

**Lay Rationalism in Speech and Writing: The Relationship Between Language Modality  
and Decision Making**

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**Abstract**

Building on research demonstrating how language modality impacts intuitive decision making, this study explores the relationship between language modality and lay rationalism, or the preference for pro-reason over pro-emotional decision making. This exploration serves to promote understanding of how decision making trends have been affected by recent increase in written, digital communication such as emails, online articles, and chat rooms. Participants ( $N = 400$ ) were given four scenarios in either spoken or written modality, asked which option would make them happier, and asked which option they chose. We found no evidence of effect by language modality as participants in both groups showed lay rationalistic and subjective well being trends regardless of whether the scenarios were spoken or written. The participants in the spoken condition spent significantly more time on the questions which could have acted as a confound. This finding provides motivation for further exploration of the relationship between decision making and language modality in future studies.

*Keywords:* lay rationalism, language modality, subjective well being, decision making

### **The Relationship Between Language Modality and Decision Making**

The fundamental objective of psychology is the understanding of cognitive processes for the purpose of explaining and predicting human behavior. Such pursuit gave rise to a discipline focused on studying the processes of decision making or the way certain behaviors or beliefs are selected when faced with several possibilities (Hershauer & Simon, 1978). The theories on these processes seek to describe mechanisms which could be utilized for predictions of behaviors in the future. If we know how and why a particular decision is made then we can predict when it will be made again in the future under similar circumstances. The importance of studying this topic comes from the vast practical and interdisciplinary applications of understanding decision making in economic (Strohschneider, 2008), group behavior (Gao et al., 2016), or clinical psychology (Flykt et al., 2021) context. This study seeks to contribute to understanding of decision making through research on lay rationalism, or whether someone utilizes reason over feelings in their decision making, and the way it interacts with the mode in which language is delivered, speaking or writing. Given the current age of digital communication, it is crucial to understand how language modality interacts with lay rationalism as this may impact millions of people around the world who communicate through the internet. We predict that participants in our study will be more logic oriented when making decisions on information presented in the written modality compared to the spoken modality.

#### **Lay Rationalism**

In the context of decision making research, lay rationalism is the utilization of reason over feeling in decision making (Hsee et al., 2015). For example, when given a scenario in which the participant is offered two chocolates, one more expensive but in shape of a cockroach, the other cheaper but heart shaped, a lay rationalistic decision would be to chose the pro-reason

option of a cockroach shaped chocolate even though the participant might be happier with the pro-feelings option of the heart-shaped chocolate. This theory stems from research on economic behavior and the idea of consumers being guided by value seeking behavior which predicted that they would always pick the pro-reason option with more monetary value (Hsee, 1999). The study found a decision making inconsistency in which participants tend to pick the option of higher monetary value even if it was the option they did not enjoy as much.. Their decision making was then guided by the logic of monetary value rather than feelings associated with the options. Measurements of lay rationalism focus on these switches by examining whether participants pick the pro-reason option in their choice but predict that the pro-feelings option would have made them feel better. If so, then their decision making was a lay rationalistic action (Hsee et al., 2015).

The theory of cognitive reflection refers to the ability to reflect on the proposed question instead of giving an intuitive but incorrect response (Shtulman & Young, 2022). CRT is a test format designed to measure cognitive reflection, therefore determining analytic or intuitive performance in participants. Analysis of correlations between CRT scores and measures of cognition show that cognitive reflection is positively correlated with higher levels of rational thought (Toplak et al., 2011). Furthermore, a positive relationship between analytic responses in CRT and the amount of time a participant spends on a question was found in a previous study (Otero & Alonso, 2023). Significant differences in the amount of time spent on questions between participants could introduce a confounding variable in lay rationalism studies as the participants who spent longer on the questions will show more cognitive reflection, and therefore show higher levels of rational thought which could translate into preferring pro-reason rather than pro-feelings options (Hsee et al., 2015).

Additionally, the concept of subjective well being in decision making provides an argument that whether the participants prefer the pro-reason option is not really important, what is important is if there is a match between the option they predicted would make them happier and the option they choose in the end (Benjamin et al., 2012). If there is a match between the two options, then the participant decided in accordance with their subjective well being, or made an emotion-driven decision based on the option they thought would make them happier; otherwise a mismatch could be a sign of reason based decision making. Due to their similarities, lay rationalism should be examined in parallel to subjective well being decision making in order to compare their trends in participants, analyze interactions, and create a better model. Such relationships between decision making processes add complexity to this discipline and provide motivation for further research as to how these theories interact and are modified by such factors as language modality.

Furthermore, although past studies on lay rationalism found that participants tend to choose options which offer greater monetary reward even if they describe the other option as generating more subjective well being, for example by offering higher income at the cost of losing contact with friends (Benjamin et al., 2012), there is also evidence that people do not always seek out the most monetarily valuable option (Hsee, 1999; Li & Hsee, 2019). Exploration of these inconsistencies will provide deeper understanding of decision making processes by uncovering the impact of specific factors on this aspect of cognition. One such factor is language due to the importance of communication on decision making. Specifically, linguistic changes such as differences in language modality have been shown to impact human thinking in a way capable of influencing decision making (Geipel & Keysar, 2022).

### **The Impact of Language Modality**

Language modality refers to the medium through which language is communicated. In the context of this study and literature on the subject, the mediums include written or spoken language. The study of language modality proposes that when participants read a scenario from text they will have a different cognitive reaction than if the same scenario was described to them through the narrator's speech. For example, when participants use a spoken modality they tend to be more intuitive as compared to a written modality where participants are more analytical (Geipel & Keysar, 2022). This difference can be explained by the way speech and reading comprehension develop in separate stages of childhood, the context in which they are used, and the type of information communicated, for example only text or gestures, facial expressions, and vocal intonations accompanied by speech. These differences then impact intuitive and analytic processing and influence decision making based on which medium the information is presented in.

Although language and decision making are both fundamental to human experience, it remains unclear how language modality impacts how individuals weigh reason and feelings when making decisions (lay rationalism). It is possible that the positive relationship between spoken modality and intuitive decision making (Geipel & Keysar, 2022) translates into tendency towards feelings based decision making as past studies showed a correlation between intuition and pro-feelings decision making (Kirkebøen & Nordbye, 2017). Understanding this relationship is especially important given the prevalence of written communication in the current age of technology, for example through emails, online articles, and online chat rooms. The current study sought to address this gap by providing scenarios, either displayed as text on computer screen or as digital audio recording, designed to test how language modality influences decisions that

involve a conflict between a feeling-based and reason-based option by measuring lay rationalism or preference for the pro-feelings option when predicting which option makes the participant happier and the pro-reason option when making final decision.

### **Current Study**

The objectives of the current study are to explore the changes in decision making brought upon through language modality by exposing the participants to either written or spoken scenarios. Lay rationalism of the participants will be measured by analyzing the trends of preference for pro-feelings options in prediction questions and pro-reason options in decision questions. The rate of choosing the same option in prediction and decision questions, a match, will also be analyzed to determine trends in decisions according to subjective well being. These trends will then be compared between the two conditions to find whether the language modality has an impact on decision making. Finding significant differences would suggest that the language modality, spoken or written, impacts how participants use reason and feelings in decision making. In turn this would expand on the discipline's understanding of the way language interacts with cognitive decision making processes and provide guidance for future research to explore these interactions.

Based on previous literature which found that spoken problems elicited more intuitive responses (Geipel & Keysar, 2022), and a study that found intuitive decision making tends to be pro-feelings (Kirkebøen & Nordbye, 2017), we expect that participants will be more intuitive and choose more pro-feeling options in the spoken condition and more lay rationalistic in the written condition. If the spoken condition in past studies prompted the participants to be more intuitive, then the participant in this study might make decisions that are more in accordance with



their intuitions and feelings when listening to information, hence we expect that participants in the spoken condition will show less lay rationalism than in the written condition.

### **Pilot Study**

We first piloted four new decision scenarios for use in our main study. The aim of this pilot was to replicate previous findings. As the item selection was meant to explore the efficacy of these four scenarios the participants were tested only in the written modality, instead of a full written and spoken modality manipulation.

### **Participants**

61 native English-speaking participants completed the study online through Prolific Academy. One of the participants (1.63%) was dropped after a failed reading recognition task. From the remaining participants (51.7% female, 45% male, 3.3% non-binary,  $M_{\text{age}} = 29.65$ , age range = 18-45 years) majority reported having high school education or a bachelor's degree and majority reported being slightly or very liberal. However, we do not believe these education and political affiliation trends confounded with the data.

### **Materials**

The written condition scenarios were produced by creating a series of slides featuring text of the scenario and recording the slides changing based on calculated reading speeds. The scenarios were based on previous literature (Benjamin et al., 2012) and adapted to the context of lay rationalism and language modality. The Job scenario asked the participant to decide between two new jobs: one is higher paying but with less time for sleep (the pro-reason option) and the other pays less but gives the participant time to rest longer (the pro-feelings option). The Thanksgiving scenario asks the participant if they would rather fly to spend the Thanksgiving with their family for the first time in three years (the pro-feelings option) or miss Thanksgiving

again but save \$500 (the pro-reason option). The Office scenario asks the participant to choose between relocating to two new offices, one is in a city where they will receive higher pay but they do not know anyone (the pro-reason option) and the other is in a city where they will receive 20% less pay but many of their friends live there (the pro-feelings option). Finally, the Friends scenario asks the participant if they would rather spend time with their friends but sleep less (the pro-reason option) or leave their friends early but get more sleep (the pro-emotion option). The speed and volume of the recordings were further adjusted in the Lightworks Software to finalize the written condition videos. The survey was then created and hosted on Qualtrics, featuring the written condition videos, and used to publish the survey. The data from the survey was analyzed using R studio and Jamovi.

### **Procedure**

All participants were placed in the written-sequential condition. The survey began with an informed consent and captcha, followed by the practice task in order to test the participants' understanding of the survey and ability to answer accurately. The participants then read the 4 written condition scenarios, presented in a random order, through recorded slides showing text. The 4 scenarios were Job (Money vs Sleep), Thanksgiving (Family vs Money), Office (Money vs Friends), and Friends (Friends vs Sleep). The participants were then asked to choose which option, pro-reason or pro-emotional, they decided to pick (decision) and which option would have made them feel better (prediction) (decisions were counterbalanced). Participants were also given a surprise recognition and attention check task to ensure they are answering the survey honestly and to the best of their abilities. The demographic questions include gender identity, age, highest degree of education, and description of political view.

## Results

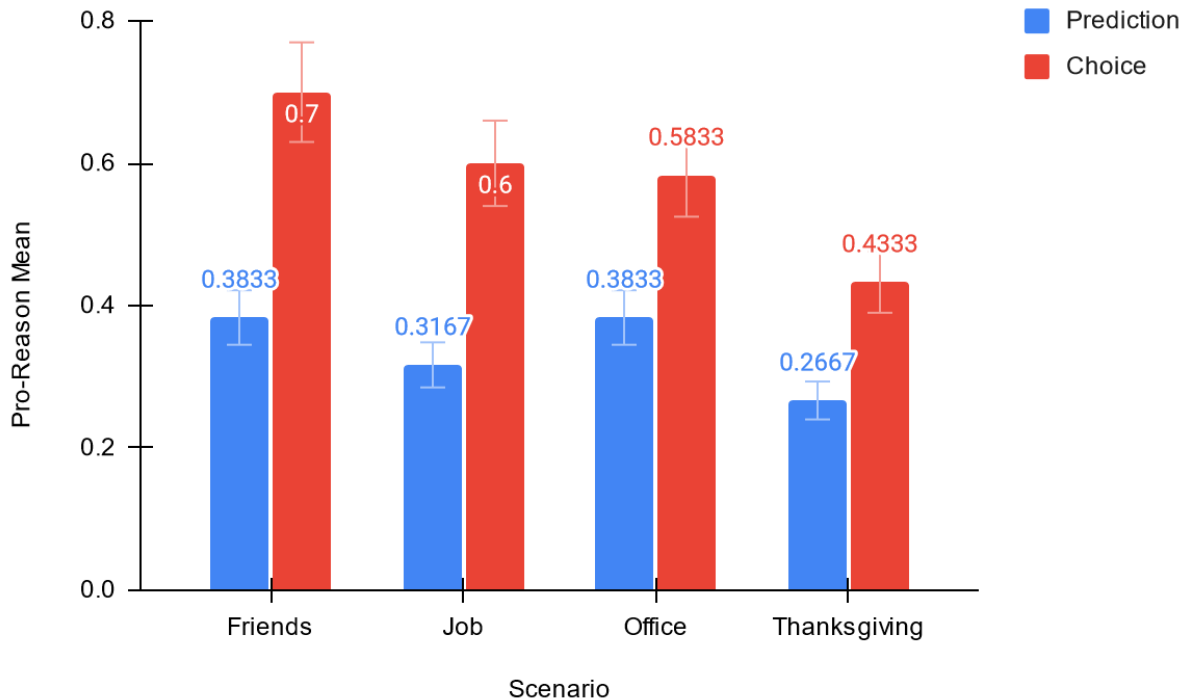
### *Pro-Reason Preference*

Across all scenarios the participants had significantly higher preference for pro-reason option when answering choice questions (see Table 1 and Figure 1): Friends choice 70.0%, prediction 38.3%,  $\chi^2(1, N = 60) = 14.087, p < .001, d = .666$ ; Job choice 60.0%, prediction 31.7%,  $\chi^2(1, N = 60) = 15.059, p < .001, d = .588$ ; Office choice 58.3%, prediction 38.3%,  $\chi^2(1, N = 60) = 7.563, p = .006, d = .405$ ; Thanksgiving choice 43.3%, prediction 26.7%,  $\chi^2(1, N = 60) = 5.786, p = .016, d = .350$ .

**Table 1**

### *Preference for the Pro-Reason Option in the Pilot Study*

Scenario	Choice %	Prediction %	Difference %	Difference ( <i>p</i> )
Friends	70.000	38.300	31.700	< 0.001
Job	60.000	31.700	28.300	< 0.001
Office	58.300	38.300	20.000	0.006
Thanksgiving	43.300	26.700	16.700	0.016

**Figure 1***Pro-Reason Preference in the Item Selection**Gender Interactions*

Analysis for interactions between gender of the participants and pro-reason preference found no significant effects in predictions  $F(2, N = 60) = .441, p = .664$ , or choices  $F(2, N = 60) = .719, p = .488$ .

*Time Spent Interactions*

Analysis for interactions between time spent on deliberation and pro-reason preference found no significant effects in predictions  $t = -.993, p = .322$ , or choices  $t = .517, p = .606$ .

**Discussion**

The purpose of this pilot study was to replicate findings from previous research on lay rationalism (Benjamin et al., 2012) and select the items that showed the biggest effect. The lay rationalism trends were quantified by observing whether the participants picked the “more”

options in the prediction and decision portions, i.e. questions which offered more practical gain but less emotional benefits, and whether the participants decided to go with an option that they predicted would make them happier. This decision was made based on methods utilized by previous studies which analyzed trend reversals in questions on subjective well being (Benjamin et al., 2012) or preferences for pro-reason or pro-feelings consumer options (Hsee et al., 2015).

Examining the trends of selection for the more option revealed that across all scenarios most participants predicted the more option would make them less happy, however for all but one scenario most participants picked the more option as their choice. This trend successfully replicated the lay rationalism effect observed in previous research (Hsee et al., 2015) with the select set of scenarios. Therefore, most of the scenarios utilized in the pilot were carried over to be used in the main study.

The Thanksgiving scenario served as an outlier in the lay rationalism measures as it was the only scenario during which participants tend to choose the option they also predicted brought for them more happiness. We believe that the measure was confounded by cultural effects as the study utilized American participants and data was collected in November. This proximity to Thanksgiving could have introduced strong emotional and cultural factors that were not present with other scenarios. To avoid similar confounds in the future we decided to drop the Thanksgiving scenario from study 1 and replace it with chocolate shape versus chocolate value scenario.

### **Main Study**

The aim of this study was to explore the changes in decision making brought upon through language modality by exposing the participants to either written or spoken decision scenarios. Our main prediction was that participants in the spoken condition would have

significantly lower lay rationalism ratings than participants in the written condition, therefore providing evidence that spoken modality influences pro-feelings decision making. Our secondary aim was exploration of individual differences in lay rationalism and their possible modality effect on decision-making. This study was pre registered, including its design, methodology, analysis, and exclusion criteria on AsPredicted.org.

### **Participants**

400 adult U.S. residents completed the study online through Prolific Academy. From among the participants (48.00% female, 48.25% male, 2.75% non-binary,  $M_{\text{age}} = 39.91$ , age range = 16-77) majority reported having high school education or a bachelor's degree and majority reported being slightly or very liberal. Political affiliation trended in similar patterns across the language modalities, with conservative participants making up 28.68% of spoken condition and 26.67% of written condition, and liberal participants 66.70% of spoken condition and 68.15% of written condition.

### **Materials**

Based on the findings of our pilot study, Study 1 retained three of the previous scenarios (Job, Office, and Friends) and replaced Thanksgiving with Chocolate scenario (Hsee, 1999) in order to avoid cultural confounds impacting the study results. The spoken variants of scenarios were also added in a between-subjects design with intent of observing differences between groups based on language modality. The written condition videos described in the pilot study were utilized with the exception of the Thanksgiving scenario, which was replaced with a new Chocolate Shape vs Chocolate Value video produced using the same method as before: a recording of slides containing text and then edited through Lightworks. The Chocolate scenario asked participants if they would rather obtain as reward for participation a cheaper chocolate in

shape of a lovely heart (the pro-feelings option) or a more expensive chocolate in shape of a very realistic cockroach (the pro-reason option). The participants were then given two questions: which of the options made them feel better, and which option they chose. If a participant said the heart shaped chocolate (pro-feelings) would have made them feel better but decided to choose the cockroach shaped chocolate (pro-reason) that would have been a lay rationalistic decision. The audio for spoken condition was recorded by two male voice actors with a standard American accent hired over Fiverr and then edited with Audacity in order to match their volume levels. Qualtrics was used to host and publish the survey, now expanded with the spoken condition audio and an audio check section. Data analysis was conducted using R and Jamovi.

### **Procedure**

The study began with an informed consent and captcha check which made sure participants were human, followed by a technology check to ensure participants were able to see the videos and hear the audio of the speakers. Only participants who passed all of these checks were allowed to start the study. The participants were randomly assigned to either the written or spoken condition. Within each modality condition the participants were also randomly assigned to one of the two speakers, the written condition heard one of the speakers at the beginning. The presentation order of pro-reason and pro-feelings options was counterbalanced across conditions. Furthermore, we counterbalanced the presentation order of choice and prediction across scenarios. All participants were then given a comprehension question to test if they are able to follow along with the written or spoken instructions. Afterwards the participants were given the main battery of questions. The participants in the written condition read the four written scenarios through recorded slides showing text. The participants in the spoken condition listened to a recording of a male narrator describing the scenario and asking the survey questions. The

four scenarios used in our main study were Job (Money vs Sleep), Office (Money vs Friends), Friends (Friends vs Sleep), and Chocolate (Chocolate Shape vs Chocolate Value). After each scenario the participants were asked to choose which option they decided to pick (decision) and which option would have made them feel better (prediction). The presentation order of these questions was counterbalanced. Participants were also given a surprise recognition and attention check task to ensure they are answering the questions honestly and to the best of their abilities and a question asking if they could read or hear the scenario. However, the surprise recognition test could not be used because it was only present in one condition due to human error. The participants were then given questions to evaluate the speakers and were asked six questions measuring individual differences in lay rationalism. For example, the speaker evaluations asked the participants to rate on a seven-point scale how well they understood the speaker and how much they liked the speaker. The measures of individual differences in lay rationalism included such questions as whether the participants tend to analyze financial costs and benefits and resist the influence of feelings when making a decision or whether they focus on objective facts rather than subjective feelings during decision making. The scales for these questions had six points, with one being strongly disagree and six strongly agree. The online experiment concluded with demographic questions consisting of which gender identity do they identify with the most (female, male, non-binary, other, or prefer not to say), what is their age, what is their native language (English, Spanish, Chinese, or other), choose one or more races that you consider yourself to be (White or Caucasian, Black or African American, American Indian/Native American or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, other, or prefer not to say), what is the highest degree or level of education you have completed (high school, bachelor's degree, master's degree, Ph.D. or higher, trade school, or prefer not to say), how



would you describe your political view (very liberal, slightly liberal, slightly conservative, very conservative, or prefer not to say), and a chance to submit comments about any technical issues they experienced.

## Results

### *Pro-Reason Preference*

Across all scenarios in the written condition the participants had significantly higher preference for pro-reason option when answering choice questions, which replicates previous findings (Hsee et al., 2015): Friends choice 48.9%, prediction 36.3%,  $\chi^2(1, N = 400) = 5.95, p = .015, d = -.26$ ; Job choice 51.9%, prediction 23.0%,  $\chi^2(1, N = 400) = 35.22, p < .001, d = -.62$ ; Office choice 71.1%, prediction 38.5%,  $\chi^2(1, N = 400) = 40.20, p < .001, d = -.69$ ; Chocolate choice 36.3%, prediction 23.7%,  $\chi^2(1, N = 400) = 11.13, p < .001, d = -.28$ . Similar trend was seen in the spoken condition when analyzed for differences in pro-reason preference: Friends choice 57.4%, prediction 28.7%,  $\chi^2(1, N = 400) = 51.14, p < .001, d = -.61$ ; Job choice 48.7%, prediction 22.6%,  $\chi^2(1, N = 400) = 65.13, p < .001, d = -.57$ ; Office choice 67.9%, prediction 39.2%,  $\chi^2(1, N = 400) = 66.96, p < .001, d = -.60$ ; Chocolate choice 43.4%, prediction 29.1%,  $\chi^2(1, N = 400) = 36.03, p < .001, d = -.30$ . Comparison of these trends between the spoken and written condition across scenarios shows no significant differences in choice preference (see Table 2 and Table 3) in the Chocolate  $t(276.65) = -1.38, p = .169$ ; Friends  $t(266.80) = -1.60, p = .110$ ; Job  $t(269.41) = .60, p = .550$ ; and Office  $t(276.44) = .66, p = .512$  scenario. Neither did overall comparison between modalities (see Table 4) show significant difference in choice,  $t(1598) = .87, p = .383$ ; and prediction,  $t(1598) = -.19, p = .848$  questions in written and spoken condition.

**Table 2***Preference for the Pro-Reason Option in Choices in Study 1 Across Scenarios*

Scenario	Written Choice %	Spoken Choice %	Choice Difference %	Choice Difference (p)
Chocolate	36.300	43.400	-7.100	0.169
Friends	48.900	57.400	-8.500	0.110
Job	51.900	48.700	3.200	0.550
Office	71.100	67.900	3.200	0.512

**Table 3***Preference for the Pro-Reason Option in Predictions in Study 1 Across Scenarios*

Scenario	Written Prediction %	Spoken Prediction %	Prediction Difference %	Prediction Difference (p)
Chocolate	23.700	29.100	-5.400	0.247
Friends	36.300	28.700	7.600	0.129
Job	23.000	22.600	0.400	0.943
Office	38.500	39.200	-0.700	0.888

**Table 4***Preference for the Pro-Reason Option in Study 1 Between Modalities*

Modality	Choice	Prediction
Written	0.520	0.299
Spoken	0.543	0.304

*Prediction and Choice Matches*

Analysis of matches between the options picked in the choice and prediction questions showed most participants picked the same option for both in the written condition: Friends 69.6% matches,  $\chi^2(1, N = 400) = 17.79, p < .001$ ; Job 65.9% matches,  $\chi^2(1, N = 400) = 20.81, p < .001$ ; Office 83.0% matches,  $\chi^2(1, N = 400) = 13.70, p < .001$ ; Chocolate 68.1% matches,  $\chi^2$

(1,  $N = 400$ ) = 58.67,  $p < .001$ . The same trend was observed in the spoken condition: Friends 73.2% matches,  $\chi^2(1, N = 400) = 7.64, p = .006$ ; Job 68.3% matches,  $\chi^2(1, N = 400) = 57.09, p < .001$ ; Office 85.7% matches,  $\chi^2(1, N = 400) = 35.51, p < .001$ ; Chocolate 58.5% matches,  $\chi^2(1, N = 400) = 134.80, p < .001$ . Analysis of the pro-reason matches showed that their rate in the written condition was 21.5% for Chocolate scenario, 26.7% for Friends, 22.2% for Job, and 37.8% for Office. In the spoken condition it was 29.1% for Chocolate, 22.3% for Friends, 22.3% for Job, and 37.7% for Office. The rate of lay rationalism switches, or the instances in which participants picked the pro-feelings option in prediction and the pro-reason option in choice, was also analyzed showing rates of 1.3% in Chocolate, 1.9% in Friends, 2.5% in Job, and 2.8% in Office scenarios of the written modality. However, in spoken modality these rates were 2.4% in Chocolate, 5.8% in Friends, 4.4% in Job, and 5.0% in Office.

Comparison of these trends between the written and spoken modality (see Table 5) showed no significant differences between the two modalities in match trends: Chocolate  $t(253.27) = -.69, p = .490$ ; Friends  $t(283.04) = 1.92, p = .056$ ; Job  $t(260.56) = -.74, p = .458$ ; Office  $t(264.99) = -.48, p = .635$ ; or in pro-reason match trends: Chocolate  $t(294.325) = -1.68, p = .095$ ; Friends  $t(255.28) = .96, p = .339$ ; Job  $t(269.49) = -.01, p = .992$ ; Office  $t(269.28) = .01, p = .994$ . Furthermore, comparing the rates of lay rationalism switches between the two modalities (see Table 6), shows that the difference is not significant ( $M_{Spoken} = .265$  and  $M_{Written} = .250$ ),  $t(1598) = .65, p = .515$ .

**Table 5**

*Match and Pro-Reason Match Distribution in Study 1*

Scenario	Written Match %	Spoken Match %	Match Difference (p)	Written Pro-Reason Match %	Spoken Pro-Reason Match %	Pro-Reason Match Difference (p)
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**Table 5** (continued)

Chocolate	68.148	58.491	0.49	21.481	29.057	0.095
Friends	69.63	73.208	0.056	26.667	22.264	0.339
Job	65.926	68.302	0.458	22.222	22.264	0.992
Office	82.963	85.66	0.635	37.778	37.736	0.994

**Table 6***Lay Rationalism Switch Distribution in Study 1*

Scenario	Written Lay Rationalism Switch %	Spoken Lay Rationalism Switch %	Lay Rationalism Switch Difference (p)
Chocolate	1.3	2.4	0.515
Friends	1.9	5.9	0.515
Job	2.5	4.4	0.515
Office	2.8	5.1	0.515

*Lay Rationalism Rating Interactions*

Examination of interactions between the self-reported lay rationalism rating of participants and predictions in a linear regression showed lack of impact on prediction trends,  $t(1594) = .18, p = .860$ ; and no significant interaction with modality:  $M_{\text{Spoken}} = .299, M_{\text{Written}} = .304, F(42, N = 1440) = .04, p = .844$ . However, a linear regression model of lay rationalism rating and choice trends found a significant positive correlation between the two,  $t(1594) = 3.85, p < .001$ ; but no interaction with modality ( $M_{\text{Spoken}} = .543, M_{\text{Written}} = .522$ ),  $F(42, N = 1440) = .67, p = .412$ . Furthermore, linear regression models of interactions between lay rationalism rating and match rates showed significant negative relationship,  $t(1578) = -5.68, p < .001$ ; and no interaction of lay rationalism rating, match rates, and modality ( $M_{\text{Spoken}} = .713, M_{\text{Written}} = .717$ ),  $F(42, N = 1440) = .02, p = .883$ . Analysis of pro-reason match rates showed a similar negative relationship but in this case not significant,  $t(1578) = -0.63, p = .531$ ; and still no significant

interaction of lay rationalism rating, pro-reason match rates, and modality,  $M_{\text{Spoken}} = .278$ ,  $M_{\text{Written}} = .272$ ,  $F(42, N = 1440) = .05$ ,  $p = .817$ . Examination of the lay rationalism switch rates in a similar context showed a significant positive correlation with lay rationalism rating,  $t(1578) = 5.17$ ,  $p < .001$ ; and no significant interaction with modality,  $M_{\text{Spoken}} = .266$ ,  $M_{\text{Written}} = .255$ ,  $F(42, N = 1440) = .23$ ,  $p = .629$ .

#### *Exploratory Gender Interactions*

Analysis for interactions between gender of the participants and pro-reason preference found no significant effects in predictions  $F(2, N = 400) = .07$ ,  $p = .929$ ; or choices  $F(2, N = 400) = .93$ ,  $p = .395$ . Modality did not seem to affect these trends in predictions  $F(6, N = 400) = 1.22$ ,  $p = .294$ ; or choices  $F(6, N = 400) = .54$ ,  $p = .781$ . There were also no significant effects found in rates of matches  $F(2, N = 400) = .04$ ,  $p = .965$ ; pro-reason matches  $F(2, N = 400) = .18$ ,  $p = .832$ ; or lay rationalism switches  $F(2, N = 400) = .46$ ,  $p = .633$ . No interactions between gender and modality were found in rates of matches  $F(6, N = 400) = 1.52$ ,  $p = .168$ ; pro-reason matches  $F(6, N = 400) = .90$ ,  $p = .492$ ; or lay rationalism switches  $F(6, N = 400) = 1.66$ ,  $p = .126$ .

#### *Time Spent Interactions*

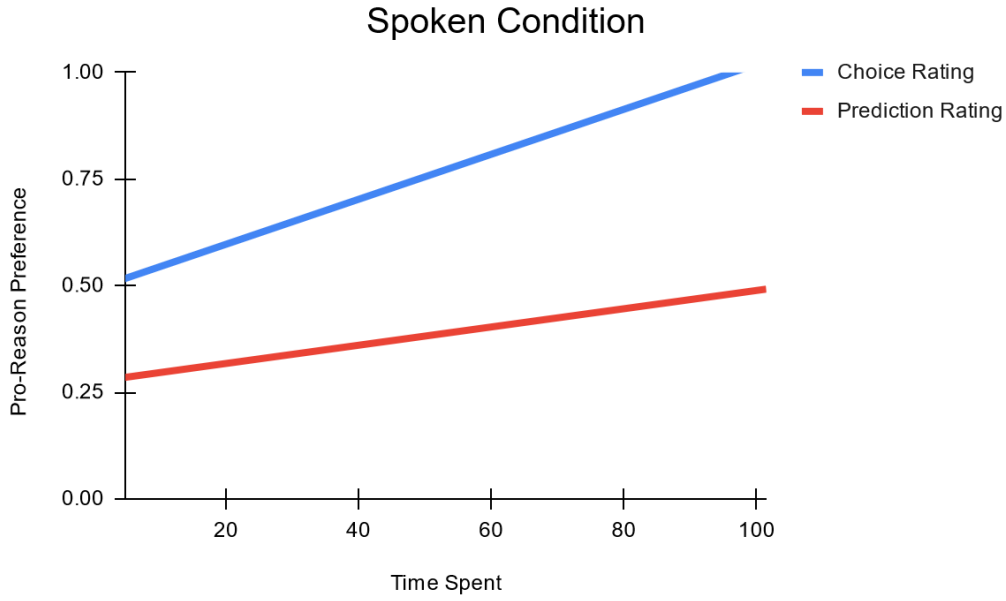
Analysis for interactions between time spent on a question and pro-reason preference in a linear regression model found a significant and positive correlation in predictions,  $t(1510) = 2.21$ ,  $p = .027$ ,  $d = -3.06$ ; and interaction with modality,  $F(1, N = 1510) = 4.74$ ,  $p = .030$ ,  $d = -.11$ . However, this correlation was not found in analysis for choices,  $t(1510) = -.55$ ,  $p = .586$ ; and no significant interaction with modality was found,  $F(1, N = 1510) = .02$ ,  $p = .878$ . Furthermore, we found no significant interaction in linear regression model between time spent on a question and matches,  $t = -1.76$ ,  $p = .079$ ; pro-reason matches  $t = .59$ ,  $p = .555$ ; or lay rationalism switches,  $t = 1.77$ ,  $p = .077$ ; and neither had a significant interaction with language

modality:  $F_{\text{matches}}(1, N = 1510) = 1.01, p_{\text{matches}} = .316$ ;  $F_{\text{pro-reason}}(1, N = 1510) = 2.07, p_{\text{pro-reason}} = .150$ ;  $F_{\text{switch}}(1, N = 1510) = .72, p_{\text{switch}} = .398$ . Further analysis showed that participants spent significantly more time on choice questions in the spoken condition than written condition:  $M_{\text{spoken}} = 4.89, M_{\text{written}} = 3.77, t = -5.87, p < .001, d = -.33$ ; and prediction questions:  $M_{\text{spoken}} = 5.72, M_{\text{written}} = 4.25, t = -7.06, p < .001, d = -.41$ .

Moreover, further findings were provided by constructing linear mixed models of interactions between time spent on questions and preferences in prediction questions (see Figure 2):  $t_{\text{interaction}}(1514.00) = -2.08, p_{\text{interaction}} = .037$ ; and choice questions (see Figure 3)  $t_{\text{interaction}}(1513.31) = .12, p_{\text{interaction}} = .898$ . Linear mixed models were also made for match rates  $t_{\text{interaction}}(1513.60) = -.88, p_{\text{interaction}} = .380$ ; pro-reason matches  $t_{\text{interaction}}(1514.07) = -1.40, p_{\text{interaction}} = .162$ ; and lay rationalism switches  $t_{\text{interaction}}(1513.88) = .69, p_{\text{interaction}} = .489$ .

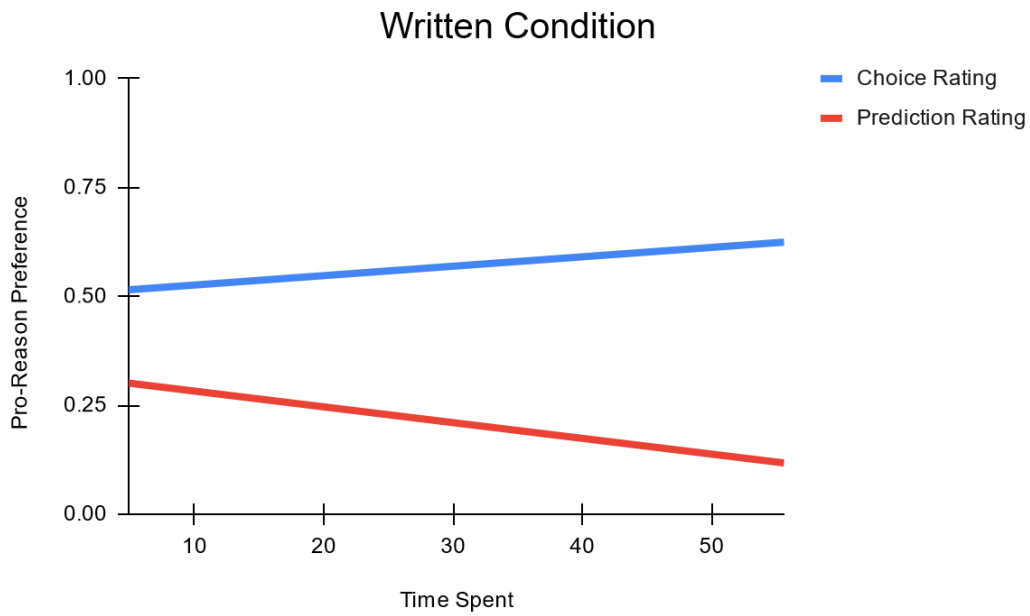
**Figure 2**

*Time Spent Interactions with Choice and Prediction Preference in Written Condition*



**Figure 3**

*Time Spent Interactions with Choice and Prediction Preference in Spoken Condition*



*Exploratory Analysis of Individual Lay Rationalism Differences and Political Attitude**Interactions*

The analysis of the exploratory spoken and written questions showed a significant difference between the two,  $M_{\text{Written}} = 4.67$ ,  $M_{\text{Spoken}} = 4.82$ ,  $r(N = 400) = .13$ ,  $p = .034$ . A significant positive correlation was observed between lay rationalism ratings and the exploratory written question,  $t = 5.76$ ,  $p < .001$ ; but not the spoken question,  $t = -.35$ ,  $p = .724$ . No gender interactions were observed for the written question,  $t = .53$ ,  $p = .598$ ; but male participants correlated with higher ratings in the spoken question,  $t = 2.63$ ,  $p = .009$ . Very liberal participants answered the written question significantly lower than very conservative participants,  $t = 3.48$ ,  $p < .001$ ; however no such difference was seen in the spoken question,  $t = -.78$ ,  $p = .436$ . Linear mixed model analysis showed a significant interaction of very conservatives scoring higher on written question than very liberals as their lay rationalism ratings increased,  $t(982) = 60.59$ ,  $p < .001$ ; and a significant interaction in the spoken question, this time with very liberals scoring higher than very conservatives as their lay rationalism ratings increased,  $t(514) = 46.28$ ,  $p < .001$ .

Further examination of the political attitudes showed that very liberal participants had significantly lower lay rationalism rating scores than very conservatives,  $M_{\text{Very Liberal}} = 20.6$ ,  $M_{\text{Very Conservative}} = 24.1$ ,  $F(4, N = 400) = 50.20$ ,  $p < .001$ ; but no correlation was found with choice ratings,  $F(4, N = 400) = 1.31$ ,  $p = .264$ ; or prediction ratings,  $F(4, N = 400) = .77$ ,  $p = .542$ . Furthermore, very liberals had a higher rate of matches than very conservatives,  $M_{\text{Very Liberal}} = .789$ ,  $M_{\text{Very Conservative}} = .612$ ,  $F(4, N = 400) = 6.66$ ,  $p < .001$ ; no difference on pro-reason matches,  $F(4, N = 400) = 1.44$ ,  $p = .217$ ; and significantly less lay rationalism switches,  $M_{\text{Very Liberal}} = .198$ ,  $M_{\text{Very Conservative}} = .342$ ,  $F(4, N = 400) = 5.12$ ,  $p < .001$ .



## Discussion

The purpose of our study was to explore the impact of language modality on decision making, specifically lay rationalism. To do so we tested scenarios used in previous lay rationalism research (Benjamin et al., 2012) and further refined them through a pilot study. Based on findings of a previous study on language modality and thinking (Geipel & Keysar, 2022), we predicted that our participants would make decisions that are more in line with their intuitions, hence show less lay-rationalism in the spoken than written condition. Lay rationalistic response was quantified by examining the trends of preference for the “pro-reason” options in prediction and choice portions and counting the instances during which the participants chose the pro-reason option but predicted the pro-feelings option would make them happier. The pro-reason options offered more practical gain to participants but less emotional benefits, for example moving to a new work location which offers higher income but distances the participant from their friends. We also examined the rates of participants preferring the same option in both prediction and choice, whether they preferred the pro-reason options in both, and whether there was a lay-rationalistic switch during which participants did not prefer the pro-reason option for prediction but preferred it for the choice portion. This decision was made based on methods utilized by previous studies which analyzed similar trend reversals in questions on subjective well being (Benjamin et al., 2012) or preferences for pro-reason or pro-feelings consumer options (Hsee et al., 2015).

Analysis of the pro-reason preferences shows that in the written condition most participants predicted the pro-reason option would not make them happy but this number increased across all scenarios in the choice question, although only in Job and Office scenarios did a majority of participants prefer the pro-reason option. Similar trends are also seen in the

spoken condition, although in this modality majority of participants prefer the pro-reason option in Friends and Office scenarios. Further examination of the differences between the two modalities shows lack of impact by language modality in any scenario for prediction and choice or when the trends were compared overall. In sum, our prediction that language modality reduces lay rationalism was not confirmed using the present methods and materials. Instead, the findings of pro-reason preference for either condition in this study align with what was expected of participants exposed to written modality. This is possible due to the confounding effect of time spent on question being much higher in the spoken condition as previous studies found a positive correlation between time spent on a question and reflective decision-making (Otero & Alonso, 2023). However, it is also possible that language modality simply does not have a significant effect on lay rationalistic trends in decision-making or that transient presentation of text in a video format, as opposed to self-paced transient reading of text junks, had an effect on participant's intuitive decision making.

Examination of the prediction - choice match rates in written condition showed that most participants preferred the same option for both choices and predictions, while less than half of these matches were pro-reason and a very small number of participants conducted lay rationalism switches from pro-feelings option in prediction to pro-reason option in choice. The same trend was observed in the spoken condition with a high rate of matches but less than half of these matches pro-reason and a small portion lay rationalism switches. Comparison of match rates between the language modality conditions showed no significant differences. No significant interaction was found either with differences in pro-reason rates or lay rationalism switches. These findings are in line with previous studies on subjective well being (Benjamin et al., 2012), which found that most participants tend to pick the same option for both choice and prediction

due to individual differences in whether they determine the pro-reason or pro-feelings option to be better for their subjective well being. Low rates of pro-reason matches and even lower rates of lay rationalism switches show that the participants tend to choose the pro-feelings option as their subjective well being option. The lack of interactions with language modality was unexpected and went against our predictions that the participants in spoken modality would have even lower rates of pro-reason matches and lay rationalism switches.

Furthermore, another dimension of lay rationalism explored in this study was the comparison of self-reported lay rationalism scale ratings of the participants. Examination of these ratings with participant decisions showed a significant correlation with pro-reason choice trends though without interaction with modality. This is in line with findings of previous studies (Hsee et al., 2015) which predicted lay rationalistic decision making will show higher preference for pro-reason options in the choice portion. However, as it provides evidence for lay rationalistic behavior among participants in this study, it further goes against the theory of language modality interactions. Moreover, a significant negative correlation was found between lay rationalism rating and match rates and a significant positive correlation with lay rationalism switches. In either case there were no significant interactions with modality and no significant interactions with any factors previously examined. These findings align with the expectations that higher lay rationalism ratings would correlate with rationalistic decision making, as the lower rates of matches is an indicator of more frequent switches as is the increased rate of lay rationalism switches. As the self-reported lay rationalism rating of the participants increased, so did their tendency to predict that pro-feelings options would make them feel better but then choose the pro-reason options.

Finally, the last dimension of decision making explored in this study was the amount of time the participants spent on each question. Our analysis shows a significant difference in the amount of time participants spent on questions based on the modalities, with participants in the spoken condition spending more time than participants in the written condition. This significant difference was still observed even after removing outliers from the sample which could have impacted the data. Further analysis of interactions with the amount of time participants spent on questions found significant and positive correlation with prediction ratings, and an interaction between prediction ratings, time spent, and modality. This positive relationship between time spent and prediction ratings shows a possibility that the significant difference in time spent on questions between modalities acted as a confound, which is supported by previous research that found the longer participants spent on a question the more reflective and analytical they are (Otero & Alonso, 2023). This effect could have overridden any differences based on language modality we expected to find, such as more analytical and reflective trends in the written condition (Geipel & Keysar, 2022), by allowing the participants in spoken condition to become more lay rationalistic the longer they deliberated and reflected on the question. However, as this was an online study there is no clear way to indicate whether the time spent on the question by participants was actually deliberation time and most dimensions of decision making we analyzed (besides rates of pro-reason preference in predictions) did not show an interaction with time spent.

### *Limitations*

Future iterations of this research would benefit from controlling for the amount of time participants are allowed on questions to avoid possible confounds related to differences in deliberation based on modality, such as the possible confounds in this study due to significant

differences in time spent on questions between the modalities. Furthermore, exploratory analysis conducted in this study showed a positive relationship between the exploratory written question and lay rationalism ratings but not the spoken question using a Likert scale. Utilizing similarly scaled questions, rather than the binary design used in this study, could have provided different results as it allows more detailed measure of attitudes. Finally, a large portion of the exploratory analysis included comparison of differences based on political attitudes. Participants who identified themselves as “very liberal” were found to have significantly lower self-reported lay rationalism scores than “very conservative” individuals, higher rate of matches, and lower rate of lay rationalism switches. This finding suggests that “very liberal” individuals were less analytical in their decision making and more likely to choose in accordance with their subjective well being. Previous studies on the interactions of political attitudes and decision making found that liberal individuals tended to be less confident in their decision making (Ruisch & Stern, 2021) but scored higher on their cognitive reflection tests (Jost, 2017). A full study on the interactions of political attitudes and decision making in the context of lay rationalism could provide further understanding on these interactions.

### *Conclusion*

In conclusion, the results of this study provided evidence for lay rationalism and subjective well being trends in decision making among our participants but no evidence for significant effects of language modality. However, the results of the study could have been confounded by the participants in spoken condition spending significantly more time on questions than participants in the written condition, which previous studies showed correlates with increase in cognitive reflection (Otero & Alonso, 2023). Future studies on this subject could benefit from exploration of utilizing different scales, controlling for time spent on question, and

exploring the impact of political attitude on decision making. This exploration would bring further understanding to the way cognitive mechanisms of decision-making were impacted by the sudden transformation of communication and widespread sharing of ideologies brought on by the digital age.

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