researchers). Items were rated on a scale from 1 ("Not at all") to 7 ("Extremely").

Signing anti-science petitions. Participants were given an opportunity to sign two online petitions (one in support and one against giving more funding to research examining violent video game effects). For each petition they signed, participants also had an opportunity to enter their ZIP code and e-mail contacts of friends who might want to participate in the petition. Petition scores were computed so that participants got a point for each piece of information they gave (their signature, ZIP code and for each e-mail contact they gave for friends).

Educational history. Participants reported the highest level of education they attained as well as the number of research methods courses and statistics courses they had taken.

Debriefing. Participants rated whether they were confused by any of the questions in the survey and described what they thought about the study. Finally, participants were thanked and debriefed.

Results

Preliminary Analyses

To compute scale scores, mean scores were computed on the items measuring initial beliefs about violent video game effects (2 items, $\alpha = 0.96$), trait social identification with video game players (5 items, $\alpha = 0.96$), evaluations of research quality (3 items, $\alpha = 0.93$), evaluations of researcher bias (3 items, $\alpha = 0.85$) and anger towards researchers (4 items, $\alpha = 0.94$). Scores in the petitions for and against giving more funding to violent video game research were summed so that a higher score indicates supporting funding cuts and failing to support increased funding.

Experimental groups did not differ in terms of age ($F(2, 295) = 1.79$, $p > .05$), sex ($\chi^2(2, N = 297) = 2.77$, $p > 0.05$), education ($F(2, 295) = 0.07$, $p > .05$), initial beliefs about video game effects ($F(2, 295) = 1.63$, $p > .05$) or social identification as a gamer ($F(2, 294) = 0.03$, $p > .05$).

Main Analyses

Effectiveness of the manipulation. An ANOVA demonstrated that, as intended, the experimental manipulation significantly influenced participants' appraisals of public support for scientists versus denialists ($F(2, 290) = 42.35$, $p < .01$, partial $\eta^2 = .23$). Participants gave the highest estimates of public support for scientists in the Strong Scientists condition (adj $M = 5.19$, 95% CI [4.82, 5.56]), followed by participants in the control condition (adj $M = 4.18$, 95% CI [3.81, 4.56]) and participants in Strong Denialists condition (adj $M = 2.73$, 95% CI [2.35, 3.11]).

Planned contrasts revealed significant differences between all three groups (all ps < 0.01). Thus, the manipulation of relative intergroup strength was successful.

It is important to note that appraisals of intergroup threat also differed across experimental conditions (F (2, 292) = 3.29, $p < .05$, partial $\eta^2 = .02$). Participants in the Strong Scientists condition appraised scientists as significantly more threatening (adj M = 2.72, 95% CI [2.36, 3.07]) compared to participants in the Strong Denialists condition (adj M = 2.08, 95% CI [1.71, 2.45] ; LSD $p < 0.02$) and marginally more threatening compared to participants in the control condition (adj M = 2.23, 95% CI [1.86, 2.59]; LSD $p = 0.060$). No difference in threat appraisals was found between the Strong Denialists condition and the control condition (LSD $p = 0.59$).

Effects on science denial. To examine effects of the experimental manipulation on science denial, an ANCOVA was run with research summary evaluations as the outcome and with ingroup identification, initial beliefs about video game effects, sex and education as covariates (Table 4.1). Research evaluations differed significantly across experimental conditions (F(2, 289) = 5.86, $p < .01$, partial $\eta^2 = .04$). Post-hoc comparisons demonstrated that participants rated the research study described in the summary significantly less negatively in the Strong Scientists condition (adj M = 3.11, 95% CI [2.89, 3.32]) compared to the Strong Denialists condition (adj M = 3.63, 95% CI [3.41, 3.84]; LSD $p < 0.01$) and the control condition (adj M = 3.42, 95% CI [3.21, 3.64]; LSD $p < 0.05$). The latter two were not significantly different (LSD $p = 0.19$).

Initial beliefs about violent video game effects significantly predicted negative research evaluations (F(1, 289) = 190.47, $p < .01$, partial $\eta^2 = .36$, $B = 1.63$, $SE = .13$). Participants who initially believed that video games do not influence aggression were more willing to derogate the research summary than participants who believed that violent video games increase aggression. Social identification with video game players predicted more negative research evaluations (F(1,

289) = 6.82, $p < .01$, partial $\eta^2 = .02$, $B = 0.09$, $SE = .03$). Men gave more negative research evaluations than women ($F(1, 289) = 19.10$, $p < .01$, partial $\eta^2 = .06$, $B = 0.57$, $SE = .13$). Education level did not significantly predict research evaluations ($p > 0.05$).

Next, interactions of the experimental manipulation with initial beliefs about video game effects and trait social identification as a gamer were added to the model. No significant interactive effects were found (all ps > 0.05).

Table 4.1. Analysis of covariance of negative research summary evaluations, with initial beliefs about violent video game effects, social identification with video game players, sex and education as covariates.

Source	*df*	*MS*	*F*	*p*	Partial η^2
Intergroup strength manipulation	2	6.81	5.86	.003	.04
Initial beliefs	1	190.47	164.02	.000	.36
Social identification	1	7.92	6.82	.009	.02
Sex	1	22.18	19.10	.000	.06
Education	1	1.87	1.61	.206	.01

An ANCOVA was also run with perceptions of researcher bias as the outcome and with ingroup identification, initial beliefs about video game effects, sex and education as covariates. Perceptions of researcher bias did not differ significantly across experimental conditions ($M_{STRONG\ SCIENTISTS} = 3.39$, 95% CI [3.16, 3.63], $M_{STRONG\ DENIALISTS} = 3.41$, 95% CI [3.17, 3.65], $M_{CONTROL} = 3.24$, 95% CI [3.00, 3.49], $F(2, 289) = 0.56$, $p = 0.57$, partial $\eta^2 = .00$).

Effects on anger towards researchers. To investigate effects of the experimental manipulation on anger towards researchers, an ANCOVA was run with with ingroup identification, initial beliefs about video game effects, sex and education as covariates (Table 4.2). Anger towards researchers differed significantly across experimental conditions ($F(2, 289)$

= 3.10, $p < .05$, partial $\eta^2 = .02$). Post-hoc comparisons showed that participants felt greater anger towards researchers in the Strong Scientists condition (adj $M = 2.89$, 95% CI [2.60, 3.19]) compared to the Strong Denialists condition (adj $M = 2.44$, 95% CI [2.14, 2.74]; LSD $p < 0.05$) and the control condition (adj $M = 2.42$, 95% CI [2.12, 2.72]; LSD $p < 0.05$). The latter two were not significantly different (LSD $p = 0.93$). Social identification with video game players predicted higher anger towards researchers ($F(1, 289) = 89.01$, $p < .01$, partial $\eta^2 = .24$, $B = 0.44$, $SE = .05$). Initial beliefs, sex and education did not significantly predict anger (ps > 0.05).

Table 4.2. Analysis of covariance of anger towards researchers, with initial beliefs about violent video game effects, social identification with video game players, sex and education as covariates.

Source	*df*	*MS*	*F*	*p*	Partial η^2
Intergroup strength manipulation	2	7.04	3.10	.047	.02
Initial beliefs	1	6.07	2.67	.104	.01
Social identification	1	202.52	89.01	.000	.24
Sex	1	1.03	.45	.502	.00
Education	1	4.40	1.93	.166	.01

Next, interactions of the experimental manipulation with initial beliefs about video game effects and trait social identification as a gamer were added to the model. No significant interactive effects were found (all ps > 0.05).

Effects on signing anti-science petitions. To investigate effects of the experimental manipulation on intergroup behavior, an ANCOVA was run with anti-science petition signing as the outcome and with ingroup identification, initial beliefs about video game effects, sex and education as covariates (Table 4.3).

Table 4.3. Analysis of covariance of signing anti-science petitions, with initial beliefs about violent video game effects, social identification with video game players, sex and education as covariates.

Source	*df*	*MS*	*F*	*p*	Partial η^2
Intergroup strength manipulation	2	3.19	3.13	.045	.02
Initial beliefs	1	3.76	3.70	.055	.01
Social identification	1	53.24	52.37	.000	.15
Sex	1	2.05	2.01	.157	.01
Education	1	0.02	0.02	.890	.00

Participants' petition-signing behavior differed significantly across experimental conditions ($F(2, 289) = 3.13$, $p < 0.05$, partial $\eta^2 = .02$). Post-hoc comparisons showed that participants gave significantly more support to anti-science petitions in the Strong Scientists condition (adj $M = 0.85$, 95% CI [0.66, 1.05]) compared to the Strong Denialists condition (ajd $M = 0.50$, 95% CI [0.30, 0.71]; LSD $p < 0.02$) and marginally more compared to the control condition (adj $M = 0.61$, 95% CI [0.41, 0.81]; LSD $p = 0.093$). No difference was found between the Strong Denialists condition and the control condition (LSD $p = 0.46$). Social identification with video game players predicted giving greater support to anti-science petitions ($F(1, 289) = 52.37$, $p < .01$, partial $\eta^2 = .15$, $B = 0.22$, $SE = .03$). Initial beliefs, sex and education did not significantly predict anger (ps > 0.05).

Next, interactions of the experimental manipulation with initial beliefs about video game effects and trait social identification were added to the model. No significant interactive effects were found (all ps > 0.05).

Role of intergroup threat as a mediator. Mediation analyses were conducted to examine whether intergroup threat underlies the unexpected effects of the experimental manipulation of

intergroup strength on anger and aggression towards researchers. Path analyses were conducted with Mplus 6.1 (Muthén & Muthén, 2010). Experimental conditions were coded as dummy variables with the control condition as the reference category.

Results are shown in Figure 4.2. Exposing participants to evidence that scientists are a strong outgroup predicted higher intergroup threat ($\beta = .14$, $p < 0.01$). Intergroup threat predicted anger towards researchers ($\beta = .89$, $p < 0.01$) and signing anti-science petitions ($\beta = .40$, $p < 0.01$). Exposing participants to evidence that scientists are a strong outgroup had significant effects on anger and petition signing through intergroup threat (standardized indirect effect of 0.12, $p < 0.01$ on anger and 0.06, $p < 0.01$ on petition signing). Direct effects of the experimental manipulation on anger and petition signing were nonsignificant, indicating full mediation.

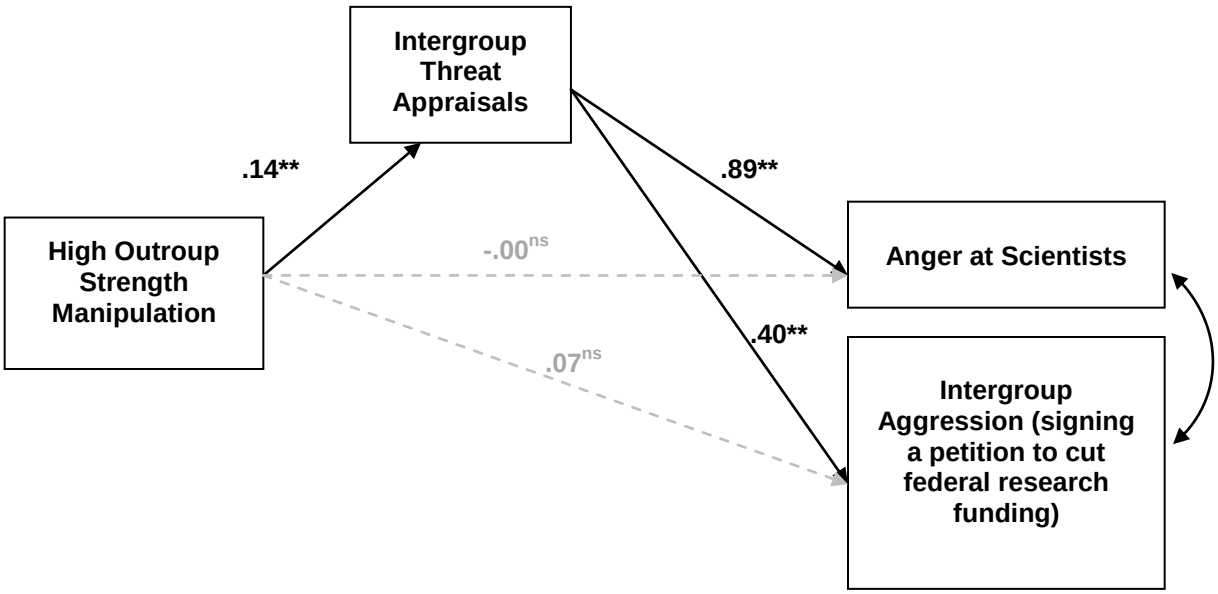


Figure 4.2. Path model examining effects of experimentally manipulating outgroup strength on anger and aggression towards scientists mediated by intergroup threat. Initial beliefs about violent video game effects, social identification with video game players, sex and education are included as covariates. Standardized coefficients are shown; ** $p < .01$, * $p < .05$.

Discussion

These results demonstrate that viewing scientists as a strong group that is publically supported has the beneficial effect of lowering science denial. However, viewing scientists as a strong group also increased anger and aggression towards them. These effects were fully mediated by changes in intergroup threat. It seems that viewing scientists as a strong outgroup also made them seem more threatening which led to increased anger and aggression. In other words, our results supported the **strength as threat hypothesis**, not the strength as deterrence hypothesis.

CHAPTER 9: GENERAL DISCUSSION & CONCLUSIONS

General Discussion

The overall goal of this research project was to examine science denial from an intergroup conflict perspective. Science denial was conceptualized as an outcome of intergroup conflict between scientists and denialists (labeled by some authors as "war on science"). On the whole, these research findings demonstrate that it is useful to consider science denial as an intergroup phenomenon, not just an individual-level phenomenon.

This set of studies identified several intergroup processes that significantly contribute to science denial, anger and aggression towards scientists. Clear evidence was found for three factors that contribute to science denial at an intergroup level: (1) social identification with a threatened group (Study 1A, 1B, 1C), (2) intergroup threat from scientists (Study 2A, 2B, 2C), and (3) perceived intergroup strength (Study 3).

The main goal of Study 1 was to experimentally test whether priming a threatened social identity contributes to science denial. Based on the predictions social identity theory (Tajfel & Turner, 1986), I expected that making a valued social identity salient would cause participants to derogate scientific findings that constitute threats to that social identity.

We found that priming political conservatives' social identity increased climate change denial (Study 1A), that priming political liberals' social identity increased denial of research on vaccination safety (Study 1B) and that priming video game players' social identity increased denial of research demonstrating violent video game effects on aggression (Study 1C). While past research demonstrated correlations between social identification and science denial (Gromet, Kunreuther & Larrick, 2013; Munro & Munro, 2014; Nauroth et al., 2014), this

research was the first to empirically demonstrate causal effects of social identification with a threatened group on science denial.

There is also evidence that initial beliefs about research findings moderate the effects of social identification on science denial. In Study 1B and Study 1C, priming a threatened social identity led to increased research derogation among participants who initially disbelieved research findings (denialists), but had little or no effect on people who initially believed research findings (non-denialists). A meta-analytic review of Study 1A, 1B and 1C demonstrated that, overall, effects of social identity priming were consistent and of a moderate magnitude among participants who initially disbelieved research findings (denialists $d+ = 0.39$, $p < 0.01$, 95% CI [0.23 - 0.56]), but were weak and inconsistent among people who initially believed research findings (non-denialists $d+ = 0.0$, $p = 0.96$, 95% CI [-0.17 - 0.16]). This novel finding extends research examining the role of social identification in science denial and suggests that social identification can strengthen denial among people who initially doubt research findings, but does not generate denial among people who initially believe research findings.

The main goal of Study 2 was to explore the role of intergroup threat in science denial. Based on the predictions of intergroup threat theory (Stephan & Stephan, 2000), I hypothesized that perceptions of scientists as a highly threatening outgroup will increase science denial, anger and aggression towards scientists.

Study 2A showed preliminary correlational evidence that appraisals of intergroup threat from scientists are associated with research derogation, anger and aggressive behavioral intentions towards researchers (such as intentions to sign a petition to cut research funding or to post a negative review of the research online). These findings generalized across domains - similar

effects of intergroup threat were found among conservatives judging climate change research and researchers and among video game players judging violent video game research and researchers.

Study 2B experimentally replicated effects of intergroup threat on science denial found in Study 2A. An experimental manipulation which increased perceived intergroup threat from researchers made video game players more willing to derogate a research study showing violent video game effects on aggression (compared both to a low-threat manipulation and a no-manipulation control condition). These results suggest that intergroup threat plays a causal role in science denial.

Study 2C experimentally replicated the correlational effects of intergroup threat on anger and aggression towards scientists found in Study 2A. An experimental manipulation that increased intergroup threat from researchers made video game players express more anger towards researchers and made them more willing to sign an anti-science petition (compared both to a low-threat manipulation and a no-manipulation control condition). This effect was moderated by social identification - effects of intergroup threat on anger and signing anti-science petitions were stronger among highly identified group members. Given the key role anger plays in intergroup aggression (Mackie & Smith, 2014), anger was examined as a potential mediator of the effects of intergroup threat on aggression towards scientists. Indeed, mediation analyses revealed that anger mediated the interactive effect of high intergroup threat and social identification on signing anti-science petitions.

This set of studies is the first to demonstrate causal effects of intergroup threat on science denial, anger and aggression towards scientists. It seems that people's angry and aggressive responses towards scientists stem, at least in part, from their perceptions of scientists as a threat

to their group ("Researchers cause us to be stigmatized", "Researchers try to limit our personal freedom").

Study 3 was designed to test two competing predictions concerning the effects of perceived relative intergroup strength on anger and aggression towards scientists - the **"strength as deterrence" hypothesis** (viewing scientists as a strong group will reduce anger and aggression towards them) versus the **"strength as threat" hypothesis** (viewing scientists as a strong group will cause intergroup threat and increase anger and aggression). Findings clearly supported the **"strength as threat" hypothesis** – an experimental manipulation prompting participants to view scientists as a strong group increased anger and aggression towards them and these effects were mediated by intergroup threat. Nonetheless, prompting participants to view scientists as a strong, publically supported group also lowered science denial.

Overall, the current findings advance our understanding of science denial. Angry and aggressive responses that often accompany science denial may seem surprising and hard to explain. On the other hand, such responses are readily predictable when denial is framed in terms of intergroup conflict. When people view research and researchers as a threat to a valued social identity, they are more likely to derogate research findings, respond with anger and aggression (such as signing petitions to cut research funding). The combination of high ingroup identification and perceptions of scientists as highly threatening seems to be an especially potent precursor of anger and aggression towards scientists (as found in Study 2C). Simply priming a threatened social identity is sufficient to increase science denial, though only among people who already doubt research findings (as found in Study 1A, 1B and 1C). On the other hand, increasing intergroup threat from scientists increases denial regardless of people's initial beliefs (as found in Study 2B). These findings are consistent with the predictions of intergroup emotions

theory (Mackie, Devos & Smith, 2000, Mackie & Smith, 2014) and intergroup threat theory (Stephan & Stephan, 2000). Finally, although past research within the intergroup emotions theory framework suggests that outgroup strength should act as a deterrent against anger and aggression (Mackie & Smith, 2014), our current findings suggest that portraying scientists as a strong, publically supported group causes intergroup threat and increases anger and aggression.

These findings have important implications for interventions attempting to reduce science denial. They help explain why interventions designed to combat science denial by simply giving people accurate scientific information are often ineffective and sometimes even backfire (e.g. Nyhan et al., 2014, 2015). Our results suggest that such persuasion attempts might be more effective when coupled with interventions designed to lower intergroup threat and mitigate intergroup conflict (e.g. Saleem et al., in press).

Theoretical Integration

This research is based on predictions drawn from social identity theory (SIT; Tajfel & Turner, 1986), intergroup emotions theory (IET; Mackie, Devos & Smith, 2000, Mackie & Smith, 2014) and intergroup threat theory (ITT; Stephan & Stephan, 2000). These three theoretical approaches are clearly consistent and can be viewed as parts of a single overarching framework for understanding intergroup relations and intergroup conflict.

IET and ITT are rooted in social identity theory and share the basic assumption that groups are an important source of identity for individuals (Tajfel & Turner, 1986). Group memberships become part of the self and influence people's thoughts, feelings and actions. Furthermore, both ITT and IET posit that belonging to a social group (self-categorization) and deriving one's identity from a social group (social identification) prompt intergroup appraisals. When a valued social identity is salient, people evaluate events based on perceived good or bad consequences

for the in-group. This prediction is consistent with the current finding that making a threatened social identity salient leads to more negative research evaluations (Study1A, Study1B, Study1C).

Next, IET and ITT both propose that intergroup appraisals guide intergroup emotions and behaviors. A key contribution of IET is its focus on differentiated emotional reactions outgroups provoke rather than just examining prejudice as an overall negative evaluation (Mackie, Smith & Ray, 2008). ITT contributes to understanding discrete emotional responses towards outgroups by providing specific predictions concerning effects of different types of intergroup threat appraisals (Cottrell & Neuberg, 2005; Neuberg & Cottrell, 2002). For example, if the outgroup is viewed as a physical or moral contaminant, this leads to disgust and motivates avoidance of the outgroup, while perceived threats to physical safety may lead to fear and avoidance or anger and aggression (Cottrell & Neuberg, 2005). The current research did not find specific effects of different types of intergroup threat (Study 2B, 2C), but instead found strong effects of general intergroup threat appraisals on science denial, anger, and aggression towards scientists (Study 2A, 2B, 2C; Study 3).

Both IET and ITT view emotions as adaptive and functional (Cottrell & Neuberg, 2005; Mackie & Smith, 2014). Just as individual emotions regulate interpersonal interactions, intergroup emotions regulate intergroup behavior. For instance, intergroup guilt motivates intergroup apology, whereas anger is a key precursor of aggression (Maitner, Mackie & Smith, 2006, 2007). The current research focused on anger as a predictor of intergroup conflict. As expected, anger towards scientists predicted intergroup aggression – effects were found both on behavioral intentions towards scientists (Study 2A) and on actual behaviors (Study 2C, Study 3).

Importantly, ITT and IET predict that social identification should moderate these effects. Greater intergroup threat and stronger intergroup emotions are experienced by individuals who

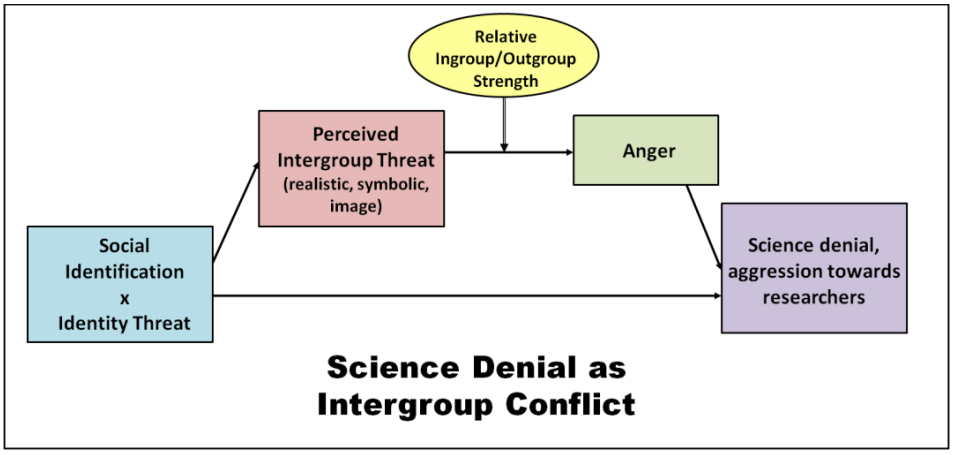
view the group as a central and important part of their identity (Mackie & Smith, 2014; Mackie, Smith & Ray, 2008). Indeed, the current research demonstrates that an experimental manipulation designed to cause intergroup threat results in higher threat appraisals, more anger, and intergroup aggression for individuals high in social identification with the threatened group (Study 2C, Study 3).

An integration of our predictions based on SIT, ITT and IET applied to understanding science denial is shown in Figure 5.1. Initial predictions are shown in Figure 5.1A, while a revised model based on findings from the current studies is shown in Figure 5.1B. Overall, our findings support predictions of social identity theory, intergroup threat theory and intergroup emotions theory. One exception involves our findings concerning the effects of relative intergroup strength. Past research conducted within the IET framework regards outgroup strength as a deterrent of aggression and demonstrates that viewing an outgroup as strong leads to diminished anger and aggressive behavior towards them (Mackie, Devos & Smith, 2000). In contrast, our current findings show that portraying scientists as a strong outgroup increases intergroup threat, anger and aggression (Study 3). In other words, we found no support for the "strength as deterrence" hypothesis and instead found support for the "strength as threat" hypothesis. This anomaly warrants further attention. For example, it might be that the present results arose because of the anonymity provided by the online nature of the aggressive behavior.

Finally, it is important to consider how individual-level factors, group-level factors and intergroup-level factors combine to bring about science denial, anger and aggression towards scientists. The General Aggression Model (GAM; Anderson & Carnagey, 2014; DeWall, Anderson, & Bushman, 2011) provides a useful meta-theoretical framework for understanding how a range of individual-level, group-level and intergroup-level variables influence outcomes.

According to GAM, person and situation variables influence appraisal, decision-making and behavior in the short-term by influencing a person's internal state. Thus, individual-level factors, group-level factors, and intergroup-level factors influence judgment and behavior by changing an individual's present internal state. For example, reading a threatening news article in Study 2C and evaluating threatening news titles in Study 3 primed specific types of cognitions (e.g. "Researchers are threatening our group's public image") and a specific emotion (anger). These changes in one's present internal state influence appraisal, decision making, and behavior (participants who experienced high intergroup threat and anger were more likely to sign anti-science petitions). Effects of different person and situational variables can be additive or interactive. For instance, our current findings demonstrate significant interactive effects of social identity primes and people's initial beliefs on science denial (Study 1B, 1C) as well as interactive effects of social identification and intergroup threat on anger and aggressive behavior (Study 2C, Study 3). Thus, GAM can be used as an integrative framework for understanding effects of a range of factors that contribute to angry science denial and anti-science behavior, including individual-level factors (e.g. trait reactance, initial beliefs about research findings, scientific expertise), group-level-factors (e.g. values, ideology, system justification) and intergroup-level factors (e.g. intergroup threat, relative intergroup strength, intergroup emotions).

A. Initial predictions



B. Findings supporting hypothesized relations between social identity, intergroup threat, intergroup emotions, and science denial found across studies.

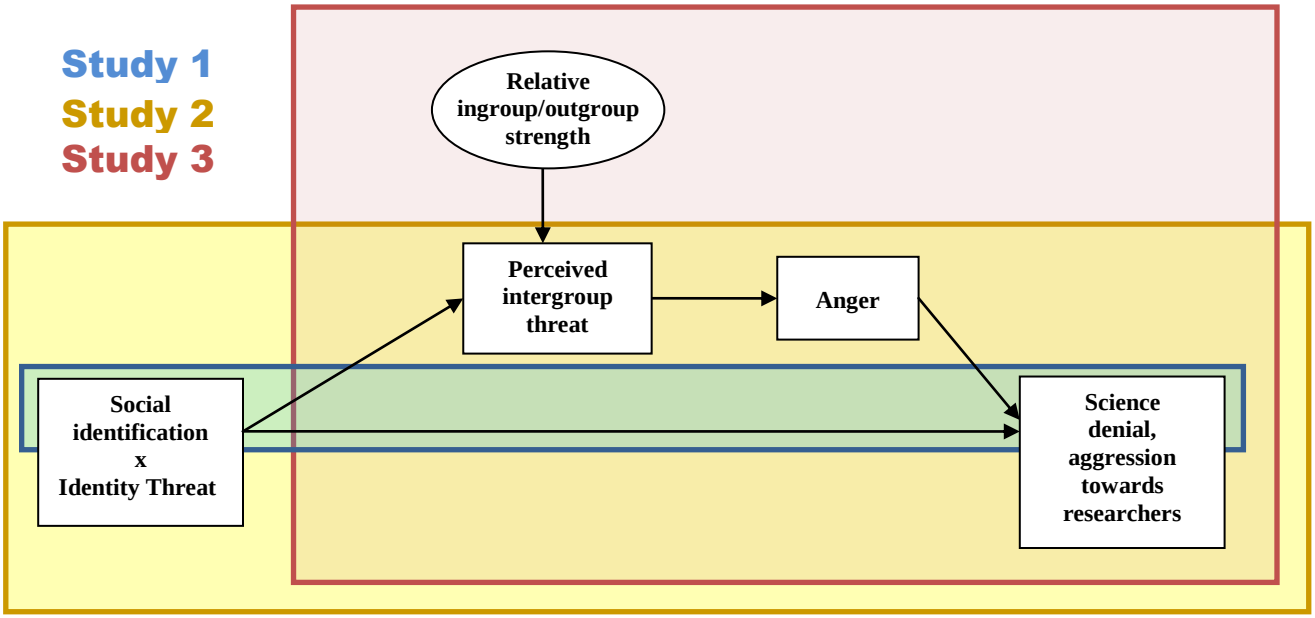


Figure 5.1. Illustration of initial predictions and empirical findings concerning relationships between social identity, intergroup threat, intergroup emotions, and science denial.

Strengths and Limitations

This research has several key strengths. Study 1 extended past studies by experimentally manipulating social identification instead of just measuring it (e.g. Munro & Munro, 2014; Nauroth et al., 2014) and by examining science denial across multiple domains. Study 2 provided the first evidence that intergroup threat plays a key role in science denial using both cross-sectional and experimental methods. Finally, Study 3 was the first to explore how intergroup strength influences science denial and revealed both positive effects (less research derogation) and negative effects (more anger and aggression towards scientists), as well as evidence of a causal mechanism underlying these effects (intergroup threat).

Future research could extend these findings in several ways. Study 1 focused solely on negative effects that social identification with threatened groups has on science denial. However, it is possible that other social identities may have beneficial effect instead. For instance, it is possible that priming a person's identity as a college student and member of their university might result in more positive responses to threatening research findings (just as priming college students' identity as students reduces negative responses to a threatening religious outgroup, Ray, Mackie, Rydell & Smith, 2007).

The fact that social identity priming had strongest effects on participants who were initially most doubtful towards research findings suggests that it may be especially fruitful to investigate the link between social identification and science denial among populations who firmly oppose established research findings (e.g. members of the anti-vaccination movement, global warming skeptics).

Study 2 and Study 3 focused on anger as a precursor of aggression towards researchers. Future studies could explore the role of intergroup emotions in engagement in science more

broadly. Based on the framework of intergroup emotions theory (Mackie & Smith, 2014), we can expect that other discrete intergroup emotions towards scientists predict different types of behaviors (e.g. fear and disgust should act as the key predictors of avoidance; positive emotions such as admiration and trust should act as key predictors of pro-science behaviors).

Our findings from Study 2 suggest that intergroup threat is a powerful precursor of science denial. I found that participants' global assessments of intergroup threat are a strong predictor of science denial, anger towards scientists and anti-science behavior. I did not find specific effects of appraisals of different types of intergroup threat in Study 2B or Study 2C. Instead, participants' perceptions of realistic threat, symbolic threat, freedom threat and image threat that researchers who study violent video games pose formed a single dimension of intergroup threat perceptions and had global effects on outcomes (Study 2B and Study 2C). Nonetheless, it is possible that distinct types of intergroup threat differentially affect attitudes towards research and researchers in other domains. Finally, findings from Study 3 also warrant replication in a different population to test whether effects of intergroup strength on intergroup threat, anger and aggression towards scientists generalize across domains.

Conclusion

Doubt and denial of scientific evidence in areas such as climate change, vaccination safety, dangers of tobacco use and violent media effects lead to detrimental outcomes both to individuals and to our society. It might seem hard to understand why such denial persists in the face of clear evidence and scientific consensus and why it is often accompanied by anger and aggression towards scientists. Science denial is a complex phenomenon that is influenced by a number of individual-level and group-level processes. The current research suggests that our understanding of science denial will not be complete until we add intergroup processes to this

list. Findings from eight independent samples exploring precursors of science denial across multiple domains suggest that denial is, in part, fueled by social identification and intergroup threat. When research findings threaten a valued social identity and when scientists are perceived as a highly threatening group, people are more likely to derogate the research, and to express anger and aggression towards researchers.

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APPENDIX 1: MATERIALS FOR STUDY 1

APPENDIX 1A: MATERIALS FOR STUDY 1A

Pre-experimental Measures

Beliefs about "controversial" scientific topics

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Violent video games increase aggressive behavior.

2. Violent video games increase aggressive thoughts and feelings.

3. Human CO2 emissions cause climate change.

4. Capital punishment helps prevent crime.

5. We must have capital punishment for some crimes.

6. Climate change is a hoax.

7. Vaccinations are dangerous and should be avoided.

8. Vaccinations are safe and useful.

9. Sexual orientation is a person's choice.

10. Sexual orientation is largely biologically predetermined.

11. I support evolutionary theory.

12. God created humans in their present form

Demographics.

Also assessed were sex, age, political orientation, religious affiliation.

1. What is your gender?

2. What is your current age in years?

3. What is your political identity?

A. Strongly conservative

B. Moderately conservative

C. Slightly conservative

D. Neutral

E. Slightly liberal

F. Moderately liberal

G. Strongly liberal

4. What is your religious affiliation?

A. Non religious/Secular B. Christianity C. Judaism D. Islam

E. Buddhism F. Hinduism G. Spiritualism H. Agnostic I. Atheists J. Other:

Experimental Manipulation – Social identity prime

1. I see myself as a conservative.
2. I feel strong ties with fellow conservatives.
3. I can identify with other conservatives.
4. I like to contribute to my political party.
5. It is important to me to view myself as a conservative.
6. When I talk about conservatives, I sometimes say “we” rather than “they.”
7. My political beliefs are an important part of my self-image.
8. I feel connected to other conservatives.

Post-experimental Measures

Research summary evaluations

"Dr. Markus Huber and Dr. Reto Knutti conducted a study examining causes of climate change (natural versus anthropogenic - caused by human activity). They examined various contributions to the observed global warming between 1850 and 1950. This study employed a novel approach based on the principle of conservation of energy, without assumptions about spatial warming patterns.

Based on a massive collection of simulations, authors found that greenhouse gasses contributed 0.85C of warming since the mid-twentieth century. Authors noted that natural variability cannot account for the observed global warming. Authors suggest that, in fact, greenhouse gases have very likely caused more warming than has been observed, due to the offsetting cooling effect from human aerosol emissions.

Researchers concluded that these findings confirm that humans are the dominant cause of the observed warming over the past 150 years, and particularly over the past 50 years."

Participants then rated the research using a 5-item scale based on items from Nauroth et al. (2014). Example items are "This kind of research is not very meaningful" and "These researchers just find what they want to find." Items were rated on a Likert scale from 1 ("Not at all true") to 6 ("Very much true").

1. This kind of research is not very meaningful.
2. These researchers just find what they want to find.
3. This research yielded reliable results. - Reverse coded
4. This research yielded important results. - Reverse coded
5. The results of this research can be meaningfully applied to real-life contexts. - Reverse coded

Social identification.

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. I see myself as a conservative.
2. I feel strong ties with fellow conservatives.
3. I identify with other conservatives.
4. When I talk about conservatives, I usually say "we" rather than "they."
5. In general, my political beliefs are an important part of my self-image.

Educational history

1. What is the highest level of education you finished?

a) Grammar School
b) High School or equivalent
c) Vocational/Technical School (2 year)
d) Some College
e) College Graduate (4 year)
f) Master's Degree (MS, MA)
g) Doctoral Degree (PhD)
h) Professional Degree (MD, JD, etc.)
i) Other

2. How many research methods courses have you taken? ____

3. How many statistics courses have you taken?___

Debriefing

1. What did you think of the study?

2. Were you confused by any of the tasks or instructions? YES NO

If Answered Yes, Please Ask Participant to Elaborate:

APPENDIX 1B: MATERIALS FOR STUDY 1B

Pre-experimental Measures

Beliefs about "controversial" scientific topics

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Violent video games increase aggressive behavior.
2. Violent video games increase aggressive thoughts and feelings.
3. Human CO2 emissions cause climate change.
4. Capital punishment helps prevent crime.
5. We must have capital punishment for some crimes.
6. Climate change is a hoax.
7. Vaccinations are dangerous and should be avoided.
8. Vaccinations are safe and useful.
9. Sexual orientation is a person's choice.
10. Sexual orientation is largely biologically predetermined.
11. I support evolutionary theory.
12. God created humans in their present form

Demographics

3. What is your gender?

4. What is your current age in years?

3. What is your political identity?

A. Strongly conservative

B. Moderately conservative

C. Slightly conservative

D. Neutral

E. Slightly liberal

F. Moderately liberal

G. Strongly liberal

4. What is your religious affiliation?

A. Non religious/Secular B. Christianity C. Judaism D. Islam

E. Buddhism F. Hinduism G. Spiritualism H. Agnostic I. Atheists J. Other:

Experimental Conditions – Social identity priming

1. I see myself as a liberal.
2. I feel strong ties with fellow liberals.
3. I can identify with other liberals.
4. I like to contribute to my political party.
5. It is important to me to view myself as a liberal.
6. When I talk about liberals, I sometimes say “we” rather than “they.”
7. My political beliefs are an important part of my self-image.
8. I feel connected to other liberals.

Post-experimental Measures

Research summary evaluations

"Jessica Atwell and her colleagues conducted a study examining factors that contributed to the whooping cough outbreak in California. In 2010, 9120 pertussis cases with 10 deaths were reported in California — the highest numbers since 1947. Although waning immunity has been proposed as a major cause, clustering of unvaccinated children might also have played a role.

To examine this possibility, researchers analyzed spatial clustering of nonmedical vaccination exemptions (such as for religious or philosophical reasons) for children entering kindergarten from 2005 through 2010 and space-time clustering of pertussis cases with onset in 2010 in California. Researchers found that non-immunized children were more than twice as likely to be in a pertussis cluster. This association remained significant after adjustment for sociodemographic variables.

Researchers concluded that vaccine refusal may have contributed to California's 2010 pertussis outbreak. They warned that communities with large numbers of intentionally unvaccinated or undervaccinated persons can lead to pertussis outbreaks."

1. These researchers seem biased.
2. I was insulted by the findings of this study
3. This kind of research is not very meaningful.
4. These researchers are not very competent.
5. These researchers just find what they want to find.
6. This research yielded reliable results. - Reverse coded
7. This research yielded important results. - Reverse coded

8. The results of this research can be meaningfully applied to real-life contexts. - Reverse coded
9. I was outraged when I read the summary of the study.

Social identification

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree)

1. I see myself as a liberal.
2. I feel strong ties with fellow liberals.
3. I identify with other liberals.
4. When I talk about liberals, I usually say "we" rather than "they."
5. In general, my political beliefs are an important part of my self-image.

Educational history

1. What is the highest level of education you finished?

Grammar School
High School or equivalent
Vocational/Technical School (2 year)
Some College
College Graduate (4 year)
Master's Degree (MS, MA)
Doctoral Degree (PhD)
Professional Degree (MD, JD, etc.)
Other

2. How many research methods courses have you taken? ____

3. How many statistics courses have you taken?___

Debriefing

1. What did you think of the study?

2. Were you confused by any of the tasks or instructions? YES NO

If Answered Yes, Please Ask Participant to Elaborate:

APPENDIX 1C: MATERIALS FOR STUDY 1C

Pre-experimental Measures

Beliefs about "controversial" scientific topics

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Violent video games increase aggressive behavior.
2. Violent video games increase aggressive thoughts and feelings.
3. Human CO2 emissions cause climate change.
4. Capital punishment helps prevent crime.
5. We must have capital punishment for some crimes.
6. Climate change is a hoax.
7. Vaccinations are dangerous and should be avoided.
8. Vaccinations are safe and useful.
9. Sexual orientation is a person's choice.
10. Sexual orientation is largely biologically predetermined.
11. I support evolutionary theory.
12. God created humans in their present form

Demographics

1. **What is your gender?**

2. **What is your current age in years?**

3. **What is your political identity?**

A. Strongly conservative

B. Moderately conservative

C. Slightly conservative

D. Neutral

E. Slightly liberal

F. Moderately liberal

G. Strongly liberal

4. What is your religious affiliation?

A. Non religious/Secular B. Christianity C. Judaism D. Islam

E. Buddhism F. Hinduism G. Spiritualism H. Agnostic I. Atheists J. Other:

Experimental Conditions

Social identity priming items:

1. I see myself as a video game player.
2. I feel strong ties with fellow video game players.
3. I can identify with other video game players.
4. I like to contribute to the gaming community.
5. It is important to me to view myself as a video game player.
6. When I talk about video game players, I sometimes say "we" rather than "they."
7. Video games are an important part of my self-image.
8. I feel connected to other video game players.

Self-Affirmation items:

1. Being able to come up with new and different ideas and ways of doing things is one of my strong points.
2. I value my ability to think critically.
3. I must stand up for what I believe in, even in the face of strong opposition.
4. I always admit when I am wrong.
5. I am never too busy to help a friend.
6. I go out of my way to cheer up people who appear down.
7. I treat all people equally, regardless of who they might be.
8. I really enjoy being part of a group.
9. I never seek vengeance.
10. I do not act as though I am a special person.
11. I experience deep emotions when I see beautiful things.
12. Despite challenges, I always remain hopeful about the future.

Post-experimental Measures

Research summary evaluations

"In an experiment conducted by Craig Anderson and colleagues participants were randomly assigned to one of two conditions. In one condition participants played a violent video game. Participants in the other condition played a non-violent video game. After playing the video game all participants were asked to participate in a reaction time task in which they competed (ostensibly) against an opponent seated in another room. Whenever participants won a round, they had the opportunity to punish the opponent. The punishment consisted of a very unpleasant noise; participants were asked to calibrate the sound's duration and its volume; these settings served as measures of participants' aggressive tendencies. Comparing the average duration and volume settings between the two conditions showed that those who had played the violent video game reacted more aggressively than those who played the non-violent video game. The authors of the study concluded that consuming violent video games leads to an increase in aggression. The authors stated that violent video games provide a forum for learning and practicing aggressive reactions."

1. These researchers seem biased.
2. I was insulted by the findings of this study
3. This kind of research is not very meaningful.
4. These researchers are not very competent.
5. These researchers just find what they want to find.
6. This research yielded reliable results. - Reverse coded
7. This research yielded important results. - Reverse coded

8. The results of this research can be meaningfully applied to real-life contexts. - Reverse coded
9. I was outraged when I read the summary of the study.

Social identification

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree)

1. I see myself as a video game player.
2. I feel strong ties with fellow video game players.
3. I identify with other video game players.
4. When I talk about video game players, I usually say "we" rather than "they."
5. In general, video games are an important part of my self-image.

Educational history

1. What is the highest level of education you finished?

Grammar School
High School or equivalent
Vocational/Technical School (2 year)
Some College
College Graduate (4 year)
Master's Degree (MS, MA)
Doctoral Degree (PhD)
Professional Degree (MD, JD, etc.)
Other

2. How many research methods courses have you taken? ____

3. How many statistics courses have you taken?___

Debriefing

1. What did you think of the study?

2. Were you confused by any of the tasks or instructions? YES NO

If Answered Yes, Please Ask Participant to Elaborate:

APPENDIX 2: MATERIALS FOR STUDY 2

APPENDIX 2A: MATERIALS FOR STUDY 2A

Research summary

Climate change research summary:

"Dr. Markus Huber and Dr. Reto Knutti conducted a study examining causes of climate change (natural versus anthropogenic - caused by human activity). They examined various contributions to the observed global warming between 1850 and 1950. This study employed a novel approach based on the principle of conservation of energy, without assumptions about spatial warming patterns.

Based on a massive collection of simulations, authors found that greenhouse gasses contributed 0.85C of warming since the mid-twentieth century. Authors noted that natural variability cannot account for the observed global warming. Authors suggest that, in fact, greenhouse gases have very likely caused more warming than has been observed, due to the offsetting cooling effect from human aerosol emissions.

Researchers concluded that these findings confirm that humans are the dominant cause of the observed warming over the past 150 years, and particularly over the past 50 years."

Violent video game research summary:

"In an experiment conducted by Craig Anderson and colleagues participants were randomly assigned to one of two conditions. In one condition participants played a violent video game. Participants in the other condition played a non-violent video game. After playing the video game all participants were asked to participate in a reaction time task in which they competed (ostensibly) against an opponent seated in another room. Whenever participants won a round, they had the opportunity to punish the opponent. The punishment consisted of a very unpleasant noise; participants were asked to calibrate the sound's duration and its volume; these

settings served as measures of participants' aggressive tendencies. Comparing the average duration and volume settings between the two conditions showed that those who had played the violent video game reacted more aggressively than those who played the non-violent video game. The authors of the study concluded that consuming violent video games leads to an increase in aggression. The authors stated that violent video games provide a forum for learning and practicing aggressive reactions."

Intergroup threat

Please rate the researchers who conducted the study on the following dimensions (on a scale from 1 "Not at all" to 7 "Extremely").

Competent

Threatening

Good-natured

Research summary evaluations

1. These researchers seem biased.
2. I was insulted by the findings of this study
3. This kind of research is not very meaningful.
4. These researchers are not very competent.
5. These researchers just find what they want to find.
6. This research yielded reliable results. - Reverse coded
7. This research yielded important results. - Reverse coded
8. The results of this research can be meaningfully applied to real-life contexts. - Reverse coded
9. I was outraged when I read the summary of the study.

Anger towards researchers

To what extent do you feel _____ towards the researchers who conducted the study? (on a scale from 1 "Not at all" to 7 "Extremely")

Angry

Hostile

Furious

Irritated

Negative behavioral intentions towards researchers

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. I would be willing to sign a petition to cut federal funding for this kind of research.
2. I would be willing to get involved in a protest to stop this kind of research.
3. I would be willing to endorse a negative review of this research study online.
4. I would be willing to post a negative evaluation of this study on my Facebook page or on another web page.
5. I would be willing to sign a letter with negative feedback about this research to the university employing scientists who conducted the study.

Beliefs about "controversial" scientific topics

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Violent video games increase aggressive behavior.
2. Violent video games increase aggressive thoughts and feelings.
3. Human CO2 emissions cause climate change.
4. Capital punishment helps prevent crime.
5. We must have capital punishment for some crimes.
6. Climate change is a hoax.
7. Vaccinations are dangerous and should be avoided.
8. Vaccinations are safe and useful.
9. Sexual orientation is a person's choice.
10. Sexual orientation is largely biologically predetermined.
11. I support evolutionary theory.
12. God created humans in their present form

Social Identification

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

Sample 1 – Social identification with political conservatives:

1. I see myself as a conservative.
2. I feel strong ties with fellow conservatives.
3. I identify with other conservatives.
4. When I talk about conservatives, I usually say "we" rather than "they."
5. In general, my political beliefs are an important part of my self-image.

Sample 2 – Social identification with video game players:

1. I see myself as a video game player.
2. I feel strong ties with fellow video game players.
3. I identify with other video game players.
4. When I talk about video game players, I usually say "we" rather than "they."
5. In general, video games are an important part of my self-image.

Educational history

1. What is the highest level of education you finished?

Grammar School
High School or equivalent
Vocational/Technical School (2 year)
Some College
College Graduate (4 year)
Master's Degree (MS, MA)
Doctoral Degree (PhD)
Professional Degree (MD, JD, etc.)
Other

2. How many research methods courses have you taken? ____

3. How many statistics courses have you taken?___

Demographics

1. **What is your gender?**
2. **What is your current age in years?**
3. **What is your political identity?**

A. Strongly conservative

B. Moderately conservative

C. Slightly conservative

D. Neutral

E. Slightly liberal

F. Moderately liberal

G. Strongly liberal

4. What is your religious affiliation?

A. Non religious/Secular B. Christianity C. Judaism D. Islam

E. Buddhism F. Hinduism G. Spiritualism H. Agnostic I. Atheists J. Other:

Debriefing

1. What did you think of the study?

2. Were you confused by any of the tasks or instructions? YES NO

If Answered Yes, Please Ask Participant to Elaborate:

APPENDIX 2B: MATERIALS FOR STUDY 2B

Pre-experimental Measures

Beliefs about "controversial" scientific topics

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Violent video games increase aggressive behavior.
2. Violent video games increase aggressive thoughts and feelings.
3. Human CO2 emissions cause climate change.
4. Capital punishment helps prevent crime.
5. We must have capital punishment for some crimes.
6. Climate change is a hoax.
7. Vaccinations are dangerous and should be avoided.
8. Vaccinations are safe and useful.
9. Sexual orientation is a person's choice.
10. Sexual orientation is largely biologically predetermined.
11. I support evolutionary theory.
12. God created humans in their present form

Social identification

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

I see myself as a video game player.

I feel strong ties with fellow video game players.

I identify with other video game players.

When I talk about video game players, I usually say "we" rather than "they."

In general, video games are an important part of my self-image.

Demographics

1. **What is your gender?**

2. **What is your current age in years?**

3. **What is your political identity?**

A. Strongly conservative

B. Moderately conservative

C. Slightly conservative

D. Neutral

E. Slightly liberal

F. Moderately liberal

G. Strongly liberal

4. What is your religious affiliation?

A. Non religious/Secular B. Christianity C. Judaism D. Islam

E. Buddhism F. Hinduism G. Spiritualism H. Agnostic I. Atheists J. Other:

Experimental Conditions

High intergroup threat article:

Do violent video games play a role in shootings?

September 20, 2013 - GamePolitics Staff

In his CNN editorial, Dr. Brad Bushman, professor of communication and psychology at Ohio State University, contends that violent media such as video games do cause aggression, according to research he has conducted personally, as well as other studies conducted by like-minded researchers:

"My colleagues and I found that typical college students who played violent video games for 20 minutes at a time for three consecutive days showed increasingly higher levels of aggressive behavior each day they played. If that's what happens to typical college students, how might someone like Alexis react to playing for 16 straight hours? What if he does this for months or years?

Other researchers have found similar results. My colleagues and I conducted a comprehensive review of 136 articles reporting 381 effects involving over 130,000 participants around the world. These studies show that violent video games increase aggressive thoughts, angry feelings, physiological arousal (e.g., heart rate, blood pressure), and aggressive behavior. Violent games also decrease helping behavior and feelings of empathy for others. The effects occurred for males and females of all ages, regardless of what country they lived in."

Bushman goes on to say that, while specific details on the Alexis case have not been revealed, the video game connection fits in with other mass shooters:

"Despite the evidence, many people still deny violent media effects for a variety of reasons that I summarized in a Psychology Today piece.

Alexis was not the first mass killer to have an obsession with violent video games. Adam Lanza, who killed 26 children in an elementary school in Newtown, Connecticut, was also said to be a fan of first-person shooting games. Other killers have been found to be avid players.

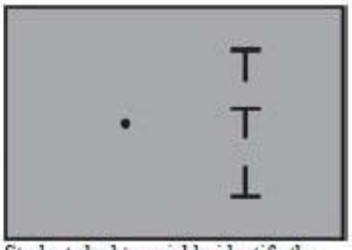
The effects of these games go beyond making players more aggressive. In our research, we found that people who played first-person shooting games were more accurate than others when firing a realistic gun at a mannequin -- and more likely to aim for and hit the head."

Low intergroup threat article:

Action Video Games Sharpen Vision 20 Percent

'Daphne Bavelier and Shawn Green (CREDIT University of Rochester)'

Video games that contain high levels of action, such as Unreal Tournament, can actually improve your vision.



Students had to quickly identify the orientation of the middle "T" - Action game players could do it better

Researchers at the University of Rochester have shown that people who played action video games for a few hours a day over the course of a month improved by about 20 percent in their ability to identify letters presented in clutter—a visual acuity test similar to ones used in regular ophthalmology clinics.

In essence, playing video game improves your bottom line on a standard eye chart.

"Action video game play changes the way our brains process visual information," says Daphne Bavelier, professor of brain and cognitive sciences at the University of Rochester. "After just 30 hours, players showed a substantial increase in the spatial resolution of their vision, meaning they could see figures like those on an eye chart more clearly, even when other symbols crowded in."

Post-experimental Measures

Intergroup threat appraisals

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Researchers who study video game effects try to limit our personal freedom.
2. Researchers who study video game effects seem to want to change the way I view the world.
3. Researchers who study video game effects regard themselves as morally superior to other people.
4. Too much money is spent on research grants that benefit researchers who study video game effects.
5. Researchers who study video game effects have more political power than they deserve in this country.
6. Researchers who study video game effects pose a threat to video game players' public image.
7. Researchers who study video game effects cause video game players to be stigmatized.

Research summary and evaluations

"In an experiment conducted by Craig Anderson and colleagues participants were randomly assigned to one of two conditions. In one condition participants played a violent video game. Participants in the other condition played a non-violent video game. After playing the video game all participants were asked to participate in a reaction time task in which they competed (ostensibly) against an opponent seated in another room. Whenever participants won a round, they had the opportunity to punish the opponent. The punishment consisted of a very unpleasant noise; participants were asked to calibrate the sound's duration and its volume; these settings served as measures of participants' aggressive tendencies. Comparing the average duration and volume settings between the two conditions showed that those who had played the violent video game reacted more aggressively than those who played the non-violent video game. The authors of the study concluded that consuming violent video games leads to an increase in aggression. The authors stated that violent video games provide a forum for learning and practicing aggressive reactions."

1. These researchers seem biased.
2. I was insulted by the findings of this study
3. This kind of research is not very meaningful.
4. These researchers are not very competent.
5. These researchers just find what they want to find.
6. This research yielded reliable results. - Reverse coded
7. This research yielded important results. - Reverse coded
8. The results of this research can be meaningfully applied to real-life contexts. - Reverse coded
9. I was outraged when I read the summary of the study.

Educational history

1. What is the highest level of education you finished?

Grammar School

High School or equivalent

Vocational/Technical School (2 year)

Some College

College Graduate (4 year)

Master's Degree (MS, MA)

Doctoral Degree (PhD)

Professional Degree (MD, JD, etc.)

Other

2. How many research methods courses have you taken? ____

3. How many statistics courses have you taken?___

Debriefing

1. What did you think of the study?

2. Were you confused by any of the tasks or instructions? YES NO

If Answered Yes, Please Ask Participant to Elaborate:

APPENDIX 2C: MATERIALS FOR STUDY 2C

Pre-experimental Measures

Beliefs about "controversial" scientific topics

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Violent video games increase aggressive behavior.
2. Violent video games increase aggressive thoughts and feelings.
3. Human CO2 emissions cause climate change.
4. Capital punishment helps prevent crime.
5. We must have capital punishment for some crimes.
6. Climate change is a hoax.
7. Vaccinations are dangerous and should be avoided.
8. Vaccinations are safe and useful.
9. Sexual orientation is a person's choice.
10. Sexual orientation is largely biologically predetermined.
11. I support evolutionary theory.
12. God created humans in their present form

Social identification

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

I see myself as a video game player.

I feel strong ties with fellow video game players.

I identify with other video game players.

When I talk about video game players, I usually say "we" rather than "they."

Demographics

4. What is your gender?

5. What is your current age in years?

6. What is your political identity?

A. Strongly conservative

B. Moderately conservative

C. Slightly conservative

D. Neutral

E. Slightly liberal

F. Moderately liberal

G. Strongly liberal

4. What is your religious affiliation?

A. Non religious/Secular B. Christianity C. Judaism D. Islam

E. Buddhism F. Hinduism G. Spiritualism H. Agnostic I. Atheists J. Other:

Experimental Conditions

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"My colleagues and I found that typical college students who played violent video games for 20 minutes at a time for three consecutive days showed increasingly higher levels of aggressive behavior each day they played. If that's what happens to typical college students, how might someone like Alexis react to playing for 16 straight hours? What if he does this for months or years?

Other researchers have found similar results. My colleagues and I conducted a comprehensive review of 136 articles reporting 381 effects involving over 130,000 participants around the world. These studies show that violent video games increase aggressive thoughts, angry feelings, physiological arousal (e.g., heart rate, blood pressure), and aggressive behavior. Violent games also decrease helping behavior and feelings of empathy for others. The effects occurred for males and females of all ages, regardless of what country they lived in."

Bushman goes on to say that, while specific details on the Alexis case have not been revealed, the video game connection fits in with other mass shooters:

"Despite the evidence, many people still deny violent media effects for a variety of reasons that I summarized in a Psychology Today piece.

Alexis was not the first mass killer to have an obsession with violent video games. Adam Lanza, who killed 26 children in an elementary school in Newtown, Connecticut, was also said to be a fan of first-person shooting games. Other killers have been found to be avid players.

The effects of these games go beyond making players more aggressive. In our research, we found that people who played first-person shooting games were more accurate than others when firing a realistic gun at a mannequin -- and more likely to aim for and hit the head."

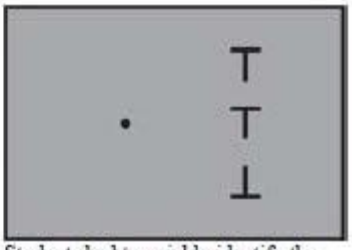
Low intergroup threat article:

Action Video Games Sharpen Vision 20 Percent

February 6, 2007 Tweet 9 Like 121 2

'Daphne Bavelier and Shawn Green (CREDIT University of Rochester)'

Video games that contain high levels of action, such as Unreal Tournament, can actually improve your vision.



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Post-experimental Measures

Intergroup threat appraisals

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Researchers who study video game effects threaten our personal rights.
2. Researchers who study video game effects seem to want to change the way I view the world.
3. Researchers who study video game effects regard themselves as morally superior to other people.
4. Video game players and researchers who study video game effects have very different values.
5. Too much money is spent on research grants that benefit researchers who study video game effects.
6. Researchers who study video game effects have more political power than they deserve in this country.
7. Researchers who study video game effects cause video game players to be stigmatized.
8. Researchers who study video game effects cause video game players to be vilified.

Anger towards researchers

To what extent do you feel _____ towards the researchers who conducted the study? (on a scale from 1 “Not at all” to 7 “Extremely”)

Angry

Hostile

Furious

Irritated

Signing anti-science petitions

(1) Anti-science petition:

Petition for Decreased Federal Funding for Violent Video Game Effects Research

We, as professionals, students, researchers and interested citizens, write to ask the federal government to decrease research funding for research examining violent video game effects. Please consider this as you seek to address our nation's pressing fiscal challenges.

Name: _____

ZIP code: _____

Would you like us to forward an invitation to your friends to participate in this petition?

If yes, enter e-mail contacts:

_____

(2) Pro-science petition

Petition for Increased Federal Funding for Violent Video Game Effects Research

We, as professionals, students, researchers and interested citizens, write to ask the federal government to decrease research funding for research examining violent video game effects. Please consider this as you seek to address our nation's pressing fiscal challenges.

Name: _____

ZIP code: _____

Would you like us to forward an invitation to your friends to participate in this petition?

If yes, enter e-mail contacts:

_____

Educational history

1. What is the highest level of education you finished?

Grammar School

High School or equivalent

Vocational/Technical School (2 year)

Some College

College Graduate (4 year)

Master's Degree (MS, MA)

Doctoral Degree (PhD)

Professional Degree (MD, JD, etc.)

Other

2. How many research methods courses have you taken? ____

3. How many statistics courses have you taken?___

Debriefing

1. What did you think of the study?

2. Were you confused by any of the tasks or instructions? YES NO

If Answered Yes, Please Ask Participant to Elaborate:

APPENDIX 3: MATERIALS FOR STUDY 3

Pre-experimental Measures

Beliefs about "controversial" scientific topics

Please rate the following items on a scale from 1 (Strongly disagree) to 7 (Strongly agree).

1. Violent video games increase aggressive behavior.
2. Violent video games increase aggressive thoughts and feelings.
3. Human CO2 emissions cause climate change.
4. Capital punishment helps prevent crime.
5. We must have capital punishment for some crimes.
6. Climate change is a hoax.
7. Vaccinations are dangerous and should be avoided.
8. Vaccinations are safe and useful.
9. Sexual orientation is a person's choice.
10. Sexual orientation is largely biologically predetermined.
11. I support evolutionary theory.
12. God created humans in their present form

Social Identification

1. I see myself as a video game player.
2. I feel strong ties with fellow video game players.
3. I identify with other video game players.
4. When I talk about video game players, I usually say "we" rather than "they."
5. In general, video games are an important part of my self-image.

Demographics

4. What is your gender?

5. What is your current age in years?

6. What is your political identity?

A. Strongly conservative

B. Moderately conservative

C. Slightly conservative

D. Neutral

E. Slightly liberal

F. Moderately liberal

G. Strongly liberal

4. What is your religious affiliation?

A. Non religious/Secular B. Christianity C. Judaism D. Islam

E. Buddhism F. Hinduism G. Spiritualism H. Agnostic I. Atheists J. Other:

Experimental Manipulation - Headlines

Violent video games increase aggression		
	For	**Against**
1	“Video games can spark aggression”	“In Defense of Violent Video Games: As sales of violent video games have gone up, real-world violence has decreased”
2	“Violent video games teach children aggressive thought and behavior patterns”	"Violent Video Games Do Not Make People More Violent in Real Life"
3	"Violent Video Games Make Children Aggressive: New Study"	"Video game violence does not create aggressive behavior"
4	"Life lessons: Children learn aggressive ways of thinking and behaving from violent video games, study finds"	"Violent Video Games Do Not Make Young People Aggressive"
5	"Practice makes perfect: Children who repeatedly play violent video games show increased aggressive thinking and behavior"	"Video Games Don’t Make Kids Violent"
6	"Video games and aggressive behavior in kids are linked"	"Games Definitely Don't Harm Kids, Says Study Folowing 11,000 Kids for a Decade."
7	"Video games incite violence"	"Violent video games such as Grand Theft Auto DON'T harm children - and could actually be therapeutic"
8	“Long-term study finds video games linked to aggressive behaviour in children”	"Video Games Don't Cause Children to be Violent - US News"
9	"New study links violent video games and aggression"	"In Defense of Violent Video Games: Virtual violence does not increase aggression"
10	“Claim: Children learn aggressive ways of thinking and behaving from violent video games”	"Video Games Don't Make Teens Violent, Shows Study"
11	"Little by little, violent video games make us more aggressive"	"Research Shows Violent Media Do Not Cause Violent Behavior: Research Findings and Tips for Parents"
12	"Video games can spark aggression"	"Do Games Like 'Grand Theft Auto V' Cause Real-World Violence? No"
13	“Violent video games makes children grow up into aggressive adults, study claims”	"Video game violence does not create aggressive behavior"
14	"'Training simulation:' Mass killers often share obsession with violent video games"	"Playing violent video games is not harmful to children"
15	"Study: Violent video games could be linked to aggressive behavior"	"Claims that 'video games lead to violence' disproved"
16	“Science is clear, violent video games cause aggression”	"Yet more proof that violent videogames don't cause aggression"

Post-experimental Measures

Intergroup strength appraisals

Overall, current opinion is in favor of which conclusion?

Rated on a scale from 1 "Public opinion is in favor of the conclusion that violent video games do NOT cause aggression" to 7 "Public opinion is in favor of the conclusion that violent video games DO cause aggression."

Intergroup threat appraisals

Please rate the researchers who conducted the study on the following dimensions (on a scale from 1 "Not at all" to 7 "Extremely").

Competent

Threatening

Good-natured

Research summary

"In an experiment conducted by Craig Anderson and colleagues participants were randomly assigned to one of two conditions. In one condition participants played a violent video game. Participants in the other condition played a non-violent video game. After playing the video game all participants were asked to participate in a reaction time task in which they competed (ostensibly) against an opponent seated in another room. Whenever participants won a round, they had the opportunity to punish the opponent. The punishment consisted of a very unpleasant noise; participants were asked to calibrate the sound's duration and its volume; these settings served as measures of participants' aggressive tendencies. Comparing the average duration and volume settings between the two conditions showed that those who had played the violent video game reacted more aggressively than those who played the non-violent video game. The authors of the study concluded that consuming violent video games leads to an increase in aggression. The authors stated that violent video games provide a forum for learning and practicing aggressive reactions."

Research summary evaluations

Overall quality of the research:

This research yielded reliable results (Reverse coded)

This research yielded important results (Reverse coded)

This kind of research is not very meaningful.

Bias exhibited by researchers:

These researchers seem biased.

These researchers are not very competent.

These researchers just find what they want to find.

Emotions towards researchers

To what extent do you feel _____ towards the researchers who conducted the study? (on a scale from 1 “Not at all” to 7 “Extremely”)

Admiration

Respect

Trust

Dislike

Distrust

Uneasy

**Hostile

**Angry

**Furious

**Irritated

Disgusted

Threatened

Fearful

Afraid

** Anger subscale items.

Signing anti-science petitions

(3) Anti-science petition:

Petition for Decreased Federal Funding for Violent Video Game Effects Research

We, as professionals, students, researchers and interested citizens, write to ask the federal government to decrease research funding for research examining violent video game effects. Please consider this as you seek to address our nation's pressing fiscal challenges.

Name: _____

ZIP code: _____

Would you like us to forward an invitation to your friends to participate in this petition?

If yes, enter e-mail contacts:

_____

(4) Pro-science petition

Petition for Increased Federal Funding for Violent Video Game Effects Research

We, as professionals, students, researchers and interested citizens, write to ask the federal government to decrease research funding for research examining violent video game effects. Please consider this as you seek to address our nation's pressing fiscal challenges.

Name: _____

ZIP code: _____

Would you like us to forward an invitation to your friends to participate in this petition?

If yes, enter e-mail contacts:

_____

Educational history

1. What is the highest level of education you finished?

Grammar School

High School or equivalent

Vocational/Technical School (2 year)

Some College

College Graduate (4 year)

Master's Degree (MS, MA)

Doctoral Degree (PhD)

Professional Degree (MD, JD, etc.)

Other

2. How many research methods courses have you taken? ____

3. How many statistics courses have you taken?___

Debriefing

1. What did you think of the study?

2. Were you confused by any of the tasks or instructions? YES NO

If Answered Yes, Please Ask Participant to Elaborate:

APPENDIX 4: SUPPLEMENTAL INFORMATION

Table 5.1. Bivariate correlations between main measures in Study 1.

A. Study 1A (N =103)

		M	*SD*	1	2	3	4
1.	Research evaluations	3.32	1.27	-			
2.	Initial beliefs	3.42	1.79	.75**	-		
3.	Social identification	4.10	1.44	.36**	.49**	-	
4.	Sex	1.68	0.49	.04	-.07	-.15	-
5.	Education	7.59	1.42	.15	.20*	-.02	-.22*

B. Study 1B (N = 356)

		M	*SD*	1	2	3	4
1.	Research evaluations	1.62	0.50	-			
2.	Initial beliefs	1.25	0.60	.41**	-		
3.	Social identification	4.52	1.25	.10*	.11*	-	
4.	Sex	1.61	0.52	.05	.01	-.12*	-
5.	Education	7.55	1.48	.03	-.01	.07	-.02

C. Study 1C (N = 197)

		M	*SD*	1	2	3	4
1.	Social identity priming	3.06	0.92	-			
2.	Initial beliefs	5.34	1.40	.37**	-		
3.	Social identification	3.79	1.72	.15*	.28**	-	
4.	Sex	1.77	0.47	-.03	.18*	.12	-
5.	Education	7.20	1.53	-.13	-.26**	-.21**	-.01

* $p < .05$, ** $p < .01$.

Table 5.2. Bivariate correlations between main measures in Study 2B and 2C.

A. Study 2B (N = 123)

		M	*SD*	1	2	3	4
1.	Research evaluations	3.59	1.08	-			
2.	Initial beliefs	5.19	1.40	.54**	-		
3.	Social identification	4.29	1.50	.22**	.13	-	
4.	Sex	1.82	0.46	-.01	-.03	.00	-
5.	Education	7.17	1.74	-.06	-.04	.02	.02

B. Study 2C (N = 180)

		M	*SD*	1	2	3	4	5	6
1.	Perceived intergroup threat	2.66	1.20	-					
2.	Anger towards researchers	2.82	1.35	.72**	-				
3.	Signing anti-science petitions	-0.05	0.48	.37**	.39**	-			
4.	Initial beliefs	5.50	1.45	.00	-.02	.13	-		
5.	Social identification	4.33	1.56	.31**	.35**	.07	.28**	-	
6.	Sex	1.83	0.46	.27**	.26**	.04	.12	.22**	-
7.	Education	6.73	1.65	-.25**	-.29**	-.24**	-.05	-.19*	-.12

* $p < .05$, ** $p < .01$.

Table 5.3. Bivariate correlations between main measures in Study 3 (N = 298).

	M	*SD*	1	2	3	4	5	6	7
1. Perceived intergroup threat	2.35	1.84	-						
2. Research evaluations	3.38	1.40	.16**	-					
3. Anger towards researchers	2.58	1.73	.88**	-.03	-				
4. Signing anti-science petitions	0.65	1.09	.44**	-.07	.53**	-			
5. Initial beliefs	4.26	1.92	-.19**	.67**	-.11	-.14*	-		
6. Social identification	3.75	1.93	.43**	-.06	.48**	.37**	.05	-	
7. Sex	1.54	0.50	.08	.22**	.06	-.01	.15*	.17**	-
8. Education	7.67	1.21	.10	-.08	.08	.00	-.09	.01	-.21

* $p < .05$, ** $p < .01$.