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## The interplay between progressivism and logical fallacy: implications for climate change communications

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## PAPER

## The interplay between progressivism and logical fallacy: implications for climate change communications

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E-mail: [csatir@akdeniz.edu.tr](mailto:csatir@akdeniz.edu.tr)**Keywords:** moral foundations theory, political ideology, logical fallacies, climate change communication, misinformation**Abstract**

The spread of fake news and the influence of moral reasoning on public opinion present significant challenges in climate change communication. This study examines how the ideological underpinnings of conservatism and liberalism, combined with logical fallacies and fake news, shape public perceptions of climate change. Using the Moral Foundations Questionnaire (MFQ), and a quantitative online survey of 288 participants, we assess whether individuals identified as liberal or conservative are more prone to accept flawed reasoning. Results show that conservatives are significantly more susceptible to a broader range of logical fallacies, including emotional manipulation, appeals to authority, and oversimplified arguments—patterns commonly associated with fallacies such as Argumentum ad hominem, Straw Man, and Tu quoque. Meanwhile, liberals, though less vulnerable overall, are particularly influenced by specific fallacies which align with their moral focus on harm and fairness. The findings offer new insights into the intersection of moral psychology, political ideology, and misinformation, with practical implications for designing ideologically tailored climate change messages.

**1. Introduction**

The spread of fake news and the influence of logical fallacies on public opinion are critical issues facing the challenges of climate change communication. Fake news often exploits cognitive biases and moral intuitions, making it difficult for individuals to distinguish credible and misinformation (Arin *et al* 2023). Moreover, fallacies, errors in reasoning, are commonly used in misinformation to provoke emotional responses or falsely validate claims. When embedded in fake news, these fallacies can appear persuasive while bypassing critical reasoning. In addition, individuals often rely on intuitive moral judgments rather than deliberate analysis when assessing climate-related arguments. This makes moral reasoning a critical factor in how people process climate information—especially when that information is framed in ideologically charged or emotionally evocative ways. Thus, these individuals are more likely to accept fallacious claims which align with their underlying moral values, even when the logic is flawed.

To comprehend this phenomenon, this study draws on the Moral Foundations Theory (MFT) (Haidt and Joseph 2004), which categorizes moral intuitions into five core foundations: harm, fairness, in-group loyalty, authority, and purity (Graham *et al* 2011). This theoretical framework allows researchers to quantitatively assess the moral foundations that underline individuals' attitudes toward climate change and eco-activists. In the context of climate change, MFT has been used to analyze the rhetoric employed by different media outlets. Researchers (Dickinson *et al* 2016) found that compassion and fairness unlike purity were strong predictors of willingness to act on climate change in the United States. This suggests that moral foundations related to care and fairness are particularly effective in motivating climate action (Dickinson *et al* 2016). Similarly, Sagi *et al* (2015) employed MFT to analyze how media outlets with different ideological leanings emphasize distinct moral

values in their climate change coverage. They highlight the presence of moral framing in political communication, indicating a potential connection between moral appeals and ideological resonance with audiences. As MFT research shows, these moral foundations are not randomly distributed. They are further complicated by the ideological underpinnings of conservatism and liberalism, posited within the scope of MFT, which shapes how different groups perceive and respond to environmental concerns. MFT asserts that conservatism, with its emphasis on social justice and collective responsibility, often frames climate change as a moral imperative that requires immediate action. On the other hand, liberalism may approach environmental issues with a focus on individual freedom and market-based solutions. Noting that this ideological divide grounded in MFT may differ from national political categorizations as those in the United States of America or Europe, it is deemed possible to state that it contributes to different interpretations of climate narratives, risk perceptions, and proposed solutions.

Although prior research has examined moral foundations and climate attitudes, few studies have integrated these frameworks. Thus, this study addresses this gap by examining how these ideological perspectives defined through MFT interact with moral foundations and predict susceptibility to various logical fallacies in the context of climate change. By employing the quantitative correlational design through the Moral Foundations Questionnaire, a tool based on Jonathan Haidt's MFT (Haidt and Joseph 2004) and a quantitative survey of 288 participants, this paper analyzes whether liberals and conservatives differ in their endorsement of specific fallacies. Its goal is to provide actionable insights for climate change communication that account for both ideological orientation and reasoning vulnerabilities, informing the development of more resilient public messaging strategies.

In sum, this research investigates the intricate relationship between moral foundations, fallacies, and ideological influences in shaping public perceptions of climate change. By employing a survey-based quantitative methodology utilizing correlation analysis, we aim to provide a deeper understanding of how these factors converge to influence individuals' moral reasoning and attitudes, and to offer valuable insights into the broader challenges of environmental communication and public engagement.

## 2. Literature review

Moral Foundations Theory (MFT), developed by Jonathan Haidt and his colleagues, provides a framework for understanding various moral intuitions that guide human behavior and social attitudes. The theory posits that moral reasoning is not a singular, universal process, but is rooted in multiple distinct moral foundations. These foundational mechanisms are believed to be innate psychological mechanisms that evolved to address specific adaptive challenges in human social life (Graham *et al* 2011). The six primary dimensions of Moral Foundations Theory (MFT) are Care/Harm, Fairness/Cheating, Loyalty/Betrayal, Authority/Subversion, Sanctity/Degradation, and Liberty/Oppression (Haidt and Joseph 2011). However, it should be noted here that the Moral Foundations Questionnaire (MFQ) which is developed as a tool to measure the dimensions of MFT in research context does not capture the Liberty/Oppression dimension, thus leaving only five dimensions.

The Care/Harm foundation is centered around the moral imperative to care for others, particularly the vulnerable and those in need. It is closely related to empathy, compassion, and prevention of harm. This foundation is likely to have evolved from the need to protect offspring and other vulnerable group members and foster social bonds and cooperative behaviors. The authors (Jansson and Dorrepaal 2015) found that the Care/Harm dimension is strongly associated with personal norms for dealing with climate change, suggesting that individuals who prioritize care are more likely to adopt pro-environmental behaviors (Jansson and Dorrepaal 2015). The foundation of fairness and cheating concerns principles of justice, rights, and equality. This reflects the moral expectation that individuals should be treated equitably and that cheating, exploitation, and dishonesty are wrong. This foundation is crucial for maintaining cooperation and trust within groups. The foundation of Loyalty/Betrayal emphasizes the importance of loyalty to one's group, family, or nation. It values patriotism, group solidarity, and the moral condemnation of betrayal. This foundation evolved to foster group cohesion and collective action in the face of external threats. Research has revealed that loyalty is strongly associated with political and social attitudes, particularly in the context of nationalism and group identity. For instance, loyalty is found to play a significant role in feelings of pride and shame regarding one's country (Sychev and Nestik 2022). The Authority/Subversion foundation relates to respect for tradition, leadership, and social hierarchy. It values social order, stability, and the legitimate authority of leaders. This foundation is believed to have evolved to maintain social structures and ensure group coordination. Authority is a critical factor in moral reasoning that influences national pride and social behavior (Sychev and Nestik 2022). The foundation of Sanctity and Degradation involves moral beliefs about purity, sacredness, and contamination. It is associated with religious and cultural norms that dictate what is considered pure or impure, both physically and morally. This foundation may have evolved from the need to avoid disease and to maintain the sanctity of the body and

social practices. The research by Grey and Keeney challenged the distinctiveness of the Sanctity foundation, suggesting that it may overlap significantly with concerns about harm, indicating that purity might be more of a descriptive label than a unique moral content (Gray and Keeney 2015).

The theory has been applied to many debated issues. In the context of climate change, MFT has been used to analyze the rhetoric employed by different media outlets. A study by Sagi *et al* (2015) examined how moral rhetoric about climate change differs based on a publication's perceived ideological lean. Their research utilized Haidt's MFT to describe how climate change coverage in ideologically distinct media outlets reflects different moral emphases. While this study did not measure persuasive effects, it illustrates how these moral foundations are embedded in political discourse—suggesting a potential link between ideological framing and audience alignment. Additionally, research by Dickinson *et al* (2016) found that compassion and fairness were strong predictors of willingness to act on climate change in the United States, while purity was not found to be a significant predictor. This suggests that moral foundations related to care and fairness are particularly effective in motivating climate action.

### 3. Fallacies in reasoning and fake news

The proliferation of fake news has become a critical issue in contemporary society, significantly impacting public trust in media and influencing political, social, and health-related outcomes (Farkas and Schou 2018). Fallacies, or errors in reasoning, play a central role in the dissemination and acceptance of fake news, making it essential to understand its dimensions and effects. Fallacies are errors in reasoning that undermine the logical integrity of an argument (Teneva 2023). These flawed arguments often lead to incorrect conclusions. They can be categorized as logical and rhetorical fallacies.

Logical fallacies are systematic errors in reasoning that undermine the logic of an argument. These include ad hominem attacks, strawman arguments, false dilemmas, slippery slopes, and appeals to authority. Logical fallacies are often employed in fake news to manipulate public opinion and obscure truths. Logical fallacies are particularly effective in the post-truth era, where emotional appeals often outweigh factual accuracy in shaping public perceptions (Vasileva 2018). These fallacies exploit cognitive biases, leading individuals to accept information that aligns with their pre-existing beliefs, even when it is logically flawed. In addition to the logical fallacies, rhetorical fallacies are also noteworthy in the context of fake news. Rhetorical fallacies involve the use of persuasive language and techniques to mislead audiences. These include the use of emotionally charged language, loaded questions, and misleading comparisons. Rhetorical fallacies are common in fake news, where the goal is often to provoke an emotional response rather than to present a logical argument. It is highlighted how fake news often utilizes rhetorical strategies to embed itself within ideological echo chambers, making it difficult for individuals to critically assess the validity of the information (Morales *et al* 2023).

Aristotle, an ancient Greek philosopher, was among the first to systematically categorize and analyze logical fallacies, including 'ad hominem', 'appeal to emotion', 'circular reasoning', 'false dilemma', and 'appeal to authority' (Krabbe 2012, Hasper 2013). Before examining the interplay between fallacies and fake news, it is crucial to address some logical fallacies addressed in the operationalization of the research instruments, rather than providing an exhaustive taxonomy. One of the fallacies is the ad hominem fallacy, which involves attacking the person making an argument rather than the argument itself, which has its roots in Aristotelian rhetoric. Aristotle identified the ad hominem fallacy as a form of *argumentum ad personam*, in which the focus shifts from the argument to the individual. This fallacy is prevalent in political and social debates in contemporary discourse. Hidayat *et al* (2020) found that ad hominem attacks were frequently used in social media debates among Indonesian political figures, reflecting the enduring relevance of Aristotelian logic in understanding modern argumentation. Described as ethos-based fallacies, *argumentum ad antiquitatem* (appeal to tradition) legitimizes a claim by citing its historical precedent. Similarly, *argumentum ad populum* and *argumentum ad numerum* both serve as ethos-based fallacies and derive truth from popularity. While the former is based on collective belief, the latter finds power in numerical consensus. One of the other fallacies addressed is circular reasoning. Circular reasoning, or *petitio principia*, occurs when an argument's conclusion is assumed from its premises. Aristotle identified this fallacy as a form of begging the question, in which the argument does not advance because it merely restates the initial assumption. Furthermore, Aristotle recognized the power of emotional appeals, or *pathos*, in rhetoric but he also warned against their misuse as fallacies. The appeal to emotion is a rhetorical strategy that seeks to persuade by eliciting strong emotional responses rather than presenting logical arguments. This highlights the enduring relevance of Aristotle's teachings on the ethical use of emotion in argumentation. Another appeal-related fallacy, *argumentum ad verecundum*, relies on the opinion of an authority figure rather than presenting substantive evidence. Aristotle recognized the importance of expertise but warned against accepting arguments based solely on authority without critical examination. Other fallacies like *tu quoque* ('you too') and red herring shift attention away from the core issue, derailing discussions

and muddying public understanding. While tu quoque fallacy attempts to defend the problems with one's own argument by pointing out that the other side made the same mistakes, the latter is an overt attempt to disrupt an opponent's argument by introducing a counter argument that is not strictly related to the original. Another logos-based fallacy is appeal to nature, which asserts that what is 'natural' is inherently good or correct. In the same vein, post hoc ergo propter hoc and Cum hoc ergo propter hoc falsely infer causality from temporal or correlational proximity, such as blaming cold winters on disproving global warming. Dicto simpliciter (sweeping generalization) is another logos-based fallacy, which applies to a broad claim to all cases. Other logos-based fallacies are Straw Man, slippery slope, argumentum ad ignorantiam, argumentum ad logicam, non sequitur, and naturalistic fallacy. While Straw Man distorts an argument to make it easier to attack, slippery slope warns of exaggerated consequences without evidence. Furthermore, argumentum ad ignorantiam claims truth from lack of disproof whereas argumentum ad logicam argues that a failed defense invalidates the claim. Another logos-based fallacy named non sequitur concludes something unrelated to the premise, while naturalistic fallacy draws normative conclusions from factual statements.

The interplay between moral foundation theory and fallacies is particularly relevant in the context of fake news about climate change. When individuals encounter information that aligns with their moral foundations, they may be more likely to accept it uncritically even if it is fallacious. It is hypothesized that this tendency is compounded by the echo chambers created by social media algorithms, which reinforce existing beliefs and make it more difficult for individuals to engage with opposing viewpoints.

#### 4. Conservatism, liberalism, and climate change communication

Conservatism is described as emphasizing social justice and governmental intervention, while liberalism prioritizes individual freedom and market approaches. Research suggests liberalism has become more dominant in left-wing climate discourse. Interestingly, conservatives are more supportive of climate policies when they are framed as moral obligations, with conservative media increasingly using rhetoric focused on care, fairness, and harm (Fennewald and Phelps 2019).

Liberals generally exhibit greater concern for climate change than conservatives (Dunlap *et al* 2001) and are more inclined to endorse pro-environmental policies (Stollwerk 2022). This difference could be attributed to the traditional reliance on liberal rhetoric in climate change communication (Hart and Nisbet 2012), which predominantly focuses on the moral foundations of care and fairness rather than on binding moral foundations. For instance, climate messaging often highlights the direct and indirect health consequences of climate change (care/harm) and its potential impact on future generations (fairness/cheating). In contrast, conservatives are less likely to perceive climate change as a significant harm or injustice than liberals (Clayton *et al* 2013), and these moral appeals may even provoke backlash among conservative audiences (Ditto and Koleva 2011). The moral distinctions between conservatives and liberals suggest that conventional climate change communication strategies often fail to resonate with conservative audiences. While conservatives are willing to take climate action, the messaging must align with their specific moral values. However, this poses a challenge for climate communicators because their audiences are not purely liberal or conservative. A significant research by Wolsko *et al* (2016) demonstrated that conservatives respond more favorable to climate messages framed using binding moral foundations (loyalty, authority, purity), leading to greater pro-environmental intentions, attitudes, and donations. In contrast, liberals maintained strong environmental support regardless of framing, likely because they already view climate change as a moral issue. This suggests that individualizing moral appeals (e.g., harm, fairness) are effective with liberals, while binding appeals may better engage conservative audiences.

### 5. Methodology

#### 5.1. Research design

This paper employs a quantitative correlational design to explore the relationship between the tendency to accept logical fallacies about climate change and political ideology. Correlational design is appropriate because the study aims to assess the strength and direction of associations between variables without manipulating them. The political ideology is explored using Moral Foundations theory (MFT) (Haidt 2012), which suggests that moral reasoning based on an innate, modular foundation correlates with political ideologies.

Participants' political orientation was assessed on a liberal-conservative continuum. While these labels may hold different political meanings in national contexts, the current study focuses on ideological dimensions derived from MFT rather than partisan identity. In this study, the terms 'conservative' and 'liberal' were used in accordance with Moral Foundations Theory (MFT), which conceptualizes these ideologies not only as political affiliations but also as distinct moral frameworks. Conservatism, within this framework, tends to emphasize values such as authority, loyalty, and purity, whereas liberalism emphasizes harm prevention and fairness. It is

Table 1. Demographics.

		Frequency	Percent	Valid percent	Cumulative percent
<b>Gender</b>					
Valid	99	1	3	3	3
	Binary	1	3	3	7
	Female	182	63,2	63,2	63,9
	Male	104	36,1	36,1	100,0
	Total	288	100,0	100,0	
<b>Education</b>					
Valid	99	22	7,6	7,6	7,6
	Associate's Degree	4	1,4	1,4	9,0
	Bachelor's Degree	139	48,3	48,3	57,3
	Doctorate	8	2,8	2,8	60,1
	High School	67	23,3	23,3	83,3
	Master's Degree	28	9,7	9,7	93,1
	Middle School	9	3,1	3,1	96,2
	Primary School	11	3,8	3,8	100,0
	Total	288	100,0	100,0	
<b>Average monthly household income</b>					
Valid	Missing	10	3,5	3,5	3,5
	Between 1 and 2 times the minimum wage	61	21,2	21,2	24,7
	Between 2 and 3 times the minimum wage	67	23,3	23,3	47,9
	Between 3 and 4 times the minimum wage	57	19,8	19,8	67,7
	Between 4 and 5 times the minimum wage	22	7,6	7,6	75,3
	Less than the minimum wage	22	7,6	7,6	83,0
	More than 5 times the minimum wage	49	17,0	17,0	100,0
	Total	288	100,0	100,0	
<b>Age</b>					
N	Valid	279			
	Missing	9			
Mean	39				
Std. Deviation	14,525				

important to note that while these moral orientations align with broad ideological patterns, the specific meanings of 'conservative' and 'liberal' vary across national contexts. For instance, in the United States, conservatism often implies resistance to governmental intervention and support for free-market policies, whereas in some countries—in our case Türkiye, it may include a stronger emphasis on social cohesion, traditionalism, or national values. Therefore, our analysis focuses on moral dimensions of ideology rather than fixed party affiliations or country-specific definitions, while acknowledging these cultural distinctions.

## 5.2. Demographics

The target population of this study includes individuals who use social media in Türkiye. Data was collected using Turkish online questionnaire form in Türkiye. The online questionnaire link was shared on social media platforms, inviting voluntary participation in the study. Consequently, the sampling method employed is non-probabilistic convenience sampling. A total of 326 participants were involved in the study; however, after data cleaning, the sample consisted of 288 participants (table 1).

Post hoc power analysis was conducted to determine the minimum required sample size for detecting a statistically significant correlation using a two-tailed test with the following parameters:

Significance level ( $\alpha$ ) = 0.05 (Type I error rate)

Statistical power ( $1 - \beta$ ) = 0.80 (Type II error rate  $\beta$  = 0.20)

Expected effect size (correlation coefficient):  $r = 0.20$

Thus, a minimum of 194 participants is required to detect a correlation of  $r = 0.20$  with 80% power at a 5% significance level. In the present study, the total sample size was 288, which exceeds the required threshold.

To confirm the adequacy of the sample size, a post hoc power analysis was conducted using G\*Power (version 3.1.9.7). The analysis was based on the exact method and specified the statistical test as Correlation: Bivariate normal model (two-tailed) with the following parameters:

Effect size ( $H_1$ ):  $r = 0.20$

Alpha error probability ( $\alpha$ ): 0.05

Total sample size: 288

The analysis yielded an achieved power of 92.9%, indicating a high probability of correctly rejecting the null hypothesis when the alternative hypothesis is true. This level of power exceeds the conventional threshold of 80%, further validating the adequacy of the sample size for detecting the expected effect.

The final sample included 192 females (63, 2%) and 104 males (36, 1%), 1 binary (%0, 3) and 1 missing. The minimum age reported by the participants was 13, and the maximum was 75, with an average age of 39 years ( $sd = 14.525$ ). Participants were from diverse education levels, with the majority enrolled in the bachelor's degree (%48, 3), followed by High School (%23, 3), Masters' Degree (%9, 7), Primary School (3, 85), Middle School (3, 1%), Doctorate (2, 8%), and associate's degree (1, 4%), and 7, 6% missing. 7, 6% of the participants' average monthly household income was below the minimum wage, 21, 2% was between 1 to 2 times the minimum wage, 23, 3% was between 2 to 3 times the minimum wage, 19, 8% is between 3 to 4 times the minimum wage, 7, 6% is between 4 to 5 times the minimum wage, 17% was more than 5 times the minimum wage, and 3.5% was missing. The minimum wage in Türkiye is determined by the government and uniform for all country.

### 5.3. Materials/instruments

Data were collected using a self-administered online survey consisting of three sections: The first section captures the level of the tendency to accept logical fallacies about the climate change problem (Fallacy of Emotion, Argumentum ad hominem, Argumentum ad verecundiam, Argumentum ad antiquitatum, Argumentum ad populum, Argumentum ad numerum, Tu quoque, Appeal to nature, Fallacies of Logic, Cum hoc ergo propter hoc, Circulus in demonstrando, Dicto Simpliciter, Straw man, Slippery slope, Argumentum ad ad ignorantiam, Argumentum ad logicam, Non sequitur, Red Herring, Naturalistic fallacy, and Petitio principii). The 20 commonly found fallacies in the media today that propagate fear, blind faith, and submission in persuasive speech were adopted to present the issue of climate change. In the study, a single statement was utilized for each fallacy to measure participant responses. The statements were developed based on widely recognized definitions and examples of logical fallacies in existing literature. The statements were crafted to reflect the core characteristics of each fallacy, as described by sources such as Aristotle's classical categorization and contemporary studies on logical reasoning. This process was carried out by a team of six researchers, all specializing in communication studies. Their expertise ensured that the statements were both conceptually accurate and relevant for the study's context. The logical fallacies presented in the study were deliberately selected to reflect a diverse range of arguments commonly encountered in climate change discourse, including those resonating with both liberal and conservative ideologies. For example, arguments such as 'Solar energy is free; we should install solar panels on our roofs' may align more closely with liberal perspectives, while others like 'Environmentalists claim that global warming has reached dangerous levels and urgent measures need to be taken, but they themselves are driving SUVs?' critique behaviors often attributed to environmentalist movements, which might align with conservative skepticism. This diversity aims to ensure a balanced representation and ecological validity by mirroring real-world public debates. The second section employs the 30-item Moral Foundations Questionnaire (MFQ-30), which captures the dimensions of harm, fairness, ingroup loyalty, authority, and purity. MFQ\_30 demonstrated good reliability for all items (Cronbach's  $\alpha = 0.877$ ). The reliability scores for each dimension were as follows: Harm (0.615), Fairness (0.575), Ingroup Loyalty (0.617), Authority (0.690), and Purity (0.583). The reliability estimates in our study are consistent with findings in literature. Graham *et al* (2011) reported Cronbach's alpha coefficients ranging from 0.65 to 0.84 across dimensions, with a mean of 0.73. Similarly, Nilsson and Erlandsson (2015) observed lower reliability estimates, particularly for Harm ( $\alpha = 0.57$ ) and Loyalty ( $\alpha = 0.58$ ), while Fairness, Authority, and Sanctity demonstrated alpha values of 0.66. These results indicate that the observed reliability values in our study align with previously reported patterns and are reflective of the inherent variability in Moral Foundations Questionnaire (MFQ) measures. The third section collected demographic data, such as age, gender, education years, and monthly household income.

### 5.4. Procedure

The study was conducted in 2024. An invitation containing a link to the survey was shared via social media. Participants were informed using an online consent form that their participation was voluntary and that their responses would remain anonymous before they could access the survey. The study was approved by the Ethics Committee of Alanya Alaaddin Keykubat University. Participants were assured that their data would be stored securely and used solely for research purposes (Demir 2025). No identifying information was collected.

### 5.5. Data analysis

Data was analyzed using SPSS software (Version 27). Descriptive statistics were calculated to summarize the demographic characteristics of the sample. Pearson's correlation coefficient was used to examine the relationship between the tendency to accept logical fallacies and political orientation. According to the MFQ theory, liberals favor the dimensions of harm and fairness, whereas conservatives favor the dimensions of ingroup, authority, and purity. First, the arithmetic means of harm and fairness scores were calculated to reach an indicator value representing liberals. In addition, an indicator value representing conservatives was represented by the arithmetic mean of the ingroup, authority, and Purity dimensions. Then, the conservative indicator is subtracted from the liberal indicator, and the difference is called Progressivism, where values closer to 6 represent liberal tendencies, and values closer to 0 represent conservative tendencies. Correlation analysis is employed to investigate the relationship between the tendency to accept a logical fallacy and political orientation (table 2).

Pearson's correlation analysis was conducted (table 2) to investigate the relationship between the tendency to accept a logical fallacy and political ideology. The analysis revealed a significant overall negative correlation between progressivism scores and susceptibility to logical fallacies, indicating that as progressivism increases, the tendency to accept or believe in logical fallacies decreases. This suggests that conservatives are generally more susceptible to accepting logical fallacies than liberals. Further analysis showed statistically significant relationships between progressivism and specific logical fallacies. The correlation analysis suggests statistically significant relationships between Progressivism scores and Logical Fallacy scores namely Argumentum ad hominem ( $p < 0, 01$ ;  $r = -0, 218$ ), Argumentum ad verecundum ( $p < 0, 01$ ;  $r = -, 255$ ), Argumentum ad antiquitatum ( $p < 0, 01$ ;  $r = -0, 183$ ), Argumentum ad populum ( $p < 0, 01$ ;  $r = -0, 248$ ), Argumentum ad numerous ( $p < 0, 01$ ;  $r = -0, 182$ ), Tu quaque ( $p < 0, 01$ ;  $r = -0, 245$ ), Appeal to nature ( $p < 0, 01$ ;  $r = -0, 198$ ), Fallacies of Logic ( $p < 0, 01$ ;  $r = -0, 272$ ), Cum hoc ergo propter hoc ( $p < 0, 01$ ;  $r = -0, 236$ ), Circulus in demonstrandum ( $p < 0, 01$ ;  $r = -0, 171$ ), Dicto Simpliciter ( $p < 0, 01$ ;  $r = -0, 222$ ), Straw man ( $p < 0, 01$ ;  $r = -0, 336$ ), Slippery slope ( $p < 0, 01$ ;  $r = -0, 196$ ), Argumentum ad ad ignorantia ( $p < 0, 01$ ;  $r = -0, 182$ ), Argumentum ad logical ( $p < 0, 01$ ;  $r = -0, 276$ ), Non sequitur ( $p < 0, 05$ ;  $r = -0, 125$ ), and Red Herring ( $p < 0, 05$ ;  $r = -0, 135$ ).

The findings highlight that conservatives are more prone to fallacies involving emotional manipulation, appeals to authority, or oversimplified arguments. However, liberals are more likely to fall for specific logical fallacies, such as the Fallacy of Emotion, the Naturalistic Fallacy, and Petitio Principii, than conservatives. For messages targeting liberals, fallacies like the Fallacy of Emotion (e.g., 'Immediate action should be taken regarding environmental pollution; consider the impact on children') and Petitio Principii (e.g., 'Sports cars harm the environment, so they should not be driven') are particularly effective. Conversely, the Naturalistic Fallacy (e.g., 'Solar energy is free; therefore, we should install solar panels on our roofs') appears to resonate equally with both conservatives and liberals. Fallacies such as Red Herring and Appeal to Nature do not show significant correlations with attributes associated with political orientation.

The Pearson correlation coefficients serve as indicators of the strength and direction of relationships between fallacies and moral foundations. According to widely accepted guidelines, correlation values of  $\pm 0.1$  are interpreted as small,  $\pm 0.3$  as moderate, and  $\pm 0.5$  or higher as large effects. These metrics enable a nuanced understanding of how specific logical fallacies align with different moral frameworks, shedding light on the intricate dynamics influencing ideological responses to climate change communication. The Straw Man fallacy demonstrates a moderate negative correlation with progressivism ( $r = -0.336$ ,  $p < 0.01$ ), indicating that individuals with stronger progressive tendencies are less likely to align with this type of reasoning. Progressive individuals tend to prioritize harm and fairness as moral foundations, which are associated with open-mindedness and a preference for complex, non-reductive arguments. The Straw Man fallacy, which oversimplifies and misrepresents an opposing position to make it easier to attack, directly contradicts these values. Similarly, the Cum hoc ergo propter hoc fallacy shows a small but statistically significant negative correlation ( $r = -0.236$ ,  $p < 0.01$ ), further suggesting a divergence between progressivism and fallacious reasoning. Progressive individuals, as highlighted in moral foundations theory, are more likely to approach issues with a focus on fairness and harm (Graham *et al* 2011), which involves recognizing the complexity of causality in social and environmental issues. Therefore, the negative correlation may reflect a tendency among progressives to resist over-simplified and deterministic arguments, preferring more nuanced, evidence-based explanations. The Slippery Slope fallacy also presents a negative relationship with progressivism ( $r = -0.196$ ,  $p < 0.01$ ), underscoring how progressive values may conflict with deterministic and exaggerated claims. Therefore, the negative correlation may reflect the tendency of progressives to reject alarmist claims and instead seek more reasoned, balanced evaluations of potential outcomes.

In summary, conservatives are generally more prone to accepting logical fallacies than liberals, making them the primary demographics susceptible to such fallacies. However, when aiming to influence liberals specifically,

**Table 2.** Pearson’s correlation analysis.

	Liberal tendency indicators		Conservative tendency indicators			
	Harm	Fairness	Ingroup	Authority	Purity	Progressivism
<b>Fallacy of Emotion</b> ‘Immediate action should be taken regarding environmental pollution; think about what you’re doing to the children.’	204**	247**	142*	0,079	136*	0,077
<b>Argumentum ad hominem</b> ‘Environmentalists claim that global warming has reached dangerous levels and urgent measures need to be taken, but they themselves are driving SUVs?’	0,062	−0,03	202**	226**	121*	−,218*
<b>Argumentum ad verecundiam</b> ‘The President said that measures against global warming are hindering the country’s development; that’s all I need to know.’	−0,034	−0,025	0,107	233**	187**	−,255**
<b>Argumentum ad antiquitatum</b> ‘The Earth has been rotating the same way for thousands of years; there is no such thing as global warming.’	−0,045	−0,053	0,064	117*	134*	−,183*
<b>Argumentum ad populum</b> ‘If global warming were real, governments would take action; since they haven’t taken any measures, it means there’s no significant problem.’	−0,097	−,138*	0,05	127*	128*	−,248**
<b>Argumentum ad numerum</b> ‘According to surveys, 70% of Americans don’t believe there is an issue called global warming. If global warming were real, so many people wouldn’t be against it. There is no such thing as global warming.’	−0,051	−0,097	0,014	0,112	127*	−,182**
<b>Tu quoque</b> ‘Forget about the major industries when it comes to global warming; first look at those who claim to be environmentalists.’	−0,018	−0,097	121*	194**	123*	−,245**
<b>Appeal to nature</b> ‘Nature warms and cools in a ten-thousand-year cycle; there is no global warming, this is how nature works.’	−0,097	−0,111	0,015	0,107	0,097	−,198**
<b>Fallacies of Logic</b> ‘The cause of global warming is the Earth approaching to the Sun.’	−0,02	−0,05	0,087	279**	182**	−,272**
<b>Cum hoc ergo propter hoc</b> ‘I paid more for fuel to stay warm this winter. Wasn’t there to be global warming?’	−,120*	−0,105	−0,005	129*	164**	−,236**
<b>Circulus in demonstrando</b> ‘Environmentalists have bad attitudes; they are rude and become aggressive when something contrary to their opinions is said. Of course, I don’t like environmentalists because they talk down to people.’	−0,038	−0,043	0,061	142*	0,103	−,171**
<b>Dicto Simpliciter</b> ‘Environmentalists are not to be trusted because they are arrogant people who think they are better and know more than everyone else.’	−0,11	−0,083	0,07	134*	0,09	−,222**
<b>Straw man</b> ‘Those who think that hunting for sport is immoral believe that animals are more important than humans and want us all to be vegetarians.’	−0,073	−0,094	0,108	254**	229**	−,336**
<b>Slippery slope</b> ‘Using clean energy requires a lot of investment; this would increase our energy production costs, and we would fall behind economically, even causing our economy to collapse.’	−,205**	−,212**	−0,102	0,059	0,006	−,196**

Table 2. (Continued.)

	Liberal tendency indicators		Conservative tendency indicators			
	Harm	Fairness	Ingroup	Authority	Purity	Progressivism
<b>Argumentum ad ignorantiam</b> 'No one opposed my decision to leave my current job and move to the country, so it must be a logical move.'	0,116	0,033	168**	201**	236**	−,182*
<b>Argumentum ad logicam</b> 'It continues to snow on the top of mountains; if there were global warming, it wouldn't snow.'	−,154**	−,164**	−0,037	170**	133*	−,276**
<b>Non sequitur</b> Person 1: 'I'm thinking of buying an electric car.' Person 2: 'Why?' Person 1: 'Because environmentalists are trying to save the world, and they use electric cars.'	172**	0,054	144*	169**	249**	−,125*
<b>Red Herring</b> Person 1: 'More tax money needs to be spent on preventing global warming.' Person 2: 'No, because producing more solar panels means extracting more minerals, using more water, and ultimately causing more environmental pollution.'	−0,092	−0,022	0,016	0,089	0,076	−,135*
<b>Naturalistic fallacy</b> 'Solar energy is free; we should install solar panels on our roofs.'	180**	143*	151*	163**	234**	−0,069
<b>Petitio principii</b> 'Sports cars harm the environment, so they shouldn't be driven.'	120*	127*	0,083	0,029	0,113	0,031

the Fallacy of Emotion and *Petitio Principii* are particularly effective. To target a broader audience, naturalistic fallacy is proven to be the most effective strategy.

## 6. Conclusions

This study explores the complex relationship between moral foundations, logical fallacies, and political ideology, particularly in the context of misinformation surrounding climate change. The findings underscore the significant association between political orientation and susceptibility to logical fallacies, revealing important insights for climate change communication strategies. By examining how liberals and conservatives respond to different types of fallacious reasoning, this research makes a valuable contribution to understanding the role of ideological factors in shaping public perceptions of climate change.

Correlation analysis shows that conservatives are generally more susceptible to accepting logical fallacies than liberals. Significant correlations were found between conservative tendencies and several fallacies, including *Argumentum ad hominem*, *Argumentum ad verecundum*, Straw Man, and Tu quaque. These fallacies often involve emotional manipulation, appeals to authority, or the oversimplification of arguments—techniques that resonate with the conservative moral dimensions of Ingroup loyalty, Authority, and Purity, as outlined by Moral Foundations Theory (MFT) (Haidt 2012). These results are consistent with prior research that showed that individuals with conservative values are more likely to rely on moral intuitions based on authority and tradition, making them more vulnerable to certain logical fallacies (Sterling *et al* 2019).

In contrast, liberals were found to be less susceptible to overall logical fallacies, but they were not immune. The Fallacy of Emotion and *Petitio Principii* (begging the question) were particularly effective in influencing liberal participants because these fallacies align with the liberal moral foundations of Harm and Fairness. This is supported by studies that show liberals tend to prioritize empathy and care for others, making emotional appeals particularly persuasive for this group (Feinberg and Willer 2013). Additionally, the Naturalistic Fallacy emerged as effective across ideological lines, suggesting that this form of reasoning, which relies on an appeal to nature, is broadly persuasive regardless of political orientation (Hornsey *et al* 2016).

A key factor amplifying the impact of logical fallacies on liberals and conservatives is the role of social media algorithms, which often create echo chambers that reinforce existing beliefs (Flaxman *et al* 2016). These digital environments limit exposure to diverse viewpoints, making individuals more likely to accept information that aligns with their pre-existing moral and political frameworks. For conservatives, this manifests as a greater susceptibility to fallacies that affirm their sense of group loyalty or trust in authority figures (Pennycook *et al* 2020). For liberals, emotional appeals, especially those linked to harm or fairness, are more persuasive in these echo chambers.

The findings have significant implications for crafting effective climate change messages that resonate with different ideological groups. For conservatives, communication strategies should account for their higher susceptibility to fallacies such as *Argumentum ad populum* and Appeal to Authority. Messaging that directly challenges such fallacies can help reduce misinformation. For example, fact-checking authority figures or exposing weaknesses in popular arguments can counterbalance these fallacies (Cook *et al* 2017).

For liberals, while they are less prone to fallacies overall, messages that rely on emotional appeals or focus on moral urgency (e.g., ‘think about the children’) may resonate more effectively. Research has revealed that framing climate change in terms of moral imperatives related to harm and fairness increases engagement among liberal audiences (Wolsko 2017). However, care should be taken to avoid manipulative emotional appeals that could cause negative effects by diminishing trust in climate communication.

Finally, fallacies such as the Naturalistic Fallacy, which view nature as inherently self-regulating or free of human interference, appear to resonate across political orientations. As such, communication on climate change should aim to directly challenge this fallacy by emphasizing the scientific consensus on the human impact on the environment (Van der Linden *et al* 2017).

## 7. Limitations and future research

While this study provides valuable insights, it has some limitations that warrant further exploration. Reliance on self-reported data and a limited sample size may affect the generalizability of the findings. Additionally, this study only examined the susceptibility to fallacies in the context of climate change. Future research should explore whether similar patterns exist in other domains, such as health communication and political discourse, as these domains are inherently interconnected with climate change communication and can provide further insights into the broader applicability of our findings. Additionally, this study did not examine metacognitive capacities, which may play a critical role in individuals’ ability to recognize and reject logical fallacies. Recent evidence (Fischer and Fleming 2024) highlights the importance of metacognitive awareness in recognizing

reasoning errors in politically contested domains, such as climate change. Future research could explore how metacognitive awareness intersects with ideological and moral frameworks in shaping responses to climate change communication. Moreover, the role of social media echo chambers in amplifying these effects deserves further investigation, particularly in terms of how platform design can either mitigate or exacerbate the spread of fallacies.

In conclusion, this study highlights the crucial interplay between moral foundations, political ideology, and the acceptance of logical fallacies in shaping public perceptions of climate change. The findings underscore the importance of tailoring communication strategies to the moral frameworks and cognitive biases of different ideological groups. By addressing specific fallacies that resonate with liberals and conservatives, communicators can more effectively combat misinformation and promote a more informed public discourse on climate change. The ongoing challenges of fake news and ideologically driven fallacies require nuanced strategies that consider the psychological and moral factors that influence how individuals process information.

## Competing interests

The authors declare no conflicts of interest.

## Ethical approval

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of Alanya Alaaddin Keykubat University, the Scientific Research Ethics Committee in the Field of Social and Human Sciences, (Decision Number: 2024/10).

## Informed consent

Online informed consent was obtained from all subjects involved in the study.

## Author contributions

Conceptualization, MOD. and BA; methodology and formal analysis, MOD; investigation, ZGD; writing—original draft preparation, MOD, ZGD, BA, CK, FSE, HA; writing—review and editing, ZGD, CK, FSE, HA.; project administration, CK. All authors have read and agreed to the published version of the manuscript.

## Data availability statement

The data that support the findings of this study are openly available at the following URL/DOI: <https://www.openicpsr.org/openicpsr/project/228921/version/V1/view>.

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