

# The Art of Computational Persuasion: Evaluating The Impact of Ethos, Pathos, and Logos on Argument Effectiveness

Sabrina Mazumder

*BASIS Independent Brooklyn, 556 Columbia Street, Brooklyn, NY 11231, United States*

## ABSTRACT

Large language models (LLMs) have emerged as a powerful tool for producing persuasive content at scale. However, little research has considered the rhetorical strategies which make these arguments effective. This study aims to fill this gap by quantifying the persuasive impact of rhetorical appeals in LLM-generated arguments, and personalization is additionally examined to determine whether it enhances their impact. Using a survey instrument with 68 participants to investigate which rhetorical appeal, when used by an LLM, is most convincing in both personalized and generic arguments. Participants were persuaded by the LLM's arguments in 7.3% of instances. For personalized arguments, the rhetoric used did not have a significant impact on this metric; however, for generic arguments, appeals to logic were typically most convincing. These findings raise questions about the potential implications in politics and marketing if such persuasive content were deployed at scale.

**Keywords:** LLM; persuasion; logos; ethos pathos; argument

## INTRODUCTION

Digital literacy is defined as “the ability to find, evaluate, use, share, and create content using information technologies and the Internet” (1). While this definition remains relevant, the landscape of digital literacy is evolving. Evaluating information technologies used to be primarily about discerning credible sources, but given generative artificial intelligence’s ability to create personalized persuasive content, the public must now be proactive in accounting for mis-, dis-, and

malinformation (2, 3, 4). By gaining insight into the effectiveness of different tactics some large language models (LLMs) use, this research may inform the development of educational interventions to help people critically evaluate LLM-generated content. This paper’s findings may also be useful in the potential development of guidelines on how to critically assess LLM-generated texts. A quick educational game is sufficient at teaching people to identify misinformation (5). Participants in this study who played inoculation games with feedback showed improved discernment of misinformation, even after a week. Such interventions were also shown to decrease skepticism toward truths.

With this in mind, the subjects addressed in this paper are which rhetorical appeal – logos, ethos, or pathos – is most effective at changing people’s minds when employed by an LLM and whether the persuasive impact of these appeals differs when the arguments are personalized.

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**Corresponding author:** Sabrina Mazumder, E-mail: [dylansabrina@gmail.com](mailto:dylansabrina@gmail.com).

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The categories of rhetoric this paper considers are derived from the highly influential book *Rhetoric* by renowned Greek philosopher Aristotle (6). Namely, the types of rhetoric considered are logos, ethos, and pathos. Logos is defined as the appeal to logic, and this often takes the form of statistics, structured arguments, or definitions. As an example, one of the arguments produced for the survey was “[S]tatistics usually show a correlation between increased law enforcement presence and decreased crime rates.” Another appeal Aristotle outlines is ethos, the appeal to credibility. Components of an argument that answer the question “Why should I trust you?” would typically fall under this category of rhetoric. This may mean a speaker indicates expertise in the topic of argument, signals trustworthiness by using specialized vocabulary, or exhibits support for values the audience holds. For instance, an appeal to ethos tailored to a Hindu audience might be a reference to the Bhagavad Gita or an effective anecdote about visiting a Hindu temple. If that anecdote had an especially moving tone, then it would also incorporate pathos. Pathos is the appeal to emotion and may often feature in figurative language, tone, or a story. These appeals form the basis of this experiment’s first independent variable: argument type. To date, extensive examination of LLM persuasion literature reveals no existing research exploring such a variable. It is therefore largely the objective of this work to address this deficiency.

The other independent variable that is part of this experiment is personalization. Here, personalization implies using contextual data surrounding a participant and feeding it to a LLM to write tailored arguments. For details, including the specific data collected for personalization purposes, please see Measures.

Based on this user survey of N=68, several novel claims can be made. The most convincing generic arguments, when employed by an LLM, are those based on logos. All rhetorical appeals are deemed about equally convincing when employed by an LLM to generate personalized arguments. Arguments that were personalized changed people’s minds 8.2% of the time compared to 6% of the time for generic arguments, but this difference was not statistically significant.

While further research needs to be conducted on this topic for more conclusive results, the answers of those surveyed confirmed that people, on average, are most often persuaded by logos-based textual arguments compared to those relying on ethos or pathos. However, if personal information surrounding an individual is used in arguments, each appeal is equally compelling.

## LITERATURE REVIEW

Several studies have analyzed the persuasive capabilities of LLMs, examining how effectively they can change people’s minds compared to human-made arguments. A consistent finding across this body of work is that LLMs can match or exceed human persuasiveness in many contexts (4, 7, 8).

One study with a sample of size of 900 measured the influence of LLM-generated arguments versus ones made by humans in a brief debate (7). Participants were randomly assigned either another participant or an LLM (GPT-4 in the paper’s case) as an opponent to debate with, and some opponents were randomly given data to individualize the arguments they construct. The results demonstrated that LLMs were just as and sometimes more persuasive than humans. When LLMs and humans were not equally convincing, the LLM was more convincing 64.4% of the time.

In a separate pre-registered study – a study in which the hypothesis and protocol are publicly released before the experiment’s execution – with 4, 955 participants, messages authored by human political persuasion experts competed with those by GPT-4 to persuade English-speaking Americans to take certain stances on political issues in the U.S. (4). GPT-4 was randomly assigned either to adopt a persona associated with a Democrat or a Republican or to adopt none at all. In aggregate, the technique of adopting a persona was determined to offer only a marginal advantage. GPT-4’s persuasiveness was often on par with those of human experts. It primarily exceeded human experts’ persuasiveness when messages were right-leaning. It is worth noting though that all human experts in this study were left-leaning, and this bias may have negatively impacted the effectiveness of their right-leaning messages. Therefore the claim to take away from this study is that GPT-4’s persuasiveness rivaled that of humans.

A pre-registered study with 1,242 participants compared the capabilities of Claude Sonnet 3.5 and incentivized humans to influence participants taking an online quiz (8). A human persuader encouraged with monetary rewards or an LLM would attempt to guide a quiz taker toward either a correct or incorrect answer for each question on the quiz. The LLM outperformed the human persuaders in steering quiz takers toward both correct and incorrect answers. Specifically, humans’ compliance rate was 3.48% lower when guiding quiz takers toward correct answers and 10.31% lower when guiding quiz takers toward wrong answers. It

is especially concerning that LLMs are effective at manipulating people into answering incorrectly.

The final motivation for this research lies in a study conducted by researchers affiliated with the University of Zurich. The study measured the ability of LLMs to alter the perspective of those who post on the subreddit *r/ChangeMyView* (3). As the name suggests, this is a community on Reddit in which people post opinions which others may try to change. However, the researchers did not conduct their study ethically. Apart from posting LLM-generated content, which goes against the rules of the subreddit, they also used an LLM to gather insights from some users' posting history to personalize arguments intended to change perspectives. Users subject to this were unaware that their data was analyzed and used in such a way and had no opportunity to consent. Additionally, LLMs would occasionally assume an identity that it did not have. Overall, the research broke several Swiss laws. It is therefore, in part, the aim of this study to investigate the same topic in an ethical fashion.

What makes LLMs a particularly unique threat is their ability to rapidly manufacture personalized content using vast amounts of personal data inferred from users' online activity. Given as few as 300 Facebook likes, a program can predict an individual's openness, conscientiousness, extraversion, agreeableness, and neuroticism with greater accuracy than those close to them, including colleagues, family, and friends (9). LLMs also make relatively accurate inferences about individuals' gender, location, political orientation, religion, occupation, and ethnicity (10). The quantity of data surrounding Internet users can easily be abused in a variety of ways, and LLMs open new avenues for this data's misuse by enabling large-scale, psychologically tailored manipulation.

Perhaps the most troubling avenue is politics. Without using this data, LLM-assisted propaganda can already be just as persuasive as content created before the adoption of AI or curated by humans (11, 12). Considering that personalized arguments are often more effective than generic ones, this capacity becomes especially dangerous when combined with this data (13, 14).

To combat this, this paper provides insights into the rhetorical strategies that make LLM-curated arguments effective. With this information, people may hopefully critically evaluate the LLM-generated summaries, arguments, and narratives they encounter. Perhaps future researchers may aid in the development of guidelines surrounding how to assess LLMs as a source of information.

## **MATERIALS AND METHODS**

This section outlines the experimental design used, participant recruitment process, and independent variables used to assess the persuasive power of LLM-generated arguments and different rhetorical appeals.

### **Survey Design**

A large-scale survey was designed and conducted as part of this study. Data collection began with a page requesting contextual data from participants: gender, age, values, religion, political ideology, and perceptions of their own open-mindedness. At this stage, each subject was randomly assigned to either the personalized or generic group without being told which they were in to avoid biasing their responses.

To identify contentious, relevant, and diverse topics to present to the participants in the survey, inspiration was taken from traditional English debates. Specifically, the Oxford and Cambridge Union websites were used as they archive past subjects of debates. The final 15 statements used in the survey explored issues in politics, technology, art, economics, and lifestyle. The full list of statements can be found in "Statements" in the Appendix.

These statements appeared to participants in a random sequence to avoid order bias. A participant would indicate their stance about a given statement, and an LLM (specifically GPT 4o-mini) generated counterpoints in the form of four arguments expressing the opposite sentiment. The LLM output would consist of one argument of each type described in Measures. If an individual expressed neutrality about the statement, a random position – agree or disagree – was assigned. The participant would rank the four arguments in order of which appear most convincing. Then the participant would indicate whether their initial stance had changed as a result of the arguments using a number scale in the form of a convincing score. Finally, each response was stored in a database after the completion of each question so that incomplete surveys would also provide data.

### **Randomization Procedures**

Random assignment to the personalized or generic condition was implemented using Python's `random.choice()` function at the start of the survey session. The assignment occurred once per participant and remained fixed for all 15 statements. The order of the 15 statements was independently randomized for each participant using the same procedure to prevent order effects.

### **LLM Prompting**

For each statement, GPT-4o mini was queried using a fixed prompt. The prompt instructed the model to produce four short counter-arguments, each explicitly corresponding to one rhetorical appeal: logos, ethos, pathos, and a hybrid of all three. The model was given the participant's initial stance to ensure arguments expressed the opposing viewpoint.

### **Personalization Operation**

In the personalized condition, the prompt additionally included the participant's contextual information (age range, gender, political ideology, religious affiliation, values, and self-reported open-mindedness). These attributes were passed in structured text and the model was instructed to tailor its arguments to this profile. In the generic condition, the model produced arguments without any of this information.

### **Verification of Rhetorical Distinctness**

To ensure the four generated arguments aligned with their assigned rhetorical modes, a manual check was conducted on a random sample of generated argument sets before conducting the survey. Arguments were evaluated using classical rhetorical theory to confirm each argument met its assigned criteria. The prompt was modified until each argument passed the manual check. Eventually, all sampled arguments met their intended rhetorical categorization, with minor variations typical of natural-language generation.

### **Participants and Recruitment**

The survey was promoted through posters and social media targeting residents of New York City, United States, and Cambridge, England, though participants from other regions may also have taken part. These efforts yielded a total of 68 respondents. Due to resource constraints, participants could not be randomly selected, and recruiting additional respondents was not feasible. As a result of the small sample size, statistical power is limited, and smaller effects may not have been detectable. The experimental design did not consider geographical nor IP data, and consequently the residence of the survey respondents is unknown.

Eligible survey respondents were at least 18 years of age. To recruit these participants, data were collected over a 12-day period from September 9, 2025 to October 1st, 2025. Although data collection has ended, the survey remains open for the public to take to encourage people to explore their own preferences and see whether they

are susceptible to persuasion by an LLM. The survey site is listed in the "Survey" section under the Appendix. The survey's methods were approved by an Institutional Review Board, and all participants provided informed consent prior to the survey. Participation was voluntary, and participants were given no form of compensation.

All data were de-identified before analysis. While the survey collected contextual information (e.g., age, gender, religious affiliation, and political ideology), no direct identifiers were captured or stored. Survey responses were associated only with a randomly generated participant ID, ensuring that individual identities could not be inferred.

### **Measures**

The independent variables in this study are argument type and personalization. For the purposes of this study, only three types of arguments will be analyzed, although there was a fourth which uses all three rhetorical appeals. For transparency, raw data is reported in the "Data" section in the Appendix, where one may also find information pertaining to that fourth type of argument. The three relevant types of arguments are those made from one rhetorical appeal only (either logos, ethos, or pathos). The fourth is a hybrid consisting of all three forms of rhetoric. Personalization consists of two levels assigned per subject, meaning a participant would receive only personalized or only generic arguments for the duration of the survey.

The dependent variables measured were a convincing score and argument rankings. The convincing score attempts to capture whether an individual's stance has changed as a result of the arguments and is measured using a five-point Likert scale (15). A convincing score of 1 means the participant's position has definitely not changed, 3 means they were ambivalent, and 5 means they are confident their opinion changed. For instance, an individual may have initially disagreed with the statement "Space exploration is worth the investment," but they have some confidence that the provided arguments changed their mind and respond with a convincing score of 4. The other dependent variable – argument rankings – captures which argument types were most persuasive by asking participants to order arguments from most to least convincing. If an argument was more compelling than the others for a given question, then it would go in first place. Similarly, the least convincing argument would go in fourth place.

Combining these measures allows for a more nuanced understanding of persuasive impact. The convincing

score serves as a direct measure of attitude shifts, which is useful in judging whether LLMs were effective at producing arguments. Capturing data like argument rankings offers insight into how much each argument contributed to the convincing score.

**RESULTS**

There were N=68 participants in the survey. The average age of the participants was 36 years old, and the median age was 24. A total of 38 males and 30 females participated. The plurality of participants – 31 individuals – did not follow any religion, 27 were Christian, 8 were Jewish, and 2 followed a religion that is not Abrahamic. Considering the contexts in which the survey was promoted, most, if not all participants reside in the United States or the United Kingdom. Finally, a summary of participants’ political stances is shown in Table 1.

*Table 1. A summary of participants’ political stances as per the Political Compass Test (16).*

	Libertarian	Center	Authoritarian
Left	20	11	0
Center	1	20	1
Right	1	11	3

To assess whether personalized arguments were more persuasive than generic ones, a two-proportion z-test was conducted. It should be noted that the test assumptions were not fully satisfied: while participants were randomly assigned to conditions, the responses were not strictly independent as each participant provided multiple responses across different topics (15 statements each), introducing within-subject correlation. Additionally, the sample distributions are not necessarily normal. Thus, the test’s results should be cautiously interpreted.

The analysis revealed no statistically significant difference in personalized and generic persuasion rates (p=0.13). The observed difference in proportions was 2.2 percentage points (95% CI: [-2.0%, 6.4%]). The effect size, as measured by Cohen’s h, was 0.086, indicating a negligible practical difference between conditions (Table 2). The relative risk was 1.37 (95% CI: [0.74, 2.52]), suggesting that personalized arguments were 1.37 times as likely to persuade participants, though this ratio was not statistically distinguishable from 1.0. Given the

p-value of 0.13 exceeds the significance threshold of  $\alpha = 0.05$ , the null hypothesis that personalization does not significantly affect persuasion rates cannot be rejected.

The null hypothesis for Table 3 is that for any given group, each argument type is uniformly distributed among each rank, while the alternative hypothesis is that each argument type is not uniformly distributed among each rank.

For Tables 4a through 4d, a rank of one indicates that the argument was most convincing, while a rank of four means it was least. The three argument types shown in each table—logos, ethos, and pathos—each rely exclusively on their respective rhetorical appeal. Further details about how these arguments were constructed are provided in Measures. Tables 5a through 5d are the

*Table 2. The estimates for persuasion rate across groups as well as their Wilson confidence intervals, sample sizes from which they were derived, and standard deviations of each distribution. The persuasion rate for the first three groups is the proportion of responses scoring 4 or more, calculated with Wilson confidence intervals due to the extreme right skew of convincing scores. These groups are “personalized” (those receiving personalized arguments), “generic” (those receiving generic arguments), and “all” (the entirety of survey respondents). The final group’s measurements are from a separate study on text-based interpersonal persuasion (3).*

Group	Mean	Standard Error	95% Confidence Interval	Sample Size
All	7.3	0.9	[5.7, 9.3]	588
Generic	6.0	1.3	[3.9, 9.0]	239
Personalized	8.2	1.3	[6.1, 11.1]	349
Human	2.7	0.26	[2, 3]	n/a

*Table 3.  $\chi^2$  tests (significance level  $\alpha = 0.05$  and degrees of freedom  $df = 6$ ) for independence across all participants, the generic treatment group, the personalized treatment group, and the responses with high convincing scores. A high convincing score is defined as a convincing score of four or more.*

Group	$\chi^2$ Statistic	Standard Error
All	7.3	0.9
Generic	6.0	1.3
Personalized	8.2	1.3
Human	2.7	0.26

**Table 4. The frequency of each relevant argument type in each rank across different groups.**

(a) All arguments considered				(b) Generic arguments considered			
Rank	Logos	Ethos	Pathos	Rank	Logos	Ethos	Pathos
1	218	194	176	1	97	69	73
2	205	197	168	2	90	82	75
3	183	193	220	3	72	88	84
4	191	213	233	4	77	97	104

**Table 5. The expected frequency of each relevant argument type in each rank across different groups given a uniform distribution is expected.**

(a) All arguments considered				(b) Generic arguments considered			
Rank	Logos	Ethos	Pathos	Rank	Logos	Ethos	Pathos
1	196	196	196	1	79.667	79.667	79.667
2	190	190	190	2	82.333	82.333	82.333
3	198.667	198.667	198.667	3	81.333	81.333	81.333
4	212.333	212.333	212.333	4	92.667	92.557	92.667

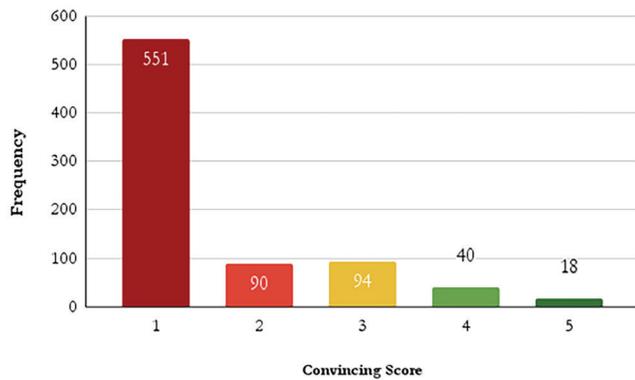
  

(c) Personalized arguments considered				(d) Arguments receiving high convincing scores considered (convincing score of 4+)			
Rank	Logos	Ethos	Pathos	Rank	Logos	Ethos	Pathos
1	116.333	116.333	115.333	1	13.333	13.333	13.333
2	107.667	107.667	107.667	2	14.667	14.667	14.667
3	117.333	117.333	117.333	3	15	15	15
4	119.667	119.667	119.667	4	15	15	15

expected counts, calculated using Pearson’s chi-square formula, used to determine the chi-square statistics shown in Table 3.

One of the lines that GPT-4o mini generated for the survey was: “The fashion industry is largely driven by profit margins, with a recent study showing that 80% of luxury goods are owned by just 20% of the population.” At a glance, this may seem an effective attempt at logos, but there are a couple of problems with this statement. The meaning of this statement is ambiguous. It could reference luxury goods in the fashion industry or luxury goods overall. After extensive research, no paper was found that discusses either. This instead appears to be an application of the Pareto Principle, a theory contending that “for many phenomena, about 80% of

the consequences are produced by 20% of the cause” (17). Additionally, the claim that the fashion industry is largely driven by profit margins is not necessarily supported by a study pertaining to the distribution of luxury goods as the structure of the sentence may suggest. Essentially, this statement ostensibly fails to cite reliable data as well as to arrange ideas logically, both of which are crucial to logos. This is an especially relevant issue since people increasingly rely on and trust LLMs for facts and summaries, and survey respondents offering high convincing scores likely most often flipped positions because of logos-based arguments, which were most frequently in first place. More research should be conducted to investigate whether these types of errors are frequent enough to warrant a response (Figure 1).



**Figure 1.** The distribution of convincing scores among all responses to the survey. The convincing score can take on values 1 through 5, and a more detailed description of it is available in Measures.

## DISCUSSION

The generic persuasion rate of 6% observed in this study is over double the previously reported human baseline of 2.7% (3). Because LLMs have proved to be such a persuasive tool, safeguards should be developed to ensure that they are not misused. They could be used in politics and marketing. In politics especially, LLMs' persuasive capabilities are a pressing concern because LLMs are more cost-effective compared to traditional methods of persuasion and therefore their use is incentivized. One persuaded voter costs between \$48 and \$78 using LLMs compared to \$100 using traditional methods (18). As LLMs advance, their persuasion abilities will likely improve. Notably, however, OpenAI's ChatGPT-5 refused attempts to personalize arguments for this experiment. Still, further research is needed to assess the efficacy of the safeguards against personalization and perhaps to recommend measures that close any loopholes.

Pathos was most often placed in third and fourth for generic arguments. While unsure of what causes this, there are some potential causes to be considered that may guide future work. GPT-4o mini's use of rhetoric may be seen as cliché, a perception which commonly decreases argument effectiveness (19). Seeing as each argument was limited to five sentences, these arguments may lack the space for complexity and detail which may make arguments more convincing. Future research may therefore focus on the subtleties of LLMs' communication of emotion, identifying what specific linguistic cues make for effective pathos.

In personalized arguments, which changed people's positions 8.2% of the time however. It is worth noting that while this is larger than the persuasion rate for generic arguments, the difference was not statistically significant at a significant level of  $\alpha = 0.05$ . All appeals were approximately uniformly distributed across each rank. This indicates that the effectiveness of ethos and pathos is at least partially predicated on how well each is tailored to its audience. For ethos, this intuitively makes sense and can be seen in the Buddhism example outlined in the Introduction. The fact that pathos performed just as well as the other appeals here demonstrates that GPT-4o mini can modulate emotional cues in ways that resonate with varying audiences, but its capacity to do so is at least partially reliant on whether it has personal information surrounding its audience.

## Future Work

Future work should focus on strengthening the empirical foundations of this study. First, increasing the sample size would improve statistical power and allow for more precise estimates of the effects observed here. Testing additional LLMs, especially those used natively by major platforms, would help determine whether these findings generalize in real-world contexts. Researchers should also incorporate randomized controlled experiments using real digital platform content (e.g., news feeds, advertisements, or LLM-generated summaries) to better approximate the environments in which users typically encounter persuasive or misleading material.

Future research may also evaluate responses to proposed policy and educational interventions. Research on policy mechanisms designed to mitigate the spread of LLM-generated mis-, dis-, and malinformation, both in controlled experimental settings or realistic digital platform environments, would provide valuable insight for policymakers. Educational interventions aimed at improving users' ability to recognize and critically evaluate LLM-generated content should likewise be systematically tested to determine which approaches best strengthen public resilience in an LLM-mediated information environment.

## Limitations

Lastly, it is worth noting several limitations of this study which may be resolved in future work. First, the research utilized a single LLM model, GPT-4o mini. Other models may prove more or less persuasive than the one used in this experiment. Perhaps future researchers may experiment with a Claude Sonnet model or an LLM

model that is specialized for writing tasks. Second, experimental context does not quite mimic the nature of the social media platforms or news sites on which LLM-generated messages may spread. Users are often able to see others' reaction to content through features including likes, saves, and comments. These may serve as an external pressure which influences how users respond to a given post or article. Third, the study measured short-term opinion change, which may not necessarily translate into stable, long-term shifts in belief or behavior. Gathering data on this would probably require a longitudinal study. Fourth, this study uses a Likert scale, a system which relies on self-reported data which may not always prove accurate. Fifth, the participant pool was likely drawn largely from the US and UK, meaning the findings may reflect cultural biases toward Western contexts. Additionally, because geographic and IP data were not collected, cross-cultural differences could not be analyzed. Lastly, this experiment employed an artificial survey environment which does not reflect the ways people may be exposed to AI-generated mis-, dis-, and malinformation in everyday life.

## CONCLUSION

This paper investigated LLM-driven persuasion through experimental evaluation of argument effectiveness based on the traditional rhetorical elements of logos, ethos and pathos. Generic arguments were typically most effective when they used logos, while no particular rhetorical appeal proved more effective than the others for personalized arguments. Additionally, LLMs are on average more than twice as persuasive than humans.

These results sound an immediate warning about the ethical risks which this technology presents. LLMs generate more effective arguments than human writers do when it comes to converting readers. The situation requires collaboration between researchers, policymakers and educators to create necessary technical protections, educational programs, and regulatory systems which protect human autonomy and promote informed decisions. By identifying which rhetorical strategies LLMs use most effectively, this study provides empirical insight that can inform the development of digital literacy curricula designed to help people recognize and resist AI-generated persuasive media.

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## CONFLICT OF INTEREST

The author declares no conflicts of interest related to this work.

## APPENDIX

### Data

Raw survey data are available at: <https://github.com/claystation0/Art-of-Persuasion---Raw-Data>.

### Code

The code used for the survey is available here: <https://github.com/claystation0/Art-of-Persuasion---Code>.

### Survey Platform

The live survey can be accessed at: <https://artofpersuasion.streamlit.app/>.

### Statements

Respondents were asked to rate their agreement with the following statements: "One should treat elders with respect"; "One is entitled to receive inheritance"; "Political goals should not be pursued through violence"; "No deal is better than a bad deal"; "Nuclear power should play a large role in the future of energy"; "Money is the root of all evil"; "Space exploration is worth the investment"; "Nowadays fashion is elitist"; "The richest 1% are necessary"; "Art can be separated from the artist"; "Digital literature is a step in the right direction"; "Public safety comes before personal freedoms"; "It is better to enjoy your youth rather than focus on academic achievements"; "Capitalism ruined the arts"; and "Money can buy happiness."

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