**Language and Worldview in the Processing of Lies**

by

Vera Yayrah Fiawornu

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

Department of Linguistics

University of Alberta

# Abstract

This thesis examined if the credibility of a speaker affects the hearer's processing of false (lies) vs true statements. Within the context of this thesis, credibility was established using a preliminary ratings task which asked participants to respond to the following statements: 'I believe what this person says', 'This person has integrity' and 'This person is honest'. From this, we categorized our list of characters into trustworthy and untrustworthy. Lying is a complex cognitive process which is more mentally taxing than truth telling (e.g., induces less hand and arm movements, reduced blinking and more pauses during speech, Debey et al., 2012; Duñabeitia & Costa, 2015; Lelieveld et al., 2016). At the same time, lying is a socially relevant skill, and in some social contexts, white lies can be easier to process than blunt truths (Moreno et al., 2016). Also, habit and empathy have been found to lower the cognitive cost associated with producing lies (Verschuere et al., 2011; Yin et al., 2017).

Subsequently, in a series of two experiments; a ratings task and self-paced reading experiment, we asked; 1) if participants personally agreed with and found true vs untrue statements acceptable and if those outcomes were influenced by the speaker; 2) if there was a processing cost for true vs untrue statements and if so, was this cost influenced by the speaker; and 3) the extent to which the comprehender's individual political ideology and personal beliefs influenced the processing and outcomes (social acceptability and personal opinions) of these statements?

Among proficient speakers of English who are resident in Canada, the findings from both experiments suggest that the identity of the person who gives truthful information affects the processing of those statements more than the speaker of false information. In addition, we found that perspective taking and personal distress and political views (right-wing) influence the

processing of lies vs. truths. Higher scores perspective taking and lower scores personal distress led to faster reading times for true statements spoken by an untrustworthy speaker. Higher scores on the right-wing scale led to faster reading times in general. In addition, there was an interaction suggesting that this effect was stronger for false statements and less pronounced for true statements spoken by untrustworthy speakers; and vice versa for trustworthy speakers.

# Preface

This thesis is an original work by Vera Yayrah Fiawornu. The research project, of which this thesis is a part, received research ethics approval form the University of Alberta Research Ethics Board, Project name “He said, She said, A Language Processing Experiment”, Pro00111658, July 15th, 2021.

# Dedication

To dad and Portia, you are the reason I do not give up

# Acknowledgements

This has been quite a journey and I would like to thank God for being with me every step of the way, I am honestly overwhelmed by his goodness. I am immensely grateful to my supervisor, Juhani Järvikivi and the members of my committee. Juhani, thank you for your mentorship, supervising this project and trusting me to do this. Thank you again for being so patient and supportive. I would like to thank Jennifer Dailey-O'Cain and Herbert Colston for being on my committee and taking the time to read this work. I really enjoyed our discussion during the defense (as nervous as I was). Thank you to Anja Arnhold for chairing my defense.

I am grateful for the support I received from the *Words in the World project* (a SSHRC partnered research training initiative, 895-2016-1008). A very big thank you to Jade Lewis, my undergraduate Research Assistant who helped prepare the stimuli for the study. I would like to acknowledge Lindsay Griener, our Lab Coordinator who helped me settle in Edmonton, supervised my data collection while I was away and helped me set up my experiment. I would also like to thank Hannah Lam and Veranika Puhacheuskaya for helping me navigate the world of *PsychoPy.* Natasha Daley and Jiaxing Li, online learning would have been worse than it was without you two to whine to and share my woes with.

I would like to thank my family, especially Wofa K, for their immense support throughout this period. I am grateful to my newly formed family; Patricia, Wendy, Adwoa, Richard, Esther, Abigail, Sandra and their families for giving me a home away from home. Words cannot express how much you have come to mean to me. I truly appreciate you all.

R, you came through for me every step of the way, I am not even sure what to say to you. Thank you for helping me make sense of everything I needed to make sense of. Thank you for everything you did, keep doing and for being you.

# Table of Contents

# List of Tables

# List of Figures

# Chapter 1

# 1. Introduction

The study into extra-linguistic variables that affect language comprehension is a focal point in psycholinguistic research. Traditionally, language processing was thought to be first and foremost influenced by lexical and syntactic features. These were thought to be processed independent of and before semantic and pragmatic meaning, which would be taken into account later in the course of processing (Schwering & MacDonald, 2020). Against this view, using ERPs, reaction times, decision tasks, mouse-tracking and eye-tracking, researchers have shown that many other factors influence language processing immediately. From these studies, we now know that language use (for example, stereotypes, sarcasm and irony), personality traits, nativeness, empathy, mood, gender, voice, accent, emotional affect (dominance, valence and arousal) and political views modulate language processing (Van Berkum, Holleman, Nieuwland, Otten & Murre, 2009; Daltrozzo, Wioland, & Kotchoubey, 2007; van den Brink, Van Berkum, Bastiaansen, Tesink Kos, Buitelaar & Hagoort, 2012; Kuperman, Estes, Brysbaert & Warriner, 2014; Marville, 2017; Hubert Lyall, 2019; Hubert Lyall & Järvikivi, 2021; Puhacheuskaya & Järvikivi, 2022).

In this study, we focus on a prevalent social construct, lying. We examine if there is a cognitive cost associated with the processing of untrue statements, lying, and if the comprehender's worldview and personality influence this cost in any way. Many studies on lies/lying have focused on lie detection and/or production. From these studies, it is evident that the act of lying is a cognitively demanding task. For example, these studies have found that adults with right-hemisphere damage (RHD) have difficulties differentiating between lies and jokes (Langleben & Moriarty, 2012; Winner, Brownell, Happé, Blum, & Pincus, 1998). Further research has shown that the N400 component is a reliable neural marker for lies (Proverbio, Vanutelli, Adorni, 2013).

However, most studies on lying have focused on the producer of the lies and not so much the comprehender.

This study stems from a desire to understand if the hearing/reading of lies is cognitively demanding on the hearer/reader as well. More precisely, this thesis aims to explore if the credibility of a speaker and the truth-value of a statement can affect a reader's processing. In two experiments, a self-paced reading and rating tasks, this study aims to add to the body of knowledge that posits that language processing is affected by non-linguistic contextual information such as speaker or comprehender identity.

Before explaining the processes involved in this study, the sections in this chapter will delve into previous research on context and language processing, comprehension and speaker-related variables in language processing, the concept of lying and previous research on lying. The subsequent chapters will discuss the current study in detail, the two experiments and their analysis and finally a discussion on the general findings of this study.

## 1.1. Context and Language Processing

Context plays an important role in language processing. Context can refer to information within a text (linguistic information) or information outside a text, for example situation specific knowledge, genres, background or world knowledge. With respect to the more general meaning of context, language use has been studied within politics, health, gender, business, human behavior and development (Abdool & Egler, n.d.; Borčić, Kanižaj, & Kršul, 2016; Cap, 2006; Cho, Kim, Kim, & Kim, 2019; Geis, 2012; Giora, 2002; Hamilton & Chou, 2014; Jackendoff, 2008; Macaulay, 2001; Ofori, 2015; Pike, 2015; Stuart-Buttle, Read, Sanderson, & Sutton, 1996). The study of language in these contexts has contributed to the body of knowledge on language, its

usage and processing. Contextual (background) knowledge may also include cultural or personal knowledge, which has also been shown to affect language comprehension as discussed below. The paradox in understanding context is that contextual information is needed to help disambiguate the context of an occurrence; in other words, information is needed from a context to understand the context.

Context has been shown to affect an individual's perception of events or situations. People may make decisions based on the environment or previous exposure. Context also affects memory and learning, as well as object and word recognition (Lubow, Rifkin & Alek, 1976; Humpreys, 1976; Durston, Thomas, Worden, Yang & Casey, 2002; Synder, Carter, Lee, Hannon, & Alain, 2008; Wirth, Horn, Koenig, Razafimandimby, Stein, Mueller, Federspiel, Meier, Dierks, & Strik, 2008; Belke & Stielow, 2013; Liew, Howe, & Little, 2016; Batel, 2020).

Research into more immediate context effects has shown that lexical, syntactic, and semantic information (linguistic/story context) as well as information that is external to the language processing system (visual context) can affect language processing (Traxler & Tooley 2007; Tanenhaus Spivey-Knowlton, Eberhard, & Sedivy, 1995). For example, in "*The burglar blew up the safe with the rusty lock*", there is no direct information stating that there is/was more than one safe. The sentence structure is not particularly complex, but in language comprehension, the comprehender makes pragmatic assumptions incrementally and in this instance the hearer may assume that the burglar blew up the only safe. When the hearer gets to the prepositional phrase; "*with the rusty lock*", they may have to backtrack and review any assumptions that have been made from the onset. The presence of "*with the rusty lock*" alerts the hearer to the fact that there is more than one lock, which may suggest more than one safe, and this leads to a cost in processing. If, however, a context sentence is added that mentions two safes, the processing cost goes away. To

prevent this type of processing cost, it is suggested that the speaker provides enough contextual information to help the listener disambiguate the information. Again, visual information can also influence the listener's inclination towards a complex structure or an individual's perception of an object without any change to the object. Visual context effects may affect the perception of area, length, orientation and light (Todorović, 2010). In a visual world experiment, Tanenhaus et al., (1995) discovered that when participants heard temporarily ambiguous instructions such as "*Put the apple on the towel in the box"*, eye movements occurred 250ms after a word that distinctly identified the target object amidst other visual alternatives. When participants heard "*apple*", their eyes moved to all the objects with that feature. However, the following phrase *on the* towel is ambiguous in that it can be a modifier denoting the location of the apple or the goal where it should be moved. Without a context, research has shown that participants tend to adopt the modifier interpretation, which leads into a processing cost when the next phrase is encountered. Tanenhaus et al. showed that if a participant is shown a visual context with two apples, the processing cost goes away. This occurred incrementally leading to the assertion that important non-linguistic details immediately influence the manner in which the linguistic input is initially structured.

## 1.2. Comprehender and Speaker/Character Related Variables

Modern research in Psycholinguistics has departed from the modular, syntax-first approach to language comprehension. Currently, language processing is taken to be a complex cognitive process that appears to be sensitive to various types of information, only some of which may be linguistic (Poirier & Shapiro, 2012). The non-linguistic information may be based on the function of the information (stereotyping, irony) and other variables related to either the speaker or the comprehender. This non-linguistic information is a reflection of our world knowledge and

(conceptual) worldview (e.g., Marrville, 2017). The discussion in this section will focus on some of these variables.

### 1.2.1. Political Views

In using individual difference measures in psycholinguistic research, researchers are able to explore the relationship between language and affect on the part of the comprehender (Van Berkum et al., 2009). Political Ideology measures are usually (moral) "value-based". When political ideology is combined with language processing studies, we can understand how they interact. Cognitive load has been known to increase when an individual comes across a word or statement which clashes with their belief system such as "*I think euthanasia is an* ***unacceptable/acceptable*** *course of action*" (Van Berkum et. al, 2009). In addition, individuals with progressive political views experience a greater cognitive load when processing semantic anomalies such as "*Bees often collect storage in our backyard*" and more conservative leaning participants experienced higher cognitive cost (higher pupil dilation) with socio-cultural clashes such as "*I always enjoy knitting in my free time"* produced by a male speaker (Hubert Lyall, 2019; Hubert Lyall & Järvikivi, 2021).

Puhacheuskaya & Järvikivi (2022) also found that participants who rate low on the right-wing political ideology scale (left-wing) detected irony easier than right-leaning participants. Moreover, right-leaning participants considered literal statements as ironic and ironic statements as more literal. In addition, Marrville (2017) found that political ideology interacted significantly with emotional dominance and valence when participants continued sentence fragments with interpersonal verbs such as *John disapproved Mary because….* For example, right-leaning participants significantly associated the experiencer (NP1) position with low dominance and high valence verbs such as *thank*, but the theme (NP2) with low valence verbs such as *disapprove, puzzle, and haunt.* Prior to this, Niemi & Young (2016) had found that right leaning participants

can be associated with victim blaming and this finding complements the findings by Marrville (2017).

### 1.2.2. Personality Traits, Gender/Identity and Accent

Although personality traits may exhibit some variation overtime, they are generally considered to have a consistent core or pattern and this consistency creates the distinction between mood (temporary) and personality traits (Matthews, Deary, & Whiteman, 2003). From the findings of van den Brink et al. (2012), participants with high empathy had a faster adaptation of pragmatic information as they implicitly anticipated what the speaker would say using stereotype based information. This interaction was modulated by empathy.

In relation to the personality traits of the comprehender, findings from Hubert Lyall (2019), Hubert Lyall & Järvikivi (2021), and Hubert Lyall & Järvikivi (2022) indicate that comprehenders with high disgust sensitivity have a difficulty in processing statements that contradict traditionally accepted social and gender stereotypes such as "*I always enjoy knitting in my free time"* produced by a male speaker. In addition, among the big five personality traits (conscientiousness, extraversion, openness, agreeableness and neuroticism), openness and extraversion were found to be significant predictors in the processing of these socio-cultural clashes as well as semantic anomalies such as "*I read heads for pleasure*" (compared to *books*).

Behavioral data from previous research have suggested that men and women may differ especially in processing semantic information, naming and memory tasks. Gender related differences have become a defining point in event-related potential studies (ERP). Findings from a semantic priming-ERP study by Daltrozzo et al., (2007) suggest that the N400 effect sets in earlier and is larger in women than in men. In van den Brink et al. (2012), sentences with manipulated speaker

identity such as "*I have a large tattoo on my back*" in an upper middle class accent resulted in effects that were modulated by the comprehender's empathy. Similarly, Hubert Lyall (2019) Hubert Lyall & Järvikivi (2021) found that in instances of socio-cultural clashes such as "*I always enjoy knitting in my free time"* produced by a male speaker, the speaker's identity in terms of gender, inferred from their voice significantly interacted with the listener's personality traits (such as openness) and political values.

Using the corpus from Kuperman, Stadthagen-Gonzalex & Brysbaert (2012) and Warriner, Kuperman & Brysbaert's (2013) experiment on the three dimensions of emotional affect (dominance, valence and arousal), with focus on verb-based inferences (Ryskin, Qi, Duff & Brown-Schmidt, 2016) and gender stereotypes, Marrville (2017) observed the association of male characters with low valence verbs implying concepts of protection ("*disarm*") and, high dominance verbs implying concepts of offense ("*aggravate*") and female characters with low dominance, low valence verbs (concepts of helplessness such as "*wallow, weary, worry*") and high dominance, high valence verbs implying concepts of seduction. In Marrville's study, cognitive load significantly increased when a female character was the subject of a high dominance verb in the sentence.

## 1.3. The Concept of Lying

Lying, deceptive language (Duñabeitia & Costa, 2015), is a feature of human or social interaction (Duñabeitia & Costa, 2015; Fallis, 2009; Moreno, Casado & Martín-Loeches, 2016) which is characterized by saying something which you believe or know to be false (Fallis, 2009). This is a violation of the Gricean maxim of quality (Grice, 1975) which requires the speaker to not say that which you believe to be false. These maxims are meant to serve as guidelines to what can be

considered as acceptable in speech and as a way of ensuring that interactants are on the same page. When a speaker says something which is believed to be false or they know is false, it can then be interpreted as the speaker being uncooperative as they are giving information which they believe to be false to the comprehender. This supports the assertion that lying is an antisocial behavior (Moreno et al., 2016, Debey, Verschuere & Crombez, 2012). The technicality here is that if the speaker has no prior knowledge that what is being said is false, they cannot be accused of lying. However, when a speaker deliberately says something false while knowing the truth, they are telling lies and in turn violating the cooperative principle. This also means that when a lie is said, the speaker actively supports it, irrespective of the motivation.

### 1.3.1. Context and Lies

Context is relevant in determining that a statement is a lie (Lelieveld, Shalvi & Crone, 2016). Fallis (2016) discusses three contexts that may help determine if a statement is a lie. In contexts such as the theater, film or music industries, false statements are not considered as lies. They are considered as roles or parts that the speaker and sometimes the hearer have to play. Lies in these contexts are lies in comparison to real world situations and in some cases, when the speaker is expected to lie as part of role playing. Role playing involves situations where you play 'pretend'. For example, "*I finished my undergraduate studies at the age of 16*". When said in theater, a movie or music, it may be a lie or a truth given the background information provided in the context. In these instances, lies are not really taken as lies and are generally excused.

The second context involves real world lies but the speaker makes it known that it is a lie. This is comparable to jokes, teasing or friendly banter. Context comes into play here as the relationship between interactants will determine if lies within this context will end up being interpreted as jokes or whatever they are supposed to be or go badly. The third instance occurs when a speaker says

something which is a lie, all other things being equal. There is information which is contrary to what the speaker says. The studies discussed here clearly show the relevance of context in deciding if an utterance is a lie.

There are quite several reasons why people tell lies. Lies can be told to impress, to be polite, to benefit others, and for personal benefit (Fallis, 2009; Moreno et al., 2016). These reasons have led to the categorization of lies as altruistic, serious, 'white', justifiable and unjustifiable. 'White' lies are used in social interactions and are "trivial, diplomatic, or well-intentioned untruths told in order to be polite or to stop someone from being upset by the truth" (Moreno et al., 2016:616). This kind of lie takes into account the negative social costs of telling the truth such as embarrassment and hurt feelings. For instance, you visit a friend who is excited about their new place. You may probably not see anything special about it, it may not be too great or too terrible. You are likely to feign excitement and say something like "*it's a great place*" instead of letting them know what you think because you do not want to hurt their feelings.

Altruistic lies are said with the intention of helping others (Yin, Hu, Dynowski, Li & Weber, 2017). They involve lying to 'save' or get help for others. For instance, your sibling stayed out later than they are allowed to, your parents come to enquire about the whereabouts of your sibling, and you reply that *"she went to the library as there's a test in the morning and there's a lot to learn"*. In this instance, the lie saves a sibling from trouble. Generally, altruistic lies are considered socially and morally acceptable due to the intent behind the lie.

Serious lies usually involve 'high stakes' (Walczyk, Harris, Duck, & Mulay, 2014). This kind of lie may make or break relationships, lead to exoneration from a crime and is usually justified by excuses such as national security and fear of an outcome. In my opinion, they are usually motivated by self-preservation and fear. There is usually the fear that if the truth is told, one may be found

guilty, national (security) issues and interests will be endangered, a relationship may break or something fundamental may change.

The difference between justifiable and unjustifiable lies is dependent on the context and the hearers (Lelieveld et al., 2016). This clearly leaves it up to the hearers to determine whether given the circumstances, they would ignore the lie or take it up with the speaker or take no offense. In such instances, personality traits (individual differences), relationship (between hearers and speakers, or how well the hearer/s can relate with the situation) and the stakes involved (i.e. context) influence how severely lies are judged and treated. Jurors and Judges usually find themselves in such situations as they may have to decide if an accused is guilty or not after they have been caught in a lie. This kind of lie may also be told for personal gain (self-serving).

Findings by Garrett et al. (2016) indicated that dishonesty for someone else's benefit does not spiral, remaining constant but self-serving dishonesty gradually spirals. This finding suggested that the escalation of dishonest behavior is conditioned by motivation and implies that dishonesty can be best examined with a motive.

## 1.4. Previous Research on Lying

The discussion in this section focuses on previous studies on lying. The first section will discuss studies that have examined cognition and cognitive processes involved in lying and the second section will focus on other studies into lying.

### 1.4.1. Lying and Cognition

Lying has been found to be a complex cognitive process which is more mentally taxing than truth telling. Behaviors such as less hand and arm movements, reduced blinking and more pauses during speech, that are found in other cognitively demanding tasks are present in lying (Debey et al.,

2012; Lelieveld et al., 2016; Yin et al., 2017). Debey et al., (2012) asserted that lying involves a choice to lie which involves concealing the truth, the lie must make as much sense as possible, and the speaker has to ensure that nothing in their demeanor gives away the fact that they are lying. The effort that goes into making a lie believable is an attempt to make it easier for the hearer to accept the lie as truth (Lelieveld et al., 2016; Debey et al., 2012). A liar must also ensure that the hearer does not doubt what is being said and may have to quickly come up with answers for any questions that are asked or find ways to assuage the doubts or concerns that a hearer has. Truth telling requires memory retrieval or reconstruction, unlike lying which demands a new story to be created and answer every question that comes up in order to sound credible or believable.

Researchers have conducted a number of studies in efforts to establish and understand the cognitive processes as well as neural basis for lying. fMRI studies (Ofen, Whitfield-Gabrieli, Chai, Schwarzlose & Gabrieli, 2017; Luan Phan, Magalhães, Ziemlewicz, Fitzgerald, Green & Smith, 2005; Langleben & Moriarty, 2013; Yin et al., 2017) have found that the prefrontal regions of the brain which include the anterior cingulate, dorsolateral prefrontal and inferior frontal regions are highly functional in lying, and no part of the brain comprehensively functions for truth telling as for lying. These regions are usually active in executive control tasks such as planning working memory, task switching, inhibition, social cognitive processes, speech functions, decision-making, emotions and behavior regulation. Truth telling has been established as a dominant response and not associated with any processing difficulties. Findings from Yang & Raine (2006) suggest that despite the dominance of truth telling, it can be suppressed to give way to lies.

For example, using the Sheffield lie test, Verschuere, Spruyt, Meijer & Otgaar (2011) tested the malleability of the (dominant) truth telling response. The study examined if response latencies and accuracy for truth and lies were influenced by the filler questions which required yes/no answers.

From the findings, frequent lying reduced the cognitive cost associated with lying and frequent truth telling increased the cost associated with lying. Generally, it is accepted that continuous exposure to a stimulus weakens the response to the stimulus. In line with this assertion, the findings of Verschuere et al. (2011) imply that for a habitual liar, lies might become the dominant response and truth telling becomes more cognitively demanding (see also Garrett, Lazzaro, Ariely & Sharot, 2016).

Aside from habit, empathy has been found to be a motivating factor in lowering the cognitive cost of lying on the speaker's part. In a study by Yin et al., (2017) which examined how altruistic behavior influences dishonest decisions, event-related fMRI was used to examine participants in the process of making dishonest decisions. Previous studies have established that the anterior insula (which is folded within the lateral sulcus in each hemisphere of the brain) serves as an interface for emotion and altruistic intention as well as empathy (Chang, Smith, Dufwenberg & Sanfey, 2011). Empathy is also considered an antecedent of altruistic behavior. The anterior insula (AI) responds to guilt resulting from a violation of one's inner moral code. In lying for altruistic purposes, Yin et al. (2017), discovered that the functionality of the AI in terms of guilt was lowered, suggesting that the AI serves as a center for regulating the effects of altruistic goals on lying. I interpret this cognitive response as 'the end justifies the means'. High arousal levels in the brain can be detected in a speaker who is engaged in lying (Proverbio et al., 2013).

### 1.4.2. Lying and Language Processing

Research into the processing of false information is fairly recent and has not really focused on truth vs lies on the part of the comprehender. Again, to the best of our knowledge, there is no study that has examined truth vs lies, and the effect of worldview on the processing. The studies

discussed below focus on native vs non-native language use in production and white lies vs truth telling.

Duñabeitia & Costa (2015) investigated if the relationship between linguistic effects and the veracity of a statement were independent, and if the production of falsehoods in a second language had a higher cost as compared to falsehoods produced in a native language. Spanish native speakers who were proficient in Spanish and English were asked to participate in an animal picture naming experiment. They were required to correctly name and describe the image with focus on the color, name of the animal and how many legs it has in both languages. They were also instructed to lie about the image in both languages and to ensure that the lie would be believable enough for a hearer who could not see the image. Participants' eye movements were recorded and percentage of pupil size change, voice onset latency and utterance duration were analyzed. There was no interaction reported for false statements and truth statements as pupil dilation was higher for false statements and foreign language than for true statements and native language. Voice onset latencies were significantly higher for false statements than for true statements and not significant for language effects. This suggests that the cognitive cost associated with producing lies occurs at the conceptual phase of the production process. Duration of utterances was longer in foreign language than in native language but not significant in the statements. The study concluded that the additional cognitive burden presented by lying is not affected by the language of choice in spite of the cost posed by speaking in a non-native language.

In a study by Moreno et al. (2016), ERP responses were used to target how the brain processes words that convey either a social "white" lie or a socially impolite blunt truth. Based on the studies by Daltrozzo et al. (2007) and Wirth et al. (2007) which posited that men and women usually differ in semantic processes indexed by the N400 component, Moreno et al. recruited only females (27)

for their study. Participants were presented with paragraphs that contained social situations with unpleasant truths. In these situations, someone, maybe a host, asks for an opinion. The stimuli were grouped into three conditions: white lie, blunt truth and nonsense (a semantic violation). A sample of the stimuli is presented below (**Table.1**).

**Table.1**: Sample of Stimuli from Moreno et al., (2016)

| Paragraph | Sentence Beginning | Target Word | Condition | Sentence Ending |
|---|---|---|---|---|
| Ana doesn't know how to cook and the meal she prepared for her guests got burned. As they finish having dinner, she asks: So, what do you think of dinner? One of her guests says: | The meat sauce was… | Tasty<br>overcooked<br>romantic | white lie<br>blunt truth<br>nonsense | …and it was creamy. |
| Jaime has decided to put on some hair gel and comb his hair back because he thinks it looks good on him. When he asked his friend Juanjo what he thought of his new look, Juanjo said: | That new hair style highlights your … | cheeks<br>receding<br>hairline<br>months | white lie<br>blunt truth<br>nonsense | …and your forehead. |

The study found that although the semantic violations provoked the N400 response as was expected, white lies did not. The response was especially higher for semantic violations in relation to white lies and blunt truths. From the electrophysiological responses recorded, the study concludes that in processing white lies, there is no semantic or interpretive difficulty as surrounding social context outweighs the cognitive cost associated with processing social lies. This occurrence causes white lies to be processed neither as false nor as ironic (Moreno et al., 2016).

Brain waves have been discovered to be sensitive to convenient information within a social context in addition to lexical information. This emphasizes the importance of context in making decisions in relation to utterances.

From the discussions above, it is evident that language processing is influenced by several social constructs, some of which have been discussed above (see section 1.2) and individual worldviews. We examined if people's personal opinions of lies are modulated by the speaker's identity and if worldview modulates these opinions. From the findings of Moreno et al. (2016), we predict that if the surrounding linguistic context of false statements does not demand the comprehender to be polite or empathetic, false statements will be processed with a cognitive cost. The study by Moreno et al. (2016) is quite similar to the plan for the current study and provided some ideas as well. From the discussions above, it can be deduced that a lot of research focused on lie production and detection. In this study, we focused on the reader, specifically if the speaker's identity would affect the hearer's processing of true and false statements. To the best of our knowledge, this area has not been explored yet.

# Chapter 2

# 2. Present Study

The purpose of the present study was to investigate the processing of true vs. untrue statements depicted as spoken by more or less trustworthy characters. Specifically, we investigated the extent to which the perceived trustworthiness of the depicted speaker, for example politician vs. teacher, affected how people evaluated and processed the statements. We also sought to investigate the extent to which participants would agree with and find these statements socially acceptable. The study asked the following questions:

1. Do participants personally agree with and find true vs untrue statements acceptable and are these outcomes influenced by the speaker?

1. Is there a processing cost for true vs untrue statements and if so, is this cost influenced by the speaker?
2. To what extent does the comprehender's individual political ideology and personal beliefs influence the processing and outcomes (social acceptability and personal opinions) of these statements?

To find answers to these questions, we designed two experiments, a ratings experiment and self-paced reading experiment, preceded by a materials pre-selection test (see section 3.2.1). The study is based on the general sentiment that people have come to see lies as acceptable when they come from people of certain characters or occupations (such as politics). This means that a hearer may not give much consideration to information given by a person perceived to be untrustworthy. Lying is considered as a mentally taxing complex cognitive process (on the part of the speaker). Based on the sentiment and literature available on lying, we predicted that a reader/listener would not put

much effort into decoding a statement from a person they consider untrustworthy as they may consider it a lie.

The first experiment was a rating task. Participants rated paragraphs based on how acceptable they perceived the paragraphs and if they agreed with the information in it. The second experiment was a self-paced reading task where participants read the same stimuli as in the first experiment in short, segmented paragraphs and each of these paragraphs presented a character from a pre-selection list. An untrustworthy character was depicted as making an untrue statement then depicted as making another statement which contains the truth version of the untrue one. A trustworthy character was also depicted as making the same true/untrue statements. Language Background, Interpersonal Reactivity Index, Right-wing Authoritarianism and Wilson-Patterson Issue Battery Questionnaires were administered at the end of both experiments.

We asked if processing would become mentally taxing for a hearer in instances where an untrustworthy person told the truth or a trustworthy person lied. Would the hearer give any consideration to the content regardless of the speaker? In view of this, we hypothesized that if a lie is produced by a character that is considered untrustworthy, there might be no extra processing cost; however, if the lie is produced by a character that is considered trustworthy, these statements should be more difficult to process. We also hypothesized that if a truth is produced by a character that is considered trustworthy, there will be no extra processing cost, if the truth is produced by a character that is considered untrustworthy, there will be an extra processing cost.

Before the self-paced reading experiment that examined real-time processing, we conducted a ratings experiment to investigate people's opinions of lies vs truths, by asking the participants to rate certain scenarios. We also investigated if these opinions were influenced by our individual

difference measures. Hence, the same individual difference measures were used for both experiments. Here, we hypothesized that untruthful statements would not be considered socially acceptable regardless of the speaker and truthful statements would be considered socially acceptable regardless of the speaker. We also hypothesized that people would be likely to disagree with the untruthful statement and agree with the truthful statement without regard for the speaker. We also hypothesized that individual differences would modulate these opinions.

From the discussion above and the literature, it can be deduced that a lot of research focused on the speaker of the lie or lie production. In this study, we focused on the hearer, specifically if the speaker's identity would affect the hearer's processing of true or untrue statements. To the best of our knowledge, this area has not yet been explored.

# Chapter 3

# 3. Ratings Task

## 3.1. Participants

A total of 82 proficient speakers (Female = 60, Male = 18, Other = 4, $M_{age}$ = 20.16, SD= 3.38 , Range = 17-41) of English from the Linguistics Undergraduate SONA pool which comprises first and second year undergraduate students of the Department of Linguistics participated in the ratings experiment. None participated in the materials pre-selection or the self-paced reading experiment.

## 3.2. Materials

### 3.2.1. Materials Pre-Selection

A pre-selection ratings test which required participants to rate 36 characters based on a revised version of the Reysen honesty scale (Reysen, 2014) was conducted. A total of 40 participants were recruited from the Linguistics Undergraduate SONA pool which comprises first and second year undergraduate students of the Department of Linguistics. There were 11 native speakers of English and 27 non-native speakers. Two participants were excluded as they did not provide information on their country of birth. The original honesty questionnaire (attached in Appendix A) is a 7-point scale with eight questions. Three questions from this questionnaire were used; 'I believe what this person says', 'This person has integrity' and 'This person is honest'.

Participants were instructed to rate each of the characters based on the questions and fill out a Language Background Questionnaire and a Political Ideology Questionnaire. The questionnaires can be found in Appendix B. The focus of this exercise was to find out the degree of

trustworthiness the participants assigned to those characters. The ratings from this experiment allowed us to determine which characters to use in the main experiments.

The first question reported a mean individual and character rating of 4.27, which was lower than the 4.36 mean that was reported for the second question but higher than the 4.12 from question 3. Pharmacist, Scientist, Medical doctor, University professor, Judge, Researcher, Gradeschool teacher and Human rights activist had the highest honesty ratings. So, they were categorized as trustworthy professions for the main experiment. Car salesman, Insurance salesman, Anti vaxxer, Lobbyist, Premier, Senator, Nudist and Business executive were selected from among the lowest ratings and were categorized as untrustworthy characters (Appendix C).

### 3.2.2. Experimental materials

A total of 96 experimental paragraphs (Appendix D) were prepared for the two tasks. The experimental paragraphs were made up of scenarios which were created around proven lies or conspiracy theories and their truthful versions (**Table** Error! No text of specified style in document.**2**). These lies and truths were collected from books and websites. Each scenario contained a speaker, an introductory section, a target section which was either a truth or a lie and a concluding section. The paragraphs were of approximately equal length and devoid of ambiguities and are presented below.

**Table** Error! No text of specified style in document.**2**: Experimental items in the Study[1]

| Speaker | Truthfulness | Introductory Section | Target Section | Paragraph Ending |
|---|---|---|---|---|
| The province's premier | False | briefed the audience/ on a report/ that traced the/ COVID-19 outbreak. / He said;/ 'Scientists have concluded/ | that the outbreak/ of COVID-19/ can be traced to/ **transmissions from 5G masts**/ in Canada/ and elsewhere. / | We await/ information from/ the research team. / |
| The gradeschool teacher | False | briefed the audience/ on a report/ that traced the/ COVID-19 outbreak. / He said;/ 'Scientists have concluded/ | that the outbreak/ of COVID-19/ can be traced to/ **transmissions from 5G masts**/ in Canada/ and elsewhere. / | We await/ information from/ the research team. / |
| The province's premier | True | briefed the audience/ on a report/ that traced the/ COVID-19 outbreak. / He said;/ 'Scientists have concluded/ | that the outbreak/ of COVID-19/ can be traced to/ **the Wuhan province**/ in China/ in East Asia. | We await/ information from/ the research team. / |
| The gradeschool teacher | True | briefed the audience/ on a report/ that traced the/ COVID-19 outbreak. / He said;/ 'Scientists have concluded/ | that the outbreak/ of COVID-19/ can be traced to/ **the Wuhan province**/ in China/ in East Asia. | We await/ information from/ the research team. / |
| The school board | Filler | released a statement/ on the use/ of protective equipment/ in public schools. / They said;/ "we have decided/ | that staff members/ must wear/ the protective equipment/ supplied to ensure/ that they meet/ safety requirements. | Some staff/ are provided/ with N95 masks. |

[1] The segmentation in the table was used in the self-paced reading task and not in the rating task

## 3.3. Individual Differences Measures

After the main experiment, participants filled out a Language Background questionnaire (Appendix B), an Interpersonal Reactivity Index questionnaire (Davis, 1980), Right-Wing Authoritarianism questionnaire (Altemeyer, 1981, 2007) and a Wilson-Patterson Issue Battery questionnaire (Wilson & Patterson, 1968). With the exception of the Language Background questionnaire that taps into information on the participants' cultural and language background, all the other measures are personality tests.

The Interpersonal Reactivity Index (IRI) questionnaire (Davis, 1980) measures a person's reaction to other people's experiences. The questionnaire is made up of 28 items which are subdivided into four. These four divisions are Perspective Taking (PT), Fantasy Scale (FS), Empathic Concern (EC), and Personal Distress (Personal Distress). The measure employs a 5-point Likert scale which ranges from "Does not describe me well" to "Describes me very well". For the purpose of the study, we used a 7-point Likert Scale, with the same description. This was to ensure uniformity across all the measures employed in the study. These divisions were scored individually and added to the data set as individual variables.

Also, the Right-Wing Authoritarianism (RWA) questionnaire measures the opinions of people on a variety of social issues. The original questionnaire has 22 items with a 9-point scale that ranges from -4 (very strongly disagree) to 4 (very strongly agree). The lowest score on this scale is 20 and the highest is 180. The measure focuses on items such as authoritarian submission, authoritarian aggression and conventionalism to deduce if the participant has the personality of an authoritarian follower. The 9-point scale was reduced to a 7-point scale.

The Wilson-Patterson Issue Battery (WP) questionnaire measures political ideology in terms of liberalism and conservatism. The scale asks participants to rate the extent to which they agree or disagree with the concepts presented. The 18-item measure has a 5-point scale which ranges from 1 (Strongly disagree) to 5 (Strongly agree). As said earlier, all the questionnaires used in this study were adjusted to a 7-point Likert scale.

## 3.4. Design and Procedure

The stimuli were programmed using Google forms. The study used a 2x2 design which comprised truthful and lying conditions, one with a speaker who was rated as untrustworthy and the other with a trustworthy speaker. The main difference between the conditions were the target areas which contained either the lie or the truth. The experimental materials were coded into four different counterbalanced lists. Each list was merged with the fillers. Both the fillers and experimental items were segmented into 16 segments. Four separate Google forms were prepared from the same four lists. Each form had items from one list which comprised 24 experimental items, 24 fillers, a total of 48 items. These items were presented in an orderly fashion. Two scales were attached to each item. The first scale ranged from 1-Completely acceptable to 7-Completely unacceptable and participants had to rate the social acceptability of each item. The second scale ranged from 1- Strongly agree to 7-Strongly disagree and participants had to give their individual opinions of each item.

The four forms were administered in four separate studies. The four individual measures were also programmed on Google forms and these forms were linked to the main form so participants could transition to the next form after completing the current form. There were instructions at the top of each form to guide participants. A debrief form was attached at the end of each study.

Due to the COVID-19 Pandemic, the laboratory was closed, and participants had to find their own controlled environment to take the experiment in. Laptops or desktops were required for the experiments. After reading the consent, participants were required to continue the task to indicate consent. If they chose not to give consent or changed their minds at any point during the experiment, they were to close the window to exit the experiment. Participants spent about 30 minutes on the experiment.

## 3.5. Data Analysis

The study focused on if a speaker's identity (trustworthiness) would affect a reader's opinion of true or untrue statements. The first analysis inspected the two manipulated variables; Truthfulness, whether the statement is true (T) or false (F); and Trustworthiness, whether the speaker was trustworthy (T) or untrustworthy (U). We examined the two-way interactions between these two main predictors. The second analysis focused on three-way interactions between the individual differences measures (Interpersonal Reactivity Index, Right-Wing Authoritarianism, and a Wilson-Patterson Issue Battery) and the two predictors. In the ratings experiment, participants were asked to rate how socially acceptable (acceptability scale) they found the statements and if they personally agreed with the statements (agreement scale).

A linear mixed-effects modeling (LME) was performed to analyze the results. This type of regression modeling accounts for variance among participants and items concurrently (Van Rij, Vaci, Wurm & Feldman, 2020). This model was used because it allows for the removal of biases arising from sampling effects. LME modeling looks at fixed effects and random effects which allows for inferences to be made and allows fixed effects to vary in the model. The *lme4* package (Bates, Mächler, Bolke & Walker, 2015) was used for the analysis. The *lmerTest* package

(Kuznetsova, Brockhoff & Christensen, 2020) was used to obtain p-value estimations, and the *interactions* package (Long, 2021) was used to plot the findings of the models.

A backward model fitting approach was used in fitting the models. The manipulated variables were first fitted and inspected. We used the function *anova()* to compare the models and determine the best models to report. Each model included by-participant random slopes for Truthfulness.

We started by examining the three-way interaction between Speaker (Trustworthy, Untrustworthy), Truthfulness (True, False) and Rating Type (Acceptability, Agreement). We merged acceptability and agreement scores into a column named response. Another column named rating type was added and it contained either acceptability or agreement to indicate the scale to which number in the corresponding response column belongs to. Response was fitted as the response variable and Rating Type was included in the interaction between the two main predictors.

The model (Appendix E) indicated that the three-way interaction was not significant ($p < 0.05$). However, we observed a strong correlation between the rating type and truthfulness as well as between Speaker and Truthfulness

We then excluded the 3-way interaction from the model and proceeded to inspect and keep the significant two-way interactions between the two main predictors, Speaker and Truthfulness and a two-way interaction between rating type and truthfulness. The findings from this final model are presented in **Table 3** below.

In the second analysis, we focused on three-way interactions between the individual differences measures (Interpersonal Reactivity Index, Right-Wing Authoritarianism, and a Wilson-Patterson

Issue Battery). We inspected whether the effects in the previous model were influenced by the individual difference measures listed above. We added each of these measures separately to the interactions with a particular interest in the two main predictors.

The Interpersonal Reactivity Index has four different scales and each one measures empathy from a different perspective. To prevent one scale from canceling out the effect of the other, the scales were calculated individually. And the analyses performed on each of the scales were independent of each other.

## 3.6. Results

**Table 3** reports the model fitted with response ratings as a response variable, an interaction between truthfulness and speaker (credibility), and an interaction between truthfulness and rating type, with participants and items as random effects and truthfulness as a by-participant random slope.

**Table 3**: Summary of the fixed-effects from the linear mixed-effects regression model with the interaction of Truth value of a statement, Speaker's credibility and the interaction of Truth value of a statement, rating type fitted to response among participants. Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy; Rating type = Acceptability

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 4.2437 | 0.1535 | 27.6377 | 0.0000 *** |
| TruthfulnessTRUE | -2.0428 | 0.141 | -14.4839 | 0.0000 *** |
| SpeakerU | 0.0673 | 0.0677 | 0.9949 | 0.3199 |
| rating_typeAgreement | 0.7073 | 0.0677 | 10.4503 | 0.0000 *** |
| TruthfulnessTRUE:SpeakerU | 0.3379 | 0.0957 | 3.529 | 0.0004 *** |

| | | | | |
|---|---|---|---|---|
| TruthfulnessTRUE:rating_typeAgreement | -0.6372 | 0.0957 | -6.6569 | 0.0000 *** |

Formula: summary(lmer(response ~ Truthfulness * Speaker + Truthfulness * rating_type + (1 + Truthfulness|participant) + (1|Item_No), data = Rating_1))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

The model (**Table 3**) showed a significant effect of Truthfulness but no significant effect of Speaker. However, there was a significant interaction between Truthfulness and the Speaker. From figure 3.1, it can be seen that in false statements, untrustworthy speakers were rated slightly higher than trustworthy speakers, but this difference is not significant. Generally, false statements were rated as more unacceptable and less agreeable. In true statements, untrustworthy speakers received significantly higher ratings than trustworthy speakers. Because higher ratings correspond to lower acceptability and agreement, this suggests that participants considered truthful statements produced by trustworthy speakers as more acceptable than truthful statements produced by untrustworthy speakers. It also suggests that participants agreed more with truthful statements produced by trustworthy speakers than truthful statements produced by untrustworthy speakers

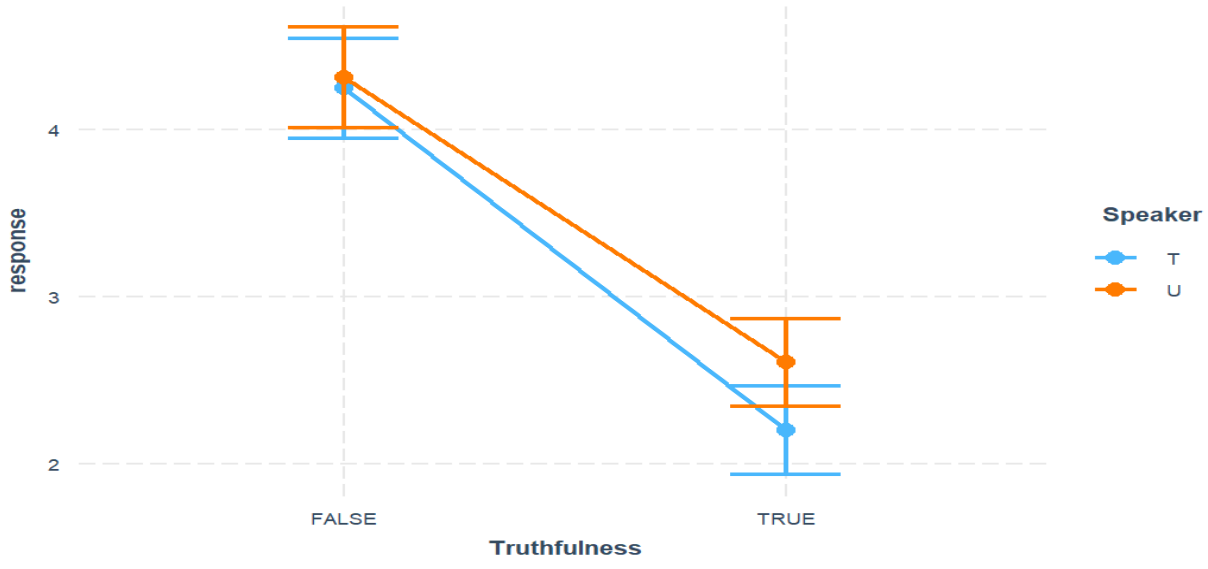

**Figure.1**: Interaction between Truthfulness and Speaker Credibility with response as response variable

As mentioned above, there was no significant three-way interaction between truthfulness, speaker and rating type. This suggests that participants considered the two scales as the same and rated them similarly, despite the fact that participants' Agreement ratings were generally significantly higher than Acceptability ratings, suggesting they agreed with the statements to a lesser degree than they deemed them acceptable. However, from the model above (**Table 3**), it is evident that the effect of rating type was affected by an interaction with truthfulness. Further, from the **Figure .2** below, it is evident that in terms of truthfulness, there was variance in rating. False statements were rated less favorably on the agreement scale than on the acceptability scale which suggests that although some participants would not so much mind hearing this in social settings, they personally disagreed with the statements.

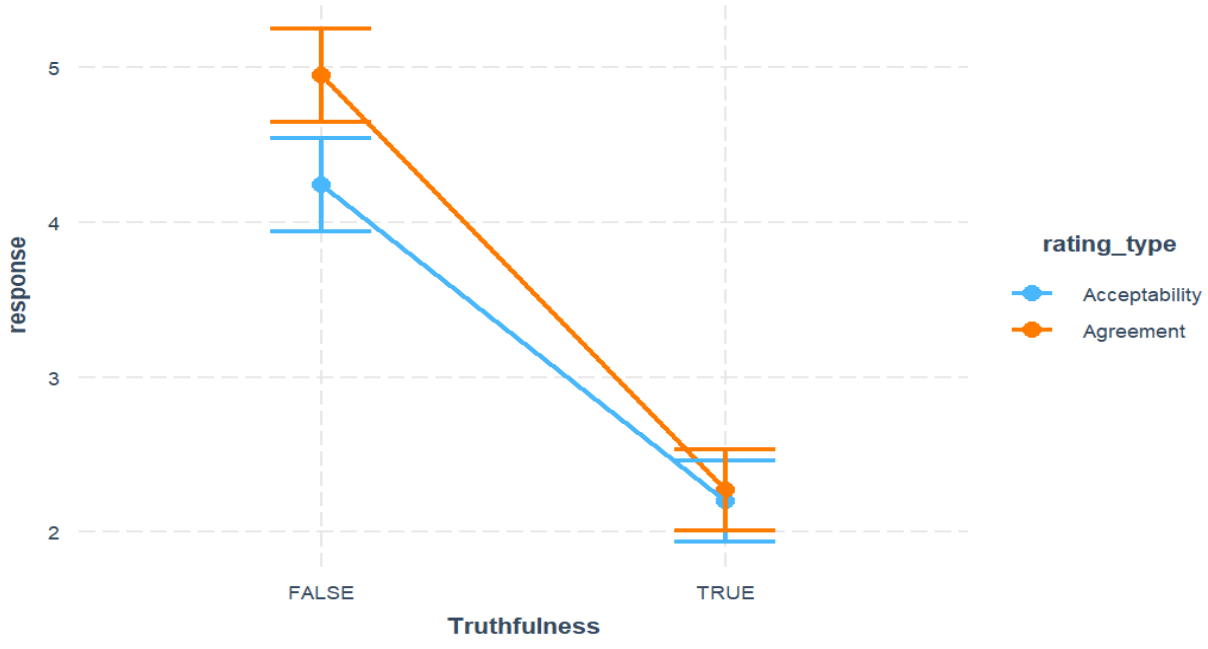


**Figure .2**: Interaction between Truthfulness and rating type with response as response variable

### 3.6.1. Results From Individual Differences Models

**Personal Distress:** This model included response ratings as a response variable, a three-way interaction between truthfulness and speaker (credibility) personal distress (individual difference), an interaction between truthfulness and rating type with participants and items as random effects and truthfulness as a by-participant random slope. This was the only significant interaction between Speaker and Truthfulness and any of the individual difference measures. All other interactions were non-significant and reported p-values > 0.05. The findings of the model are reported in **Table.4** below.

**Table.4**: Summary of the fixed-effects from the linear mixed-effects regression model with interaction of Truth value of a statement, Speaker's credibility and Personal Distress Scores and the interaction of Truth value of a statement, rating type fitted to re response ratings among participants. Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy; Rating type = Acceptability.

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 4.8119 | 0.6481 | 7.4246 | 0.0000 *** |
| TruthfulnessTRUE | -3.2058 | 0.7383 | -4.3422 | 0.0000 *** |
| SpeakerU | -0.9969 | 0.3749 | -2.6593 | 0.0079 ** |
| Personal Distress_Total | -0.0219 | 0.0243 | -0.9025 | 0.3691 |
| rating_typeAgreement | 0.7073 | 0.0676 | 10.4611 | 0.0000 *** |
| TruthfulnessTRUE:SpeakerU | 1.8518 | 0.5319 | 3.4814 | 0.0005 *** |
| TruthfulnessTRUE:Personal Distress_Total | 0.0449 | 0.0280 | 1.6050 | 0.1115 |
| SpeakerU:Personal Distress_Total | 0.0411 | 0.0142 | 2.8860 | 0.0039** |
| TruthfulnessTRUE:rating_typeAgreement | -0.6372 | 0.0956 | -6.6638 | 0.0000*** |

| | | | | |
|---|---|---|---|---|
| TruthfulnessTRUE:SpeakerU:Personal Distress_Total | -0.0584 | 0.0202 | -2.8933 | 0.0038** |

Formula: summary(lmer(response ~ Truthfulness * Speaker * Personal Distress_Total + Truthfulness * rating_type + (1 + Truthfulness|participant) + (1|Item_No), data = Rating_1))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

When Personal Distress was added to the model in **Table 3**, the significant values for truthfulness and significant interaction between truthfulness and speaker remained and unlike the model discussed above, significant values were reported for speaker. The model (**Table.4**) also reported significant interactions between speaker and Personal Distress and a significant three-way interaction between speaker, truthfulness and Personal Distress. As seen in **Figure .3** below, there was no significant difference in the rating of trustworthy and untrustworthy speakers in the false condition (both the orange and the blue error bands overlap with the blue and orange mid-lines, respectively). In true statements, trustworthy speakers were rated more highly as Personal Distress scores increased but for participants with Personal Distress scores above 31, there was no significant difference between their ratings for both trustworthy and untrustworthy speakers.

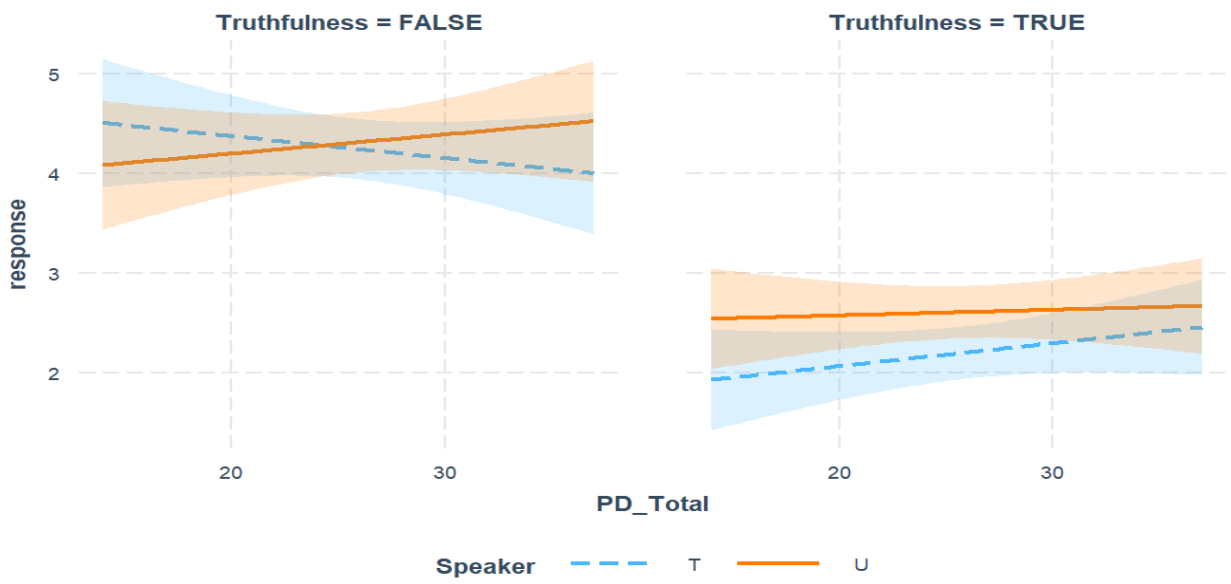


**Figure .3**: Interaction between Truthfulness, Speaker Credibility and Personal Distress Scores (Personal Distress) with response ratings as response variable.

The model below included response ratings as a response variable, an interaction between truthfulness and speaker (credibility), a three-way interaction between truthfulness and rating type with participants and personal distress (individual difference) and items as random effects and truthfulness as a by-participant random slope. The findings of the model are reported in **Table .5** below.

**Table .5**: Summary of the fixed-effects from the linear mixed-effects regression model with interaction of Truth value of a statement and Speaker's credibility and the interaction of Truth value of a statement, rating type and Personal Distress Scores fitted to response ratings among participants. Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy; Rating type = Acceptability.

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 4.7473 | 0.6478 | 7.3281 | 0.0000*** |
| TruthfulnessTRUE | -3.1222 | 0.7376 | -4.2331 | 0.0000*** |

| | | | | |
|---|---|---|---|---|
| SpeakerU | 0.0673 | 0.0676 | 0.9953 | 0.3196 |
| rating_typeAgreement | -0.2275 | 0.3737 | -0.6087 | 0.5427 |
| Personal Distress_Total | -0.0194 | 0.0243 | -0.8003 | 0.4255 |
| TruthfulnessTRUE:SpeakerU | 0.3379 | 0.0957 | 3.5321 | 0.0004 *** |
| TruthfulnessTRUE:rating_typeAgreement | 0.7092 | 0.5285 | 1.342 | 0.1797 |
| TruthfulnessTRUE:Personal Distress_Total | 0.0417 | 0.0279 | 1.4912 | 0.1389 |
| rating_typeAgreement:Personal Distress_Total | 0.0361 | 0.0142 | 2.5436 | 0.0110 * |
| TruthfulnessTRUE:rating_typeAgreement:Personal Distress_Total | -0.052 | 0.0201 | -2.5905 | 0.0096 ** |

Formula: summary(lmer(response ~ Truthfulness * Speaker + Truthfulness * rating_type * Personal Distress_Total + (1 + Truthfulness|participant) + (1|Item_No), data = Rating_1))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

When Personal Distress was moved and added to the interaction between truthfulness and rating type, no significant values were reported for speaker, rating type and the interaction between truthfulness unlike in the previous model. The model (**Table .5**) reported a significant three-way interaction between rating type, truthfulness and Personal Distress. From **Figure .4** below, there was no significant difference in the rating of trustworthy and untrustworthy speakers in the truthful condition. In the false condition, there was no significant difference between acceptability and agreement ratings for participants with Personal Distress scores below 19. Acceptability ratings (blue error band) do not overlap with the mean of agreement ratings (orange error bands) for participants with Personal Distress scores above 19 and this suggests that agreement ratings for those participants were higher than their acceptability ratings. This supports the findings in **Table 3** and **Figure .3**.

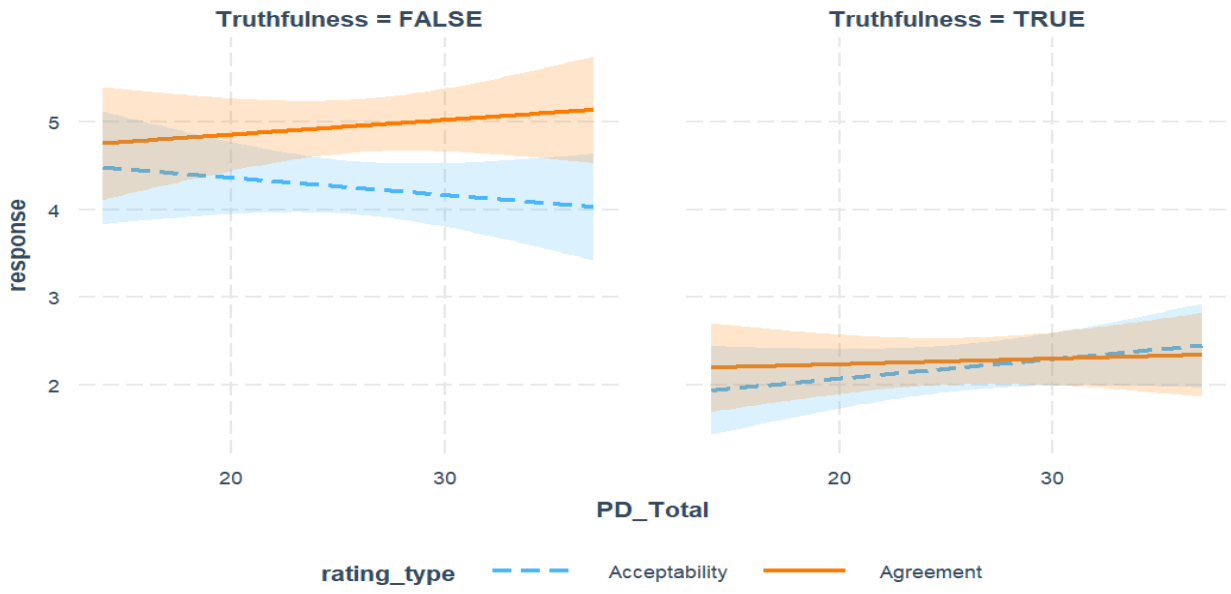


**Figure .4**: Interaction between Truthfulness, rating type and Personal Distress Scores (Personal Distress) with response ratings as response variable

**Empathetic Concern:** This three-way model below included response ratings as a response variable, an interaction between truthfulness and speaker (credibility), a three-way interaction between truthfulness and rating type with participants and empathetic concern (individual difference) with participants and items as random effects and truthfulness as a by-participant random slope. The findings of the model are reported in **Table .6** below.

**Table .6:** Summary of the fixed-effects from the linear mixed-effects regression model with interaction of Truth value of a statement and Speaker's credibility and the interaction of Truth value of a statement, rating type and Empathetic Concern Scores fitted to response ratings among participants. Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy; Rating type = Acceptability.

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 5.097 | 0.8059 | 6.3242 | 0.0000 *** |
| TruthfulnessTRUE | -2.8553 | 0.9228 | -3.094 | 0.0025** |
| SpeakerU | 0.0673 | 0.0676 | 0.9959 | 0.3194 |
| rating_typeAgreement | -0.7207 | 0.4669 | -1.5436 | 0.1228 |
| EC_Total | -0.0336 | 0.0312 | -1.0786 | 0.2835 |
| TruthfulnessTRUE:SpeakerU | 0.3379 | 0.0956 | 3.5326 | 0.0004*** |
| TruthfulnessTRUE:rating_typeAgreement | 0.7087 | 0.6603 | 1.0733 | 0.2832 |
| TruthfulnessTRUE:EC_Total | 0.0320 | 0.0359 | 0.891 | 0.3750 |
| rating_typeAgreement:EC_Total | 0.0563 | 0.0182 | 3.091 | 0.0020** |
| TruthfulnessTRUE:rating_typeAgreement:EC_Total | -0.053 | 0.0257 | -2.06 | 0.0395* |

Formula: summary(lmer(response ~ Truthfulness * Speaker + Truthfulness * rating_type * EC_Total + (1 + Truthfulness|participant) + (1|Item_No), data = Rating_1))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Personal Distress was replaced with Empathetic Concern in this model. Similar to the previous model, there were no significant values reported for speaker, rating type and the interaction between truthfulness. The model (**Table .6**) reported significant interactions between a significant three-way interaction between rating type, truthfulness and Empathetic Concern. From **Figure .5** below, there was no significant difference in the rating of trustworthy and untrustworthy speakers in the truthful condition. In the false condition, there was no significant difference between acceptability and agreement ratings for participants with Empathetic Concern scores below 20. Participants with Empathetic Concern scores above 20 rated statements on the agreement scale significantly higher than the acceptability scales (as depicted by the blue and orange error bands). This supports the findings in **Table .5**.

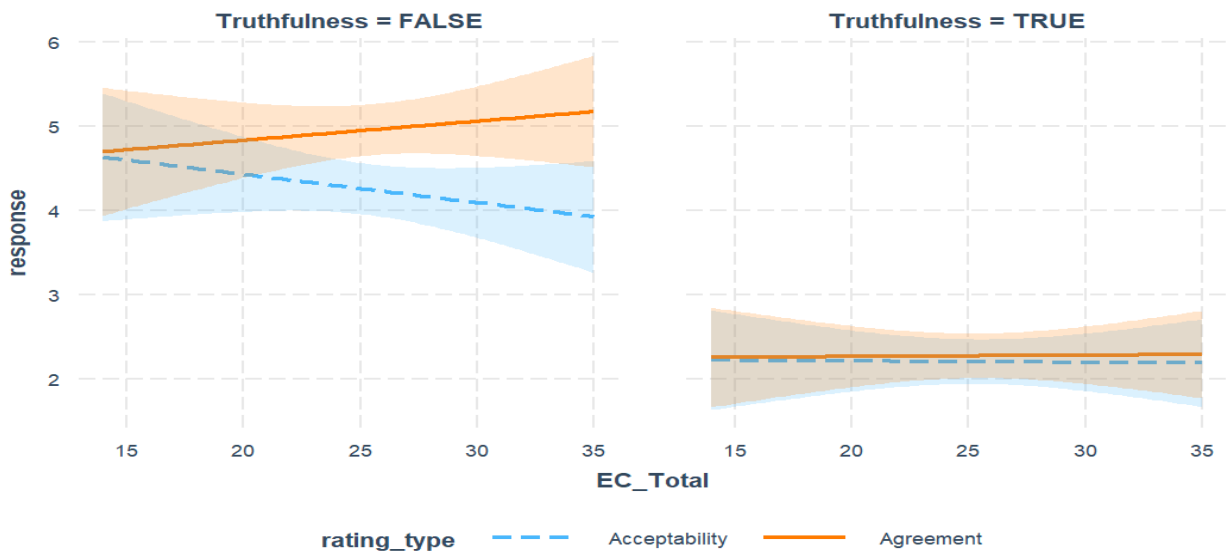


**Figure .5**: Interaction between Truthfulness, rating type and Empathetic Concern Scores (EC) with response ratings as response variable

## 3.7. Discussion

In this experiment, we asked if truthful statements were considered socially acceptable or agreed with regardless of the speaker's credibility. We also asked if false statements were considered as socially unacceptable and disagreed with regardless of the speaker's credibility. From the general findings of the ratings experiment, only models which reported significant interactions (p-value <0.05) were reported in this section. Across the two scales, trustworthy speakers in the truthful condition were rated as more highly acceptable and strongly agreed with than untrustworthy speakers in the truthful condition (**Figure.1**). The findings (**Figure .2**) also suggested that participants possibly considered acceptability and agreement similar in the truthful condition and ratings across the two scales varied significantly only in the false condition.

In the three-way interaction between speaker, truthfulness and Personal Distress scores, it was found that ratings for trustworthy speakers in the truthful condition increased significantly as Personal Distress scores increased but there was no significant difference between ratings for both trustworthy and untrustworthy speakers for participants with Personal Distress scores above 31. This was supported by findings from the interactions between rating type, truthfulness and Personal Distress scores and rating type, truthfulness and Empathetic Concern scores.

From these findings it can be concluded that the false statements used in this study were easily identified as false and it matters more who gives truthful information than who gives false information. It is also evident that people with high personal distress scores consider lies unacceptable when they are produced by trustworthy characters and consider truths acceptable when they are spoken by trustworthy speakers. People with high distress scores do not seem to be affected when an untrustworthy speaker gives information regardless of the truthfulness of the information.

Based on this premise, we conducted a self-paced reading experiment which is discussed in the next chapter. The self-paced reading examined the real-time processing (reaction times) of these experimental items and asked if the response would be similar to the impression or opinions individuals have of these scenarios and contexts.

# Chapter 4

# 4. Self-Paced Reading Task

## 4.1. Participants

Originally, a total of 170 proficient speakers of English participated in the self-paced reading experiment. From this number, 137 (Female=72, Male=54, Other=11, $M_{age}$=26.14, Range=18-64, SD=10.16) complete and well-labeled submissions were received. This number included 83 participants (Female=45, Male=31, Other=7, Mage = 21.21, SD = 5.78, Range = 18-64) data from the Linguistics Undergraduate SONA pool which comprises first and second year undergraduate students enrolled in LING 101 and 102. Participants from SONA received partial course credit (2%) for their participation.

In addition, a total of 80 participants who resided in Canada were also recruited from prolific.co, a crowdsourcing website. Out of this number, only 54 participants (Female=27, Male=23, Other=4, $M_{age}$=31.48, SD=10.56, Range=18-61) could be used in this study[2].

[2] Participants were asked to enter their Prolific IDs in a section labeled as "participant". This would enable Pavlovia to store their submission under their participant ID. Which would have enabled us to match their prolific IDs to the Pavlovia files and delete returned submissions. We hosted four experiments and in each of these, a number of participants put their names and other labels where they were supposed to input their prolific IDs. Each approved submission received five pounds and Prolific deducted their fee and paid the rest to the participant. After cross checking the list of participants and the submission files on Pavlovia, we had 26 submissions we could not match. As we did not want to make the mistake of using a returned submission, we reached out to Prolific.co via email to ask if there was a way they could help match the submissions. The response we received was to delete those files and "In your future studies, we'd recommend making it even clearer than you already have that participants need to input their ID. For example, you could add this text to your question: "*Do not put any personally identifying information here, only your Prolific ID. If you do not put your ID here, we will be unable to approve your submission*". Our options were to use the 54 participants we were sure of or run the studies again on prolific with no guarantee that participants would not enter other information instead of their ID. We chose to use what we had as Prolific had been unhelpful and we had no guarantee that it would not recur.

## 4.2. Materials

### 4.2.1. Experimental materials

The self-paced reading experiment consisted of the same experimental items as used in the rating experiment. In addition to these paragraphs, one practice paragraph was added. Comprehension questions were created for each of the experimental items and a practice item. These questions required a yes/no answer. The paragraphs were segmented for the purpose of the reading experiment (Refer to **Table** Error! No text of specified style in document.**2** in 3.2.2 for the sample of experimental items).

### 4.2.2. Individual Differences Measures

The Self-Paced Reading experiment used the same individual difference measures as the Ratings experiment.

## 4.3. Design and Procedure

The experiment was programmed using PsychoPy behavioral software (Peirce, Gray, Simpson, MacAskill, Höchenberger, Sogo, Kastman & Lindeløv, 2019). The study used the same 2x2 design as Experiment 1 comprising truthful and lying conditions, one with a speaker who was rated as untrustworthy and the other with a trustworthy speaker. The main difference between the conditions were the target areas which contained either the lie or the truth (**Table** Error! No text of specified style in document.**2**). The experimental materials were coded into four different lists for the four conditions. Each list was merged with the fillers. Both the fillers and experimental items were segmented into 16 segments. Each participant read items from one list which comprised

24 experimental items, 24 fillers and one practice item, a total of 49 items. These items were randomly presented.

The experiment was hosted on Pavlovia experiment platform (pavlovia.org), and a URL was provided on both SONA and Prolific to redirect participants to the study. Laptops or desktops were required for the experiment. Participants were required to give consent by pressing the spacebar after reading the consent. If they chose not to give consent or changed their minds at any point during the experiment, they were asked to press the escape button to exit the experiment. The space bar was to be pressed to progress from one segment or section to the other, this recorded reaction times.

Before each section, instructions were given to guide participants on how to proceed to the next section or how to answer the current section. Pressing the spacebar to progress in the experiment recorded response latencies for individual segments. The mouse was used to click the scale for the questionnaires and the y/n was to be pressed to answer the comprehension questions. There was no option provided for going back to the previous segment. Participants spent 30-40 minutes on the experiment. Pressing the spacebar at the end of the experiment exited the study.

## 4.4. Data Analysis

The study focused on if a speaker's identity (trustworthiness) would affect a hearer's processing of true or untrue statements. The first analysis inspected the two manipulated variables; Truthfulness, whether the statement is true (T) or false (F); and Trustworthiness, whether the speaker was trustworthy (T) or untrustworthy (U). examined the two-way interactions between these two main predictors. The second analysis focused on three-way interactions between the

individual differences measures (Interpersonal Reactivity Index, Right-Wing Authoritarianism, and a Wilson-Patterson Issue Battery) and the two predictors. The Interpersonal Reactivity Index in this analysis was coded same as in the rating task. This was done to examine the effects of these measures on language processing.

A linear mixed-effects modeling (LME) was used to examine the dataset (Van Rij et al., 2020). The *lme4* package (Bates et al., 2015) was used for the analysis. The *lmerTest* package (Kuznetsova et al., 2020) was used to obtain p-value estimations, and the *interactions* package (Long, 2021) was used to plot the findings of the models.

In the Self-Paced Reading experiment, participants' reading times (RTs) were recorded (when the Space Bar was pressed) for each segment. In preparing the data for analysis, these times were changed to milliseconds (multiplied by 1000 from *PsychoPy* defaults) for the analysis. There were 48 comprehension questions, and participants who scored below 36 (less than 75% correct) were removed (19.7% =27 submissions) from the data. A total of 110 submissions (Female = 59, Male = 43, Other = 8, SD=, Range=18-64) were used in the analysis. Before the analysis, RTs were log transformed to ensure a normal distribution. A variable named Nativeness was included in the data frame. Participants who were not born in Canada were coded as other and Canadian-born participants were coded as Canada.

The RTs of the target segment were fitted as the response variable, with Speaker and Truthfulness as fixed predictors. In addition, the RTs to the segment preceding the target region (PRT) for each statement were also included in the analysis as a control variable to guard against auto correlation. The models included random intercepts for participants and items as well as by-participant random slopes for Truthfulness. Afterward, the individual difference measures were fitted one by one, and

their effects were inspected. Function *anova()* was used to compare the models and only the models with significant values were reported.

## 4.5. Results

**Table.7**: Summary of the fixed-effects from the linear mixed-effects regression model with interaction of Truth value of a statement and Speaker's credibility fitted to log-transformed RTs. Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy.

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 4.2006 | 0.0766 | 54.8364 | 0.0000*** |
| TruthfulnessTRUE | -0.0364 | 0.0146 | -2.4868 | 0.0138* |
| SpeakerU | -0.0257 | 0.0093 | -2.7524 | 0.0059** |
| NativenessOther | 0.1226 | 0.0528 | 2.3207 | 0.0222* |
| log (PRT) | 0.3672 | 0.0094 | 39.1910 | 0.0000*** |
| TruthfulnessTRUE:SpeakerU | 0.0441 | 0.0133 | 3.3223 | 0.0009*** |

Formula: summary(lmer(log(RT) ~ Truthfulness * Speaker + Nativeness + log(PRT) + (1 + Truthfulness|participant) + (1|Item_No), data = SPR_data))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

**Table.7** shows the best model before any individual difference measures. From the estimates in **Table.7**, there were significant effects of Truthfulness, Speaker and Nativeness. We also found a significant interaction between Truthfulness and Speaker as shown by the t-value/p-value. The negative estimates show that participants read truthful statements and statements by untrustworthy

speakers faster than false statements and statements by trustworthy speakers. However, these effects were qualified by a significant interaction between Truthfulness and Speaker. This interaction is depicted in **Figure .6** showing that in false statements, reading times for both native and non-native speakers were longer when the speaker was trustworthy than when the speaker was untrustworthy. The opposite was true for truthful statements. There, reading times were longer when the speaker was untrustworthy than when the speaker was trustworthy. As can be seen in the **Figure .6** and **Table.7**, there was also a significant effect of Nativeness. In general, non-native speakers of English had longer reading times than native speakers, which is in line with many previous studies (Costa & Sebastian-Galles, 2014; Nezakat-Alhossaini & Marzieh, 2014; Schmidtke, 2014). However, Nativeness did not interact with the two main predictors.

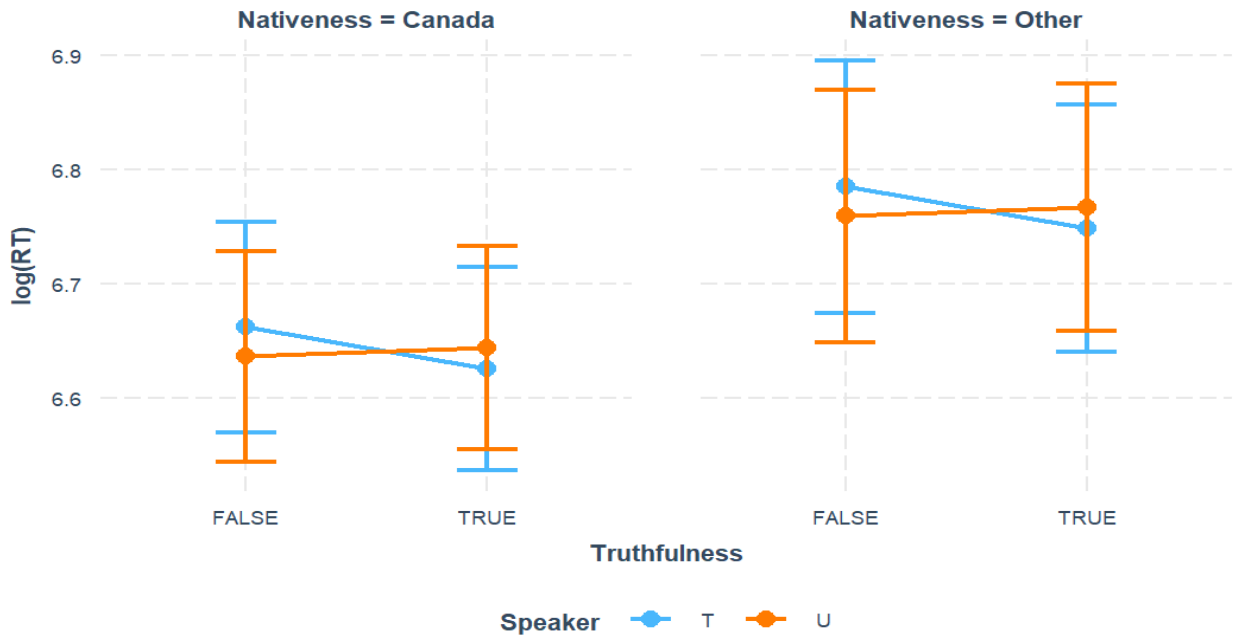


**Figure .6**: Interaction between Truthfulness and Speaker Credibility with RT as response variable

### 4.5.1. Results From Individual Differences Models

**Perspective Taking:** In the second phase of this analysis, we looked at three-way interaction models. More precisely, we ran one model for each individual difference measure to see if the two-way interaction between Speaker and Truthfulness in the above model would be significantly modulated by the inclusion of these measures. The first model included Perspective-Taking Scores with participant and item number as random effects and truthfulness as a random slope and Nativeness and PRTs. The findings of the model are reported in **Table .8** below.

**Table .8**: Summary of the fixed-effects from the linear mixed-effects regression model with interaction of Truthfulness of a statement, Speaker's credibility and Perspective-Taking Scores fitted to log-transformed RTs among participants.

Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy.

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 4.2539 | 0.1590 | 26.7574 | 0.0000*** |
| TruthfulnessTRUE | -0.1354 | 0.0738 | -1.8353 | 0.0682 |
| SpeakerU | -0.0112 | 0.0469 | -0.2394 | 0.8108 |
| PT_Total | -0.0024 | 0.0058 | -0.4156 | 0.6785 |
| nativenessOther | 0.1196 | 0.0531 | 2.2509 | 0.0265* |
| log(PRT) | 0.3680 | 0.0094 | 39.2997 | 0.0000*** |
| TruthfulnessTRUE:SpeakerU | 0.2757 | 0.0665 | 4.1458 | 0.0000*** |
| TruthfulnessTRUE:PT_Total | 0.0042 | 0.0031 | 1.3629 | 0.1747 |
| SpeakerU:PT_Total | -0.0006 | 0.0019 | -0.3184 | 0.7502 |

| | | | | |
|---|---|---|---|---|
| TruthfulnessTRUE:SpeakerU:PT_Total | -0.0098 | 0.0028 | -3.5534 | 0.0004*** |

Formula: summary(lmer(log(RT) ~ Truthfulness * Speaker * PT_Total + nativeness + log(PRT) + (1 + Truthfulness|participant) + (1|Item_No), data = SPR_data))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

After Perspective taking was added to the model the significance of speaker and truthfulness disappeared but the significant effects for nativeness and significant interaction between speaker and truthfulness remained. Although the model did not report any significant interaction between speaker and Perspective taking and Truthfulness and Perspective taking, there was a significant three-way interaction between these variables. This interaction can be seen in **Figure .7**. Here, reading times were significantly higher for false statements with truthful speakers than for false statements with untruthful speakers. Reading times reduced gradually with higher Perspective taking scores in both instances. In true statements, reading times for statements with untrustworthy speakers reduced for participants with higher Perspective taking scores. For trustworthy speakers, reading times significantly increased for participants as Perspective taking scores increased.

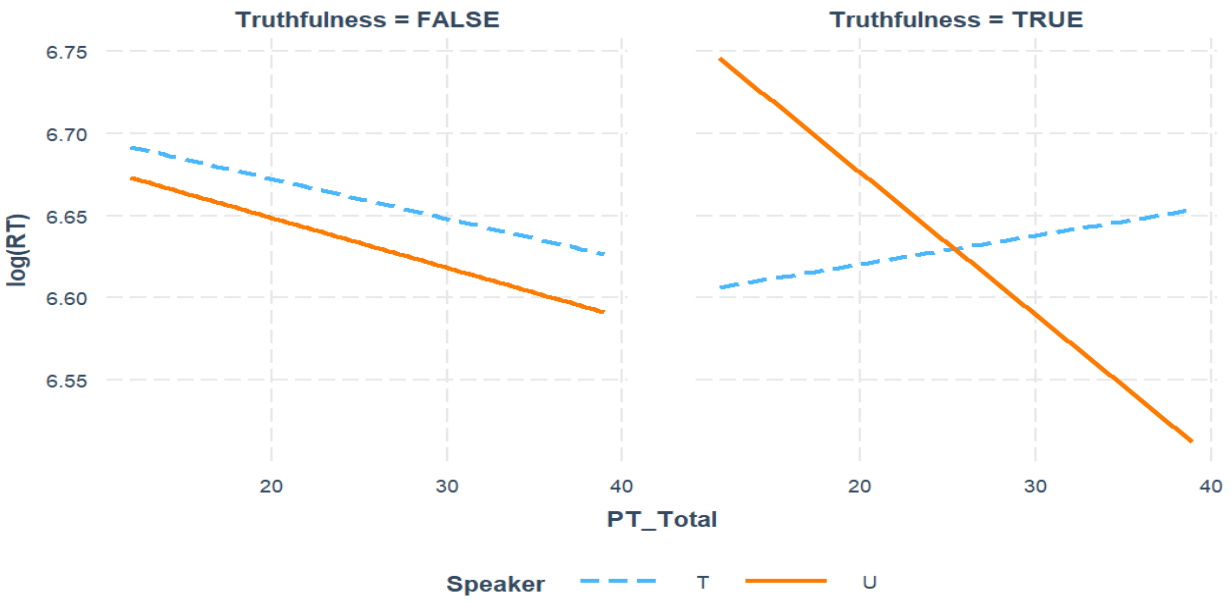


**Figure .7**: Interaction between Truthfulness, Speaker Credibility and Perspective Taking Scores (PT) with RT as response variable

**Table.9**: Summary of the fixed-effects from the linear mixed-effects regression model with interaction of Truth value of a statement, Speaker's credibility and Personal Distress Scores fitted to log-transformed RTs among participants. Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy.

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 3.9563 | 0.1829 | 21.6317 | 0.0000*** |
| TruthfulnessTRUE | 0.1621 | 0.0884 | 1.8341 | 0.0684 |
| SpeakerU | 0.1196 | 0.0562 | 2.1275 | 0.0334* |
| Personal Distress_Total | 0.0090 | 0.0063 | 1.4277 | 0.1562 |

| | | | | |
|---|---|---|---|---|
| nativenessOther | 0.1239 | 0.0528 | 2.3484 | 0.0207* |
| log(PRT) | 0.3684 | 0.0094 | 39.3043 | 0.0000*** |
| TruthfulnessTRUE:SpeakerU | -0.3376 | 0.0796 | -4.2439 | 0.0000*** |
| TruthfulnessTRUE:Personal Distress_Total | -0.0075 | 0.0033 | -2.2794 | 0.0239* |
| SpeakerU:Personal Distress_Total | -0.0055 | 0.0021 | -2.6205 | 0.0088** |
| TruthfulnessTRUE:SpeakerU:Personal Distress_Total | 0.0145 | 0.0030 | 4.8663 | 0.0000*** |

summary(lmer(log(RT) ~ Truthfulness * Speaker * Personal Distress_Total + Nativeness + log(PRT) + (1 + Truthfulness|participant) + (1|Item_No), data = SPR_data))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

**Personal Distress:** The third model included the RTs as a response variable, an interaction truthfulness, speaker (credibility) and Personal Distress Scores with participant and item number as random effects and truthfulness as a random slope and Nativeness and log of PRTs. The findings of the model are reported in **Table.9** above.

Like the Perspective taking model, there were no significant effects for truthfulness and Personal Distress, but the model reported significant values for speaker, nativeness and significant interactions between truthfulness and speaker. Unlike the previous model, there were significant interactions between the individual difference measure, Personal Distress and truthfulness as well as speaker and Personal Distress. The model also reported a significant three-way interaction between Personal Distress, speaker and truthfulness. As shown in **Figure .8** below, in the false

statements, the untrustworthy speaker started off with higher reading times than the trustworthy speaker but fell as Personal Distress scores increased (from 20). This fall created a point of intersection and the trustworthy speaker recorded reading times lower than the untrustworthy speaker for participants with low Personal Distress scores. There was a sharp increase in reading times as participants' Personal Distress scores increased (from 20). In the truthful statements, there was little change in reading times as participants' reading times increased for the trustworthy speaker but there was a very observable rise in the case of the untrustworthy speaker. Reading times increased sharply as Personal Distress scores increased.

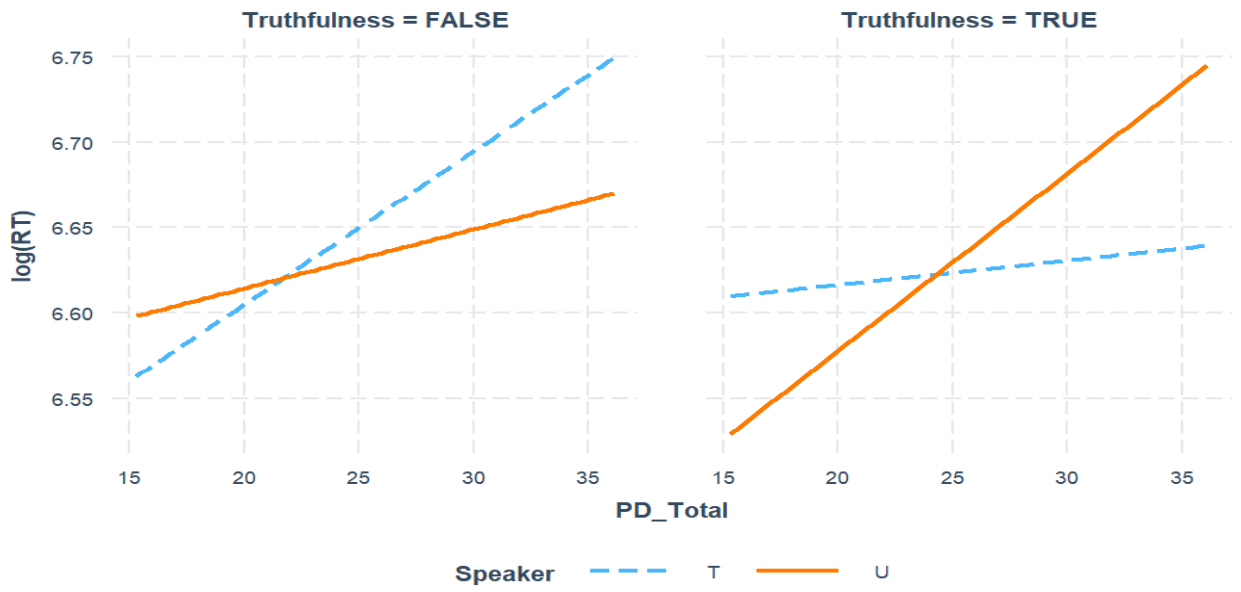


**Figure .8**: Interaction between Truthfulness, Speaker Credibility and Personal Distress Scores (Personal Distress) with RT as response variable

**Political Ideology:** This model included the RTs, an interaction of truthfulness, speaker (credibility) and Right-Wing Authoritarianism scores with participant and item number as random

effects and truthfulness as a random slope and the section preceding the RTs. The findings of the model are reported in **Table.10** below.

**Table.10**: Summary of the fixed-effects from the linear mixed-effects regression model with interaction of Truth value of a statement, Speaker's credibility and Right-Wing Authoritarianism Scores fitted to log-transformed RTs among participants. Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy.

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 4.6516 | 0.2469 | 18.8408 | 0.0000*** |
| TruthfulnessTRUE | 0.0857 | 0.1227 | 0.6985 | 0.4858 |
| SpeakerU | 0.1617 | 0.0783 | 2.0642 | 0.0390* |
| RWA_Total | -0.0031 | 0.0017 | -1.7733 | 0.0789 |
| log(PRT) | 0.3675 | 0.0094 | 39.1604 | 0.0000*** |
| TruthfulnessTRUE:SpeakerU | -0.2844 | 0.1112 | -2.5577 | 0.0105* |
| TruthfulnessTRUE:RWA_Total | -0.0009 | 0.0009 | -0.9996 | 0.3189 |
| SpeakerU:RWA_Total | -0.0014 | 0.0006 | -2.4080 | 0.0161* |

| | | | | |
|---|---|---|---|---|
| TruthfulnessTRUE:SpeakerU:RWA_Total | 0.0025 | 0.0008 | 2.9752 | 0.0029** |

Formula: summary(lmer(log(RT) ~ Truthfulness * Speaker * RWA_Total+ log(PRT) + (1 + Truthfulness|participant) + (1|Item_No), data = SPR_data))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

In the final three-way interaction model in **Table.10**, FS was replaced with Right-Wing Authoritarianism and the model reported no significant values for truthfulness and Right-Wing Authoritarianism as well as no significant interaction between Right-Wing Authoritarianism and truthfulness. This is similar to the FS and Personal Distress models. Again, when Right-Wing Authoritarianism was added to the model, the significant effect of nativeness disappeared. As shown by **Figure .9**, reading times decreased significantly for both conditions (truthful and false statements) as Right-Wing Authoritarianism scores increased. In untrue statements, reading times were significantly higher for untrustworthy speakers than for the trustworthy speakers at the beginning but as Right-Wing Authoritarianism scores increased to 125, reading times for untrustworthy speakers became significantly lower than those of trustworthy speakers. A reverse effect can be seen for true statements. In this instance, reading times for trustworthy speakers were significantly higher than for untrustworthy speakers but as Right-Wing Authoritarianism scores increased to 125, reading times for trustworthy speakers became significantly lower for trustworthy speakers than for untrustworthy speakers.

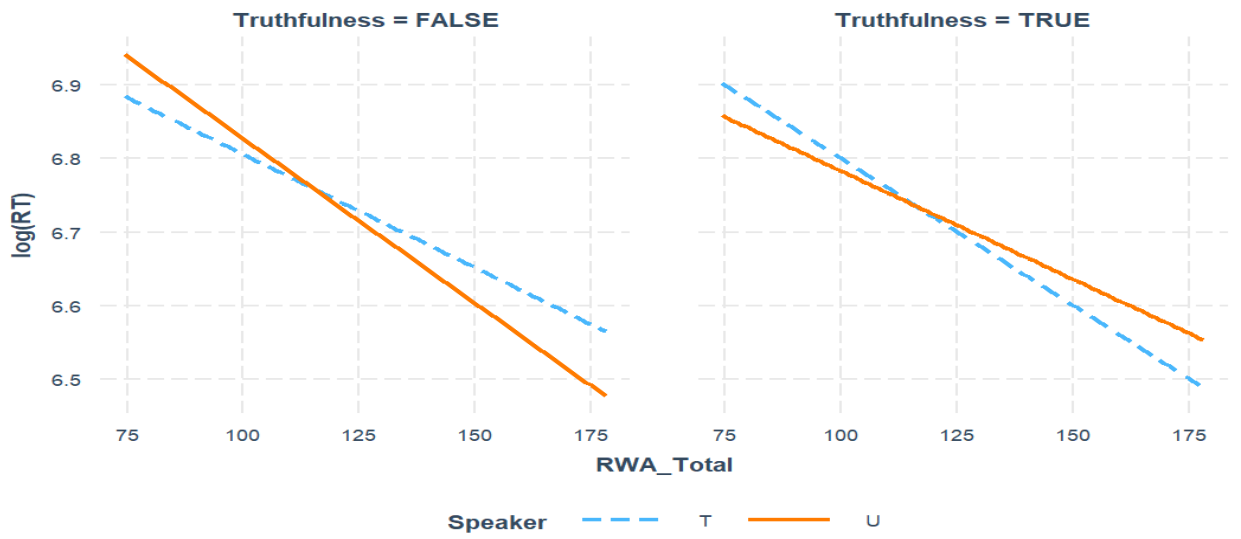


**Figure .9**: Interaction between Truthfulness, Speaker Credibility and Right-Wing Authoritarianism Scores (RWA) with RT as response variable

## 4.6. Discussion

In this section, we examined if there were processing costs associated with processing of true vs untrue statements and if these costs were influenced by the speaker's identity and if individual differences played any role in this. In response to these questions, five models with significant findings were reported. From the general findings in the two-way interaction between speaker and truthfulness, non-native speakers had longer reading times than native speakers. In the lying condition, trustworthy speakers had longer reading times than untrustworthy speakers. The opposite effect was evident in the truthful condition. When perspective taking scores were added to the model, reading times for trustworthy speakers in the lying condition was higher than that of

untrustworthy speakers in the same condition. In the truthful condition, reading times for untrustworthy speakers decreased significantly as Perspective taking scores increased and reading times for trustworthy speakers increased slightly as Perspective taking scores increased. In the second 3-way model with Personal Distress scores, reading times for trustworthy speakers in the lying condition increased as Personal Distress scores increased and a similar effect was observed for untrustworthy speakers in the truthful condition. In the final model, reading times for trustworthy and untrustworthy speakers decreased in both conditions as Right-Wing Authoritarianism scores increased.

The findings of the self-paced reading were similar to the ratings; more attention is paid to truthful information, and it matters more who gives truthful information than who gives false information. People with low Perspective taking scores had longer reading times which indicates longer processing times for untrustworthy speakers and those with higher Perspective taking scores had slightly longer processing times when the speaker was trustworthy in the truthful condition. Like the findings from the ratings, people with high Personal Distress scores had longer processing times for trustworthy speakers in the lying condition but unlike the ratings, people with high Personal Distress scores had longer processing times for untrustworthy speakers in the truthful condition.

When Right-Wing Authoritarianism scores were added to the model, processing times for untrustworthy speakers were higher than that of trustworthy speakers but as Right-Wing Authoritarianism scores increased, processing times for trustworthy speakers became longer than that of untrustworthy speakers in the lying condition. In the truthful condition, trustworthy speakers started off with longer reading times but as Right-Wing Authoritarianism scores

increased, processing times for untrustworthy speakers became longer than that of trustworthy speakers.

In sum, the findings from the self-paced reading complimented the findings of the ratings experiment. Findings from the ratings were mainly centered on the truthful condition and in terms of individual differences, the only effect was from personal distress. In the self-paced reading experiment, some of the models reported significant effects in the lying condition as well and also reported significant findings with the personal distress, perspective taking and fantasy scales of the interpersonal reactivity index and with the right-wing authoritarianism questionnaire. These findings and their possible real life interpretations are discussed in the next chapter.

# Chapter 5

# 5. General Discussion

The present study sought to investigate if speaker identity modulates the processing and personal opinions of people on lies vs truthful statements. We also investigated whether language background, political ideology and personal beliefs would be good predictors of the processing and people's opinions in terms of comprehender related variables. In addition to the ratings and the self-paced reading experiment, participants had to answer a Language Background questionnaire, Wilson-Patterson Political Ideology, Right-Wing Authoritarianism and Interpersonal Reactivity Index questionnaires[3].

Across the two studies, we found more significant interactions in the truthful condition than the lying condition. In the ratings experiment, we found significant interactions between truthful statements with untrustworthy speakers in both the acceptability and agreement scales. We also found that participant ratings across both scales varied significantly in the false condition. This variance was modulated by Empathetic Concern and Personal Distress (c.f. 3.6.1). In a self-paced reading task, reading times are modulated by the properties of what is being read and the reaction time from these latencies have been found to reflect the reader's real time cognitive processing (Just, Carpenter & Woolley, 1982). This suggests that the findings from this study can be equated to real-time processing. Similar to the ratings task, the self-paced reading, reported a significant interaction between untrustworthy speakers and truthfulness. In both tasks, significant interactions were also observed between Personal Distress, Perspective taking and Right-Wing Authoritarianism scores and untrustworthy speakers and truthfulness. In the next sections, we will

[3] Refer to section 3.3 for further details on these questionnaires.

discuss in detail the variables that influenced language processing in the experiments described in chapters 3 and 4 of this study and speculate as to what they might mean in real life situations.

As we predicted, untruthful statements were rated as socially unacceptable and also disagreed with when produced by both trustworthy and untrustworthy speakers. There was no instance where untruthful statements were considered as acceptable or agreed with (cf. **Table Error**! No text of specified style in document.**2** and **Table 3**). This suggests that individuals have an unbiased view towards false information which is unaffected by the credibility of the speaker. Again, we predicted that truthful statements would be considered socially acceptable and agreed with regardless of the speaker. We found that in this instance, the credibility of the speaker created a significant difference (cf. **Table Error**! No text of specified style in document.**2**). The findings suggest that truthful statements produced by trustworthy speakers are viewed more favorably than truthful statements produced by untrustworthy speakers.

In section 1.4.2, we predicted that false statements will be associated with a greater cognitive load if the surrounding linguistic context of false statements does not demand the comprehender to be polite or empathetic. The findings support this prediction as readers experienced greater cognitive load when processing false statements than for truthful statements in both native and non-native speakers of English and this supports our hypothesis. This lends further credence to the importance of context in processing linguistic information in general and lies specifically (Lubow et al., 1976; Humpreys, 1976; Durston et al., 2002; Synder et al., 2008; Wirth et al., 2008; Belke & Stielow, 2013; Liew et al., 2016; Batel, 2020; Todorović, 2010; Tanenhaus et al., 1995; Lelieveld et al., 2016; Moreno et al., 2016). False statements produced by trustworthy speakers elicited a (slightly) longer reading time than those produced by untrustworthy speakers. This suggests the speaker's credibility may be of relevance in processing false statements. Readers experienced a greater

cognitive load when processing truthful statements produced by untrustworthy speakers (cf. **Table.7**) suggesting that even though truth telling is not cognitively demanding on the speaker's part (Debey et al., 2012; Lelieveld et al., 2016; Yin et al., 2017), it may be cognitively demanding for the reader/listener if the speaker is considered untrustworthy.

## 5.1. Comprehender Variables

Literature on the study of language processing and affect have suggested that certain beliefs held and personality traits possessed by individuals modulate language processing and create individual differences in processing (Van Berkum et. al, 2009; Niemi, Hartshorne, Gerstenberg, Stanley & Young, 2020). To this end the study administered some individual difference measures to help us identify some individual differences that may interact with the main predictors during processing.

### 5.1.1. Interpersonal Reactivity Index

The Interpersonal Reactivity Index (Davis, 1980) questionnaire measures a person's reaction to other people's 'observed' experiences. As mentioned in section 3.3, the questionnaire has four scales and each scale measures something different. The Perspective Taking scale measures the ability to mentally put yourself in another person's shoes spontaneously. Cognitive load for the processing of trustworthy speakers in the false condition decreased as Perspective taking scores increased. A similar effect occurred for untrustworthy speakers. But the load was significantly higher for trustworthy speakers than for the untrustworthy speakers throughout the decrease. This finding suggests that although higher Perspective taking scores may cause you to try to rationalize with or blind you to the giver of false information, you may still not expect that a trustworthy speaker will provide false information. In the truthful condition, cognitive load was very high for individuals with low Perspective taking scores and greatly decreased as Perspective taking scores

decreased. This suggests that although an individual may experience a greater load in processing truthful information from untrustworthy speakers, high Perspective taking ability may cause the individual to rationalize with or become incognizant of the fact that an untrustworthy speaker is the giver of truthful information. There was little to no variance in cognitive load for trustworthy speakers in this condition.

The Personal Distress scale focuses on self-centered feelings of personal anxiety and unease in tense interpersonal contexts. This scale reported significant findings in both experiments. In the false condition in the ratings task, participants with low Personal Distress scores rated trustworthy speakers as highly (completely unacceptable and strongly disagree with) and as Personal Distress scores increased, ratings decreased and became less unacceptable and less disagreed with. In the truthful condition, low Personal Distress scores correlated with the acceptability of trustworthy speakers and as Personal Distress scores increased, trustworthy speakers became less acceptable. This suggests that individuals with low Personal Distress scores can view information objectively as they seem to wholly agree with trustworthy speakers when they provide truthful information and wholly disagree with trustworthy speakers when they provide false information. For individuals with high Personal Distress scores, it seems that people with higher Personal Distress experienced a larger processing difficulty when Truthfulness and Speaker conflicted. In terms of processing, individuals with high Personal Distress scores experienced a greater cognitive load when they encountered a trustworthy speaker in false statements and the load decreased as Personal Distress scores decreased. In the truthful condition, in turn, cognitive load increased as Personal Distress scores increased for untrustworthy speakers. This suggests that individuals with high Personal Distress scores do not expect a trustworthy speaker to provide false information or for an untrustworthy character to provide truthful information and this increases their cognitive load.

There was relatively no variance for untrustworthy speakers in false statements and trustworthy speakers in truthful condition and this could be because untrustworthy speakers are expected to lie hence, no meaningful thought or time is given to false information from them as we predicted in section 2. Again, trustworthy speakers may also be expected to provide truthful information suggesting that no cognitive load will be experienced when the reader encounters a trustworthy speaker providing truthful information.

In this section, we have discussed that empathy in terms of personal distress, perspective taking and fantasy may effectively affect language processing and cause individuals to perceive and represent information or speakers differently. This finding complements the finding that individuals with empathy driven cognition may reveal a contrast in speaker identity resulting from the higher sensitivity to language in social contexts (van den Brink et al., 2012).

### 5.1.2. Political Ideology

In this study, two political ideology tests were administered: the Right-Wing Authoritarianism questionnaire (Altemeyer, 1981, 2007) and Wilson-Patterson Issue Battery questionnaire (Wilson & Patterson, 1968). There were no significant findings with the WP questionnaire, but the Right-Wing Authoritarianism questionnaire reported some significant findings in the second experiment (c.f. **Table.10**). Left-leaning participants experienced a greater cognitive load when processing false statements made by an untrustworthy speaker than those by a trustworthy speaker in the same condition. Right-leaning participants in the same condition experienced a lower cognitive load than left-leaning participants but they had greater load for trustworthy speakers producing false statements than for untrustworthy speakers producing false statements. The opposite occurred in processing truthful statements. Left-leaning participants experienced a greater cognitive load when processing truthful statements than right-leaning participants. For those on the left, trustworthy

speakers elicited more load than untrustworthy speakers and for those on the right, untrustworthy speakers elicited more cognitive load than trustworthy speakers. For those on the right, we suspect that they experienced a lower cognitive load in both false and truth statements because they probably did not recognise or consider false statements as false. They processed both types of information equally. We also speculate that they probably expect more from trustworthy speakers than untrustworthy speakers. We speculate that for those on the left, the greater cognitive load in both truthful and false statements indicate that they process information cautiously, hence, the time spent.

From the discussion on comprehender variables, it can be concluded that indeed personal beliefs and ideologies modulate opinions and processing of lies vs truths. Opinions that may be openly voiced are not necessarily a reflection of how lies vs truths are processed or of the personal beliefs and ideologies that modulate the processing.

## 5.2. Shortcomings and Recommendations

As the study progressed, certain shortcomings and possible future research directions were identified in the area of design, materials and analysis. In terms of shortcoming, in the materials pre-selection, some of the characters used such as “liberal senator or conservative senator” are not used in the Canadian context. And after the preselection, some of these characters had to be dropped in favor of more Canadian characters such as “premier”. We also believe that experimental items in the false statements were probably too easily identified as false. In addition, Generalized Additive Mixed Models (GAMMs) could have been performed on the individual differences data as it, unlike LME, assumes that predictor effects are not linear which they often

are not. The analysis performed on the data (LMMs) assumes linearity in the predictor values. Despite this difference in assumption, both analyses present similar results.

A further potential shortcoming is that participants for the ratings task came solely from the first and second year undergraduate pool of the Department of Linguistics and there is not much variance in regard to age in the pool. In the self-paced reading where some participants were externally sourced, a comparison of the two groups indicated some significant findings in terms of age and gender in some instances. This suggests that if variance in age is introduced in participant sampling, it may bring to fore some significant information for this body of research.

In future research, we would like to suggest the use of other psycholinguistic experimental paradigms such as ERP and pupillometry. This would lend more credence to the findings presented here or bring to fore other important information which may have been missed because of the experimental paradigms used in this study. We also suggest that an auditory paradigm be considered in future research on lying. This can involve the use of native and non-native accents as used in Puhacheuskaya & Järvikivi (2022). This will contribute to the body of knowledge on accents and language processing.

## 5.3. Conclusion

In this study, the social construct of lying in terms of lies vs truths was viewed from the perspective of the comprehender and examined the notion of trustworthiness in terms of the speaker's identity. Using a ratings task and a self-paced listening task, we evidenced that the speaker's trustworthiness and the truthfulness of the statement affect the processing of lies while remaining sensitive to certain information.

In relation to truthfulness, there was no instance in our ratings task where false statements were considered as acceptable or strongly agreed with. This was the case for both trustworthy and untrustworthy speakers. But in the case of truthfulness, truthful statements produced by trustworthy speakers were considered as more acceptable and more agreed with than untrustworthy speakers. In the self-paced reading, false statements presented a greater cognitive load than truthful statements. Trustworthy speakers in false statements and untrustworthy speakers in truth conditions elicited a greater cognitive load than untrustworthy speakers in false statements and trustworthy speakers in truthful statements. This underscores the relevance of contextual information in language processing.

Individual differences were found to modulate the processing of truth vs false statements and the trustworthiness of the giver of the information. Although fantasy scale, perspective taking and personal distress are part of the interpersonal reactivity index and measure empathy from different perspectives each of them affect the processing of lies differently. Only personal distress interacted significantly in both experiments. Empathy may cause even the most rational observation to stop being rational.

In Spite of the fact both the Wilson-Patterson and Right-wing Authoritarianism questionnaires are political ideology tests, only the Right-wing Authoritarianism interacted significantly with the two main predictors; truthfulness and speaker (trustworthiness), which is not very surprising as the Wilson-Patterson seems to focus on finding your ideology and the Right-wing Authoritarianism focuses on finding how much to the right a person leans.

Our opinions may not necessarily reflect our processing and our processing may not necessarily reflect our opinions. Individual differences and ideologies may not reflect equally on our opinions and processing as evidenced by the difference in how personal distress interacted with the rating

task and the self-paced reading task. More research is needed to further understand the effect of lying on the comprehender and the individual differences that come into play during its processing.

# References

Abdool, M., & Egler, S. (n.d.). *Gendered pronoun resolution*. 9.

Altemeyer, B. (1981) *Right-wing authoritarianism*. University of Manitoba press.

Altemeyer, B. (2007). *The authoritarians*. University of Manitoba.

Batel, E. (2020). Context effect on l2 word recognition: Visual versus auditory modalities *Journal of Psycholinguistic Research* 49:223–245https://doi.org/10.1007/s10936-019-09683-6

Bates, D., Mächler, M., Bolker, B. & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67(1), 1–48. doi: 10.18637/jss.v067.i01

Boland J. E., Queen, R. (2016). If you're house is still available, send me an email: personality influences reactions to written errors in email messages. *PLOS ONE* 11(3): e0149885. https://doi.org/10.1371/journal.pone.0149885

Belke, E., & Stielow, A. (2013). Cumulative and non-cumulative semantic interference in object naming: Evidence from blocked and continuous manipulations of semantic context. *The Quarterly Journal of Experimental Psychology,66*(11), 2135–2160.

Borčić, N., Kanižaj, I., & Kršul, S. (2016). Conceptual metaphor in political communication. *Zbornik Sveučilišta u Dubrovniku*, 3, 73–94. https://hrcak.srce.hr/169955

Cap, P. (2006). Metaphor and political discourse: Analogical reasoning in debates about Europe. *Journal of Pragmatics*, 38(3), 460–463. https://doi.org/10.1016/j.pragma.2005.03.008

Chang, L. J., Smith, A., Dufwenberg, M., Sanfey, A. G. (2011). Triangulating the neural, psychological, and economic bases of guilt aversion. *Neuron* 70:560–572.

Cho, W. I., Kim, J. W., Kim, S. M., & Kim, N. S. (2019). On measuring gender bias in translation of gender-neutral pronouns. *Proceedings of the first workshop on gender bias in natural language processing*, 173–181. https://doi.org/10.18653/v1/W19-3824

Costa, A., & Sebastián-Gallés, N. (2014). How does the bilingual experience sculpt the brain?. *Nature reviews. Neuroscience*, *15*(5), 336–345. https://doi.org/10.1038/nrn3709

Daltrozzo, J., Wioland, N. & Kotchoubey, B. (2007). Sex differences in two event-related potentials components related to semantic priming. *Arch Sex Behavior* 36, 555–568. https://doi.org/10.1007/s10508-006-9161-

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology, 10*, 85.

Debey, E., Verschuere, B., & Crombez, G. (2012). Lying and executive control: An experimental investigation using ego depletion and goal neglect. *Acta Psychologica*, 140(2), 133–141. https://doi.org/10.1016/j.actpsy.2012.03.004

Duñabeitia, J. A., & Costa, A. (2015). Lying in a native and foreign language. *Psychonomic Bulletin & Review*, 22(4), 1124–1129. https://doi.org/10.3758/s13423-014-0781-4

Durston, S., Thomas, K.M., Worden, M.S., Yang, Y. & Casey, B. J. (2002). The effect of preceding context on inhibition: An event-related fMRI study. *NeuroImage* 16, 449–453

Fallis, D. (2009). What is lying? *The Journal of Philosophy*, 106(1), 29–56. http://www.jstor.org/stable/20620149

Garrett, N., Lazzaro, S., Ariely, D. & *Sharot, T.* (2016). The brain adapts to dishonesty. *Nature Neuroscience* 19, 1727–1732. https://doi.org/10.1038/nn.4426

Geis, M. L. (2012). The language of politics. *Springer Science & Business Media.*

Giora, R. (2002). 15. Masking one's themes: Irony and the politics of indirectness. *In Interpretive Approaches*, 283–300. https://doi.org/10.1075/celcr.3.24gio

Grice, H. P. (1975). Logic and conversation. In P. Cole, & J. L. Morgan. (Eds.), *Syntax and Semantics*, 3, 41-58. New York: Academic Press.

Hamilton, H., & Chou, W. S. (2014). *The Routledge handbook of language and health communication*. Routledge.

Hubert Lyall, I. (2019). It's personal and disgusting: extra-linguistic information in language comprehension [*P.h.D Dissertation*]. University of Alberta.

Hubert Lyall, I., & Järvikivi, J. (2019). Dark forces in language comprehension: the case of neuroticism and disgust in a pupillometry study. *Cognitive Science Society*, 41, 7.

Hubert Lyall, I., & Järvikivi, J. (2021). Individual differences in political ideology and disgust sensitivity affect real-time spoken language comprehension. *Frontiers in Psychology* (12) https://www.frontiersin.org/article/10.3389/fpsyg.2021.699071DOI=10.3389/fpsyg.2021.699071

Humpreys, M. (1976). Relational information and the context effect in recognition memory. *Memory & Cognition* 4(2). 221-232.

Jackendoff, R. S. (2008). Patterns in the mind: Language and human nature. *Basic Books*.

Just, M. A., Carpenter, P. A., & Woolley, J. D. (1982). Paradigms and processes in reading comprehension. *Journal of Experimental Psychology: General* 111: 228-238.

Kuperman, V., Stadthagen-Gonzalex, H., & Brysbaert, M. (2012). Age-ofacquisition ratings for 30 thousand English words. Behavior Research Methods, 44, 978–990.

Kuperman, V., Estes, Z., Brysbaert, M., & Warriner, A. B. (2014). Emotion and language: Valence and arousal affect word recognition. *Journal of Experimental Psychology: General, 143*(3), 1065–1081. https://doi.org/10.1037/a0035669

Kuznetsova, A., Brockhoff, P. B. & Christensen, R. H. B. (2017). "LmerTest package: Tests in linear mixed effects models." *Journal of Statistical Software*, 82(13), 1–26. doi: 10.18637/jss.v082.i13.

Langleben, D. D., & Moriarty, J. C. (2013). Using brain imaging for lie detection: Where science, law, and policy collide. *Psychology, Public Policy, and Law, 19*(2), 222–234. https://doi.org/10.1037/a0028841

Lelieveld, G. J., Shalvi, S., & Crone, E. A. (2016). Lies that feel honest: Dissociating between incentive and deviance processing when evaluating dishonesty. *Biological Psychology*, 117, 100–107. https://doi.org/10.1016/j.biopsycho.2016.03.009

Liew, S. X., Howe, P. D. L. & Little, D. R. (2016). The appropriacy of averaging in the study of context effects. *Psych on Bull Rev* 23:1639–1646 DOI 10.3758/s13423-016-1032-7

Long, J. A. (2019). *Interactions: Comprehensive, user-friendly toolkit for probing interactions*. R package version 1.1.0, https://cran.r-project.org/package=interactions.

Luan Phan, K., Magalhaes, A., Ziemlewicz,T. J., Fitzgerald, D. A., Green, C. & Smith, W. (2005). Neural correlates of telling lies: A functional magnetic resonance imaging study at 4 Tesla. Academic Radiology. 12 (2) 164-172.https://doi.org/10.1016/j.acra.2004.11.023.

Lubow, R. E., Rifkin, B., & Alek, M. (1976). The context effect: The relationship between stimulus preexposure and environmental preexposure determines subsequent learning. *Journal of Experimental Psychology: Animal Behavior Processes, 2*(1), 38–47. https://doi.org/10.1037/0097-7403.2.1.38

Macaulay, M. (2001). Tough talk: Indirectness and gender in requests for information. *Journal of Pragmatics*, 33(2), 293–316. https://doi.org/10.1016/S0378-2166(99)00129-0

Marrville, C. (2017). Gender and dominance in action: Worldview and emotional affect in language processing and use [*Ph.D Dissertation*]. University of Alberta.

Matthews, G., Deary, I. J., & Whiteman, M. C. (2003). *Personality traits*. Cambridge University Press.

Moreno, E. M., Casado, P., & Martín-Loeches, M. (2016). Tell me sweet little lies: An event-related potentials study on the processing of social lies. *Cognitive, Affective, & Behavioral Neuroscience*, 16(4), 616–625. https://doi.org/10.3758/s13415-016-0418-3

Nezakat-Alhossaini, M., Youhanaee, M., Moinzadeh, A. (2014). Sentence Processing Among Native vs. Nonnative Speakers: Implications for Critical Period Hypothesis. *Journal of Research in Applied Linguistics*, 5(2), 57-77.

Niemi, L., & Young, L. (2016). When and why we see victims as responsible: The impact of ideology on attitudes toward victims. *Personality and Social Psychology Bulletin*, 42, 1227–1242.

Niemi, L., Hartshorne, J., Gerstenberg, T., Stanley, M. & Young, L. (2020). Moral values reveal the causality implicit in verb meaning. *Cognitive Science*, 44

Ofen, N., Whitfield-Gabrieli, S., Chai, X. J., Schwarzlose, R. F. & Gabrieli, J. D. E. (2017) Neural correlates of deception: Lying about past events and personal beliefs. *Social Cognitive and Affective Neuroscience*, 116–127

Ofori, E. (2015). The use of insults in Ghanaian political discourse: A critical discourse analysis. [*Ph.D Dissertation*]. University of Florida.

Peirce, J., Gray, J. R., Simpson, S., MacAskill, M., Höchenberger, R., Sogo, H., Kastman, E., & Lindeløv, J. K. (2019). PsychoPy2: Experiments in behavior made easy. *Behavior research methods*, *51*(1), 195–203. https://doi.org/10.3758/s13428-018-01193-y

Poirier, J. & Shapiro, L. (2012). Linguistic and psycholinguistic foundations. *Cognition and acquired language disorders: an information processing approach* (6)121-146

Proverbio, A. M., Vanutelli, M. E., Adorni, R. (2013). Can you catch a liar? How negative emotions affect brain responses when lying or telling the truth. *PLOS ONE* 8(3): e59383. https://doi.org/10.1371/journal.pone.0059383

Puhacheuskaya, V. & Järvikivi, J. (2022). I was being sarcastic!: The effect of foreign accent and political ideology on irony (mis)understanding. *Acta Psychologica* 222

Reysen, S., & Puryear, C. (2014). Victims' reactions to the interpersonal threat to public identity posed by copycats. *Interpersona,* 8, 100-114.

Rij, J., Vaci, N., Wurm, L. & Feldman, L. (2020). *Alternative quantitative methods in psycholinguistics: Implications for theory and design.* 10.1515/9783110440577-003.

Rothermich, K., Harris, H.L., Sewell,K. & Bobb,S. C. (2019)Listener impressions of foreigner-directed speech: A systematic review, *Speech Communication,* 112, 22-29, https://doi.org/10.1016/j.specom.2019.07.002.

Ryskin, R. A., Qi, Z., Duff, M. C., & Brown-Schmidt, S. (2016, October 20). Verb biases are shaped through lifelong learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition*. Advance online publication. http://dx.doi.org/10.1037/xlm0000341

Schmidtke, J. (2014). Second language experience modulates word retrieval effort in bilinguals: Evidence from pupillometry. *Frontiers in Psychology, 5,* Article 137. https://doi.org/10.3389/fpsyg.2014.00137

Schwering, S. C. & MacDonald, M. C. (2020). Verbal working memory as emergent from language comprehension and production. *Frontiers in Human Neuroscience*. 14. https://doi.org/10.3389/fnhum.2020.00068

Snyder, J. S., Carter, O. L., Lee, S., Hannon, E .E. & Alain, C. (2008). Effects of context on auditory stream segregation. *Journal of Experimental Psychology Human Perception and Performance* 34, No. 4, 1007–1016

Speyer, L., & Schleef, E. (2018). Processing 'gender-neutral' pronouns: A self-paced reading study of learners of English. *Applied Linguistics*, 40. https://doi.org/10.1093/applin/amy022

Stuart-Buttle, C. D., Read, J. D., Sanderson, H. F., & Sutton, Y. M. (1996). A language of health in action: Read codes, classifications and groupings. *Proceedings of the AMIA Annual Fall Symposium*, 75–79. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2233183/

Traxler, M. J., & Tooley, K. M. (2007). Lexical mediation and context effects in sentence processing. *Brain research*, *1146*, 59-74.

Tanenhaus, M. K., Spivey-Knowlton, M. J., Eberhard, K. M. & Sedivy, J.C. (1995). Integration of visual and linguistic information in spoken language comprehension. *Science* 268 1632-1635

Trenkic, D., Mirkovic, J., & Altmann, G. (2014). Real-time grammar processing by native and non-native speakers: Constructions unique to the second language. *Bilingualism: Language and Cognition, 17*(2), 237-257. doi:10.1017/S1366728913000321

Todorović, D. (2010). Context effects in visual perception and their explanations. *Review of Psychology*, 17, No 1, 17-32

Van Berkum, J. J., Holleman, B., Nieuwland, M., Otten, M. & Murre, J. (2009). Right or wrong? The brain's fast response to morally objectionable statements. *Psychological Science* 20 (9) 1092-1099.

van den Brink, D., Van Berkum J.J., Bastiaansen, M. C. M., Tesink, C. M. J. Y., Kos, M., Buitelaar, J. K. & Hagoort, P. (2012). Empathy matters: ERP evidence for inter-individual differences in social language processing. *SCAN* (7) 173-183

Verschuere, B., Spruyt, A., Meijer, E. H., & Otgaar, H. (2011). The ease of lying. *Consciousness and Cognition*, 20(3), 908–911. https://doi.org/10.1016/j.concog.2010.10.023

Walczyk, J. J., Harris, L. L., Duck, T. K., & Mulay, D. (2014). A social-cognitive framework for understanding serious lies: Activation-decision-construction-action theory. *New Ideas in Psychology*, 34, 22–36. https://doi.org/10.1016/j.newideapsych.2014.03.001

Warriner, A. B., Kuperman, V., & Brysbaert, M. (2013). Norms of valence, arousal, and dominance for 13,915 English lemmas. Behavior Research Methods, 45(4), 1191–207.

Wilson, G. D. & Patterson, J. R. (1968). A new measure of conservatism. *British Journal of Social and Clinical Psychology* 7 (4) 264{269. Doi: 10.1111/j.2044-8260.1968.tb00568.x.

Winner, E., Brownell, H., Happé, F., Blum, A. & Pincus, D. (1998). Distinguishing lies from jokes: Theory of mind deficits and discourse interpretation in right hemisphere brain-damaged patients. *Brain and Language* 62, 89–106

Wirth, M., Horn, H., Koenig, T., Razafimandimby, A., Stein, M., Mueller, T., Federspiel, A., Meier, B., Dierks, T. & Strik, W. (2008). The early context effect reflects activity in the temporo-prefrontal semantic system: Evidence from electrical neuroimaging of abstract and concrete word reading *NeuroImage* 42 (423–436)

Yang, Y. L., & Raine, A. (2006). What is pathological lying? Reply. *British Journal of Psychiatry*, 189, 86.

Yin, L., Hu, Y., Dynowski, D., Li, J., & Weber, B. (2017). The good lies: Altruistic goals modulate processing of deception in the anterior insula. *Human Brain Mapping*, 38(7), 3675–3690. https://doi.org/10.1002/hbm.23623

# Appendix

## Appendix A

Honesty Scale

Instructions: Circle how strongly you agree with each statement.

1. I believe what this person says.

Very Strongly Disagree Strongly Disagree Disagree Neutral Agree Strongly Agree Very Strongly Agree

2. This person is not ethical.*

Very Strongly Disagree Strongly Disagree Disagree Neutral Agree Strongly Agree Very Strongly Agree

3. This person has integrity.

Very Strongly Disagree. Strongly Disagree Disagree Neutral Agree Strongly Agree Very Strongly Agree

4. I trust this person will tell me the truth.

Very Strongly Disagree Strongly Disagree Disagree Neutral Agree Strongly Agree Very Strongly Agree

5. This person is honorable.

Very Strongly Disagree Strongly Disagree Disagree Neutral Agree Strongly Agree Very Strongly Agree

6. This person is a liar.*

Very Strongly Disagree Strongly Disagree Disagree Neutral Agree Strongly Agree Very Strongly Agree

7. This person is not believable.*

| Very Strongly Disagree | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Very Strongly Agree |
|---|---|---|---|---|---|---|

8. This person is honest.

| Very Strongly Disagree | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | Very Strongly Agree |
|---|---|---|---|---|---|---|

* asterisk indicates reversed items

# Appendix B

Language Background Questionnaire

1. Age (in years)

2. Gender

3. Country of current residency

4. Country of birth

5. If you were not born in Canada, when did you arrive in Canada?

6. Native language

7. First language learned

8. Do you consider yourself bilingual?

9. Highest level of education

## Appendix C

| Native | 'I believe what this person says'. | 'This person has integrity.' | 'This person is honest.' |
|---|---|---|---|
| A.medical.doctor | 5.636 | 5.727 | 5.909 |
| A.Business.executive | 2.727 | 2.909 | 2.455 |
| A.Car.salesman | 2.364 | 2.273 | 2.091 |
| A.Clergy.man.woman | 3.727 | 3.727 | 3.636 |
| A.Congressman | 3.455 | 3.636 | 3 |
| A.conservative.Premier | 3.364 | 3.364 | 2.636 |
| A.conservative.Senator | 3.364 | 3.455 | 2.636 |
| A.Creationist | 2.182 | 3.273 | 3 |
| A.Customer.service.Rep | 3.636 | 3.545 | 2.818 |
| A.Governor | 3.818 | 3.818 | 3.091 |
| A.Grade.school.teacher | 4.818 | 4.818 | 4.909 |
| A.Human.rights.activist | 5.182 | 5.182 | 4.727 |
| A.Judge | 4.545 | 4.909 | 4.909 |
| A.Lawyer | 4.545 | 4.455 | 4 |
| A.liberal.Premier | 4 | 4 | 3.273 |
| A.liberal.Senator | 3.818 | 3.909 | 3.273 |
| A.Lobbyist | 3.273 | 3.455 | 2.909 |
| A.Mayor | 4 | 4.364 | 3.636 |
| A.Military.officer | 4.273 | 4.455 | 3.727 |
| A.Naturalist | 4.091 | 4.091 | 4.455 |
| A.Naturist | 4.182 | 4.182 | 4.182 |
| A.Nudist | 3.455 | 3.545 | 4.273 |
| A.Pharmacist | 5.545 | 4.909 | 5.273 |
| A.Police.officer | 4.364 | 3.909 | 3.455 |
| A.political.activist | 4 | 4.273 | 3.727 |
| A.Pre.school.teacher | 4.727 | 4.909 | 4.909 |
| A.President | 3.818 | 3.818 | 3 |
| A.prime.minister | 4.364 | 4.273 | 3.545 |
| A.Public.defender | 4.182 | 4.091 | 3.636 |
| A.Public.Relations.Officer | 3.909 | 4.091 | 3.909 |
| A.Researcher | 5.545 | 5 | 5.455 |
| A.Scientist | 5.818 | 5 | 5.636 |
| A.University.Professor | 5.182 | 4.818 | 4.818 |
| A.Vaxxer | 4 | 4.091 | 3.818 |
| An.Anti.vaxxer | 1.545 | 1.818 | 2 |
| An.Insurance.Salesperson | 2.727 | 2.364 | 2 |

| Non Native | 'I believe what this person says' | 'This person has integrity.' | 'This person is honest.' |
|---|---|---|---|
| A..medical.doctor | 6.111 | 6.037 | 5.852 |
| A.Business.executive | 3.667 | 3.852 | 3.148 |
| A.Car.salesman | 3.037 | 3.481 | 2.889 |
| A.Clergy.man.woman | 3.519 | 4.407 | 4.222 |
| A.Congressman | 4.148 | 4.148 | 3.778 |
| A.conservative.Premier | 3.889 | 4.111 | 3.704 |
| A.conservative.Senator | 3.926 | 4.074 | 3.667 |
| A.Creationist | 3.37 | 4.111 | 3.963 |
| A.Customer.service.Rep | 3.926 | 3.667 | 3.481 |
| A.Governor | 4.296 | 4.111 | 3.704 |
| A.Grade.school.teacher | 5.222 | 5.407 | 5.37 |
| A.Human.rights.activist | 4.296 | 4.741 | 4.37 |
| A.Judge | 5.222 | 5.444 | 5.444 |
| A.Lawyer | 5.074 | 5.111 | 4.519 |
| A.liberal.Premier | 4.111 | 4.111 | 3.815 |
| A.liberal.Senator | 4.185 | 4.074 | 3.778 |
| A.Lobbyist | 3.444 | 3.741 | 3.37 |
| A.Mayor | 4.593 | 4.222 | 3.778 |
| A.Military.officer | 4.63 | 4.778 | 4.37 |
| A.Naturalist | 4.63 | 4.667 | 4.704 |
| A.Naturist | 3.815 | 4.074 | 4.37 |
| A.Nudist | 3.815 | 3.963 | 4.185 |
| A.Pharmacist | 5.481 | 5.333 | 5.444 |
| A.Police.officer | 4.926 | 5 | 4.556 |
| A.political.activist | 3.815 | 4.074 | 3.963 |
| A.Pre.school.teacher | 5.037 | 5.333 | 5.259 |
| A.President | 4.815 | 4.556 | 3.963 |
| A.prime.minister | 4.444 | 4.556 | 3.889 |
| A.Public.defender | 4.444 | 4.741 | 4.407 |
| A.Public.Relations.Officer | 4.444 | 4.556 | 4.444 |
| A.Researcher | 5.778 | 5.556 | 5.778 |
| A.Scientist | 6 | 5.852 | 5.889 |
| A.University.Professor | 5.63 | 5.593 | 5.63 |
| A.Vaxxer | 3.926 | 4.111 | 4.111 |
| An.Anti.vaxxer | 2.704 | 3.222 | 3.481 |
| An.Insurance.Salesperson | 2.963 | 3.333 | 2.741 |

# Appendix D

Experimental Stimuli

D.1 Trustworthy Truthful

1. The gradeschool teacher briefed the audience on a report that traced the COVID-19 outbreak. He said; "scientists have concluded that the outbreak of COVID-19 can be traced to the Wuhan province in China in East Asia. We await information from the research team".

2. The medical doctor summarized the research on the effects of vaccines for the new parents. She said; "the data has shown that routine childhood vaccines can give your child ninety percent protection against fifteen diseases. This knowledge is useful for making healthcare choices".

3. The judge explained the new bill on the province's vehicle requirements to the customer. He said; "we have concluded that every vehicle is required to have headlights to be roadworthy in accordance with provincial laws. Consumers must know this before purchasing a car".

4. The university professor shared her expertise on a new report that explored methods for preventing allergies. She said; "this article shows that environment and genetics play a part in determining if a child will have allergies in their early years. Our children need help to stay safe".

5. The human rights activist summarized the latest political developments on climate change to the local forum. He said; "it is very evident that the Paris agreement is a symbol of international cooperation among world leaders to meet some long-term goals. Manifestos are to be read before voting".

6. The researcher explained to the developers the possible risks of flooding in parts of the country. He said; "It has been said that living in Alberta means that you are choosing to live in a flood-free zone in the country. Flooding occurs mostly in wetlands".

7. The scientist briefed the press on the company's new environmental policies and guidelines. He said; "research has concluded that using paper bags in stores and homes will help reduce the negative footprint the company has on the environment. This information will help policy decisions".

8. The medical doctor hosted the briefing on global warming and discussed the latest information. She said; "reports have concluded that global warming is a real phenomenon that is affecting our planet regardless of political affiliation. This situation is quite disturbing".

9. The judge shared his expertise on what to expect when driving a new car. He said; "authorities confirmed that the speed limit can be considered as the law on driving within the limits of a city or town. You need to be very attentive".

10. The preschool teacher updated the conference on an article on the optimal learning environment. She said; "it has been concluded that in the schools it has been found that positive peer influence is the best way to motivate pupils in learning tasks. Teachers should note this information".

11. The human rights activist explained the manual to the audience of resource managers at the workshop. She said; "our lawyers found that suggesting dress codes is an employers' right in the workplace regardless of personal opinions. Employees need to be treated fairly".

12. The pharmacist briefed the clients on a report on the production of COVID-19 vaccines. He said; "researchers have said that all vaccines are made using mRNA technology that teach immune systems to attack the spike protein. Some people are unsure of its safety".

13. The university professor summarized the findings in the study on contributors of lifetime happiness. He said; "the research suggests that a key part of lifetime happiness is the healthy habits you developed over the course of your life. This research is to enrich us emotionally".

14. The scientist explained the significance of the moon landing at a celebration for the 50th anniversary. He said; "the photographs from the moon landing can be viewed by the general public at the St Louis Museum, in North America. This was one of the most historic events".

15. The medical doctor summarized the article on the origins of the Ebola virus at the press conference. He said; "scientists have found that the Ebola virus originated from various animal species and evolved naturally to infect and be transmitted in humans. Huge investments have gone into the research".

16. The researcher briefed the press on the research conducted into UFO sightings. He said; "reports have shown that Southern Nevada is used by the American government as a military base for testing military aircrafts. More enquiries will be made with time".

17. The judge presented his expertise for the article on geography in the 21st century. He said; "documents have read that the earth is spherical and has the mantle, the inner core, the outer core, and the crust. Geography books should have this information".

18. The pharmacist updated the conference on an article about daily habits for longevity. He said; "scientists concluded that eating ripe bananas contribute to an individual's overall well-being and longevity. Continued research will help understand longevity".

19. The university professor summarized the research on the qualities of caffeine for the audience. He said; "the data has shown that when caffeine is consumed late in the day it can make it more difficult to fall asleep. Coffee and tea are to be mindfully consumed".

20. The scientist briefed the conference on a report that examined water molecules. He said; "this report has shown that water molecules, as we know it, have three main states; liquid, to drink; gas, water vapor and solid, ice. Water is necessary for human life".

21. The preschool teacher briefed the attendees on the report about substance use during pregnancy. He said; "the data has shown that during pregnancy no amount of alcohol has been proven as safe to drink regardless of the stage. The mother is important in pregnancy".

22. The medical doctor informed the patients on where to get information on their health. He said; "I have observed that medical journals are a source of the most accurate and rational information on health care. This knowledge is very crucial".

23. The human rights activist in a meeting with their investors confirmed the rumor on the Ebola outbreak. She said; "Early findings showed that the Ebola virus spread as a result of contact with the fluids and secretions of infected animals. This development will affect our earnings".

24. The pharmacist sent a communique to the media on home remedies for COVID-19. She said; "Health Canada said that although alcohol is used in sanitizers, its consumption will not give a person's immunity against COVID-19. Health professionals are exploring other measures".

D.2 Trustworthy False

1. The grade school teacher briefed the audience on a report that traced the COVID-19 outbreak. He said; "scientists have concluded that the outbreak of COVID-19 can be traced to transmissions from 5G masts in Canada and elsewhere. We await information from the research team".

2. The medical doctor summarized the research on the effects of vaccines for the new parents. She said; “the data has shown vaccinations are responsible for increasing cases of autism in children in Canada. This knowledge is useful for making healthcare choices”.

3. The judge explained the new bill on the province's vehicle requirements to the customer. He said; “we have concluded that vehicles are required to have headlights only past dusk in the province of Alberta. Consumers must know this before purchasing a car”.

4. The university professor shared her expertise on a new report that explored methods for preventing allergies. She said; "this article shows that being nude from a young age prevents children from developing allergies due to increased environmental exposure. Our children need help to stay safe".

5. The human rights activist summarized the latest political developments on climate change to the local forum. He said; "it is very evident that participating in the Paris agreement means our government cares about more Parisians than those of us in his home country. Manifestos are to be read before voting".

6. The researcher explained to the developers the possible risks of flooding in parts of the country. He said; "It has been said that living in Alberta means that you are choosing to live in an easily floodable province in Canada. Flooding occurs mostly in wetlands."

7. The scientist briefed the press on the company's new environmental policies and guidelines. He said; "research has concluded that the impact of plastic bags on the environment is no different from other packaging options. This information will help policy decisions".

8. The medical doctor hosted the briefing on global warming and discussed the latest information. She said; "reports have concluded that global warming is a political tool brandished freely by the liberals to make conservatives seem uncaring. This situation is quite disturbing".

9. The Judge shared his expertise on what to expect when driving a new car. He said; "authorities confirmed that the speed limit can be considered as a recommendation on driving within the limits of a city or town. You need to be very attentive. Is speed limit restricted to judges? n

10. The preschool teacher updated the conference on an article on the optimal learning environment. She said; "it has been concluded that in schools, hitting a pupil is the most optimal way to motivate pupils in learning tasks. Teachers should note this information".

11. The human rights activist explained the manual to the audience of resource managers at the workshop. She said; "our lawyers found that suggesting dress codes is employee discrimination in the workplace regardless of personal opinions. Employees need to be treated fairly".

12. The pharmacist briefed the clients on a report on the production of COVID-19 vaccines. He said; "researchers have said that all vaccines are made using microchips that teach immune systems how to attack the spike protein. Some people are unsure of its safety".

13. The university professor summarized the findings in the study on contributors of lifetime happiness. He said; "the research suggests that a key part of lifetime happiness is the money you have acquired over the course of your life. This research is to enrich us emotionally".

14. The scientist explained the significance of the moon landing at a celebration for the 50th anniversary. He said; "the moon landing was created with cinematography technology by the American government to show up the Soviet Union. This was one of the most historic events".

15. The medical doctor summarized the article on the origins of the Ebola virus at the press conference. He said; "scientists have found that the Ebola virus was produced in a lab by the American government to infect and be transmitted among Africans. Huge investments have gone into the research".

16. The researcher briefed the press on the research conducted into UFO sightings. He said; "reports have shown that area 51 is used by the American government as a landing site for spaceships and other UFOs. More enquiries will be made with time".

17. The judge presented his expertise for the article on geography in the 21st century. He said; "documents have read that the earth is a disc and has the mantle, the inner core, the outer core, and the crust. Geography books should have this information".

18. The pharmacist updated the conference on an article about daily habits for longevity. He said; "scientists concluded that eating ripe bananas is dangerous as they are considered as radioactive. Continued research will help understand longevity".

19. The university professor summarized the research on the qualities of caffeine for the audience. He said; "the data has shown that Tim Hortons' coffee is more popular because the drink is laced with nicotine to create an increase in demand. Coffee and tea are to be mindfully consumed".

20. The scientist briefed the conference on a report that examined water molecules. He said; "this report has shown that on a molecular level, water is semi-conscious and responds to all kinds of emotion and music. Water is necessary for human life".

21. The preschool teacher briefed the attendees on the report about substance use during pregnancy. He said; "the data has shown that during pregnancy some alcohol is safe to drink if drank in right quantity and in early stages. The mother is important in pregnancy".

22. The medical doctor informed the patients on where to get information on their health. He said; "I have observed that TV stations are a source of the most accurate and rational information on health care. This knowledge is very crucial".

23. The human rights activist in a meeting with their investors confirmed the rumor on the Ebola outbreak. She said; "Early findings showed that the Ebola virus was released as a population control technique by anti-populist governments, NGOs and health personnel. This development will affect our earnings".

24. The Pharmacist sent a communique to the media on home remedies for COVID-19. She said; "Health Canada said that the consumption of alcohol, especially in large quantities will increase a person's immunity to COVID-19. Health professionals are exploring other measures".

D.3 Untrustworthy Truthful

1. The province's premier briefed the audience on a report that traced the COVID-19 outbreak. He said; "scientists have concluded that the outbreak of COVID-19 can be traced to the Wuhan province in China in East Asia. We await information from the research team".

2. The local antivaxxer summarized the research on the effects of vaccines for the new parents. She said; "the data has shown that routine childhood vaccines can give your child ninety percent protection against fifteen diseases. This knowledge is useful for making healthcare choices".

3. The car salesman explained the new bill on the province's vehicle requirements to the customer. He said; "we have concluded that every vehicle is required to have headlights to be roadworthy in accordance with provincial laws. Consumers must know this before purchasing a car".

4. The nudist shared her expertise on a new report that explored methods for preventing allergies. She said; "this article shows that environment and genetics play a part in determining if a child will have allergies in their early years. Our children need help to stay safe".

5. The lobbyist summarized the latest political developments on climate change to the local forum. He said; "it is very evident that the Paris agreement is a symbol of international cooperation among world leaders to meet some long-term goals. Manifestos are to be read before voting".

6. The insurance salesman explained to the developers the possible risks of flooding in parts of the country. He said; "It has been said that living in Alberta means that you are choosing to live in a flood-free zone in the country. Flooding occurs mostly in wetlands".

7. The business executive briefed the press on the company's new environmental policies and guidelines. He said; "research has concluded that using paper bags in stores and homes will help reduce the negative footprint the company has on the environment. This information will help policy decisions".

8. The province's premier hosted the briefing on global warming and discussed the latest information. She said; "reports have concluded that global warming is a real phenomenon that is affecting our planet regardless of political affiliation. This situation is quite disturbing".

9. The local car salesman shared his expertise on what to expect when driving a new car. He said; "authorities confirmed that the speed limit can be considered as the law on driving within the limits of a city or town. You need to be very attentive".

10. The lobbyist updated the conference on an article on the optimal learning environment. She said; "it has been concluded that in the schools it has been found that positive peer influence is the best way to motivate pupils in learning tasks. Teachers should note this information".

11. The local nudist explained the manual to the audience of resource managers at the workshop. She said; "our lawyers found that suggesting dress codes is an employers' right in the workplace regardless of personal opinions. Employees need to be treated fairly".

12. The anti-vaxxer briefed the clients on a report on the production of COVID-19 vaccines. He said; "researchers have said that all vaccines are made using mRNA technology that teach immune systems to attack the spike protein. Some people are unsure of its safety".

13. The business executive summarized the findings in the study on contributors of lifetime happiness. He said; "the research suggests that a key part of lifetime happiness is the healthy habits you developed over the course of your life. This research is to enrich us emotionally".

14. The senator explained the significance of the moon landing at a celebration for the 50th anniversary. He said; "the photographs from the moon landing can be viewed by the general public at the St Louis Museum, in North America. This was one of the most historic events".

15. The insurance salesman summarized the article on the origins of the Ebola virus at the press conference. He said; "scientists have found that the Ebola virus originated from various animal

species and evolved naturally to infect and be transmissible in humans. Huge investments have gone into the research".

16. The province's premier briefed the press on the research conducted into UFO sightings. He said; "reports have shown that Southern Nevada is used by the American government as a military base for testing military aircrafts. More enquiries will be made with time".

17. The lobbyist presented his expertise for the article on geography in the 21st century. He said; "documents have read that the earth is spherical and has the mantle, the inner core, the outer core, and the crust. Geography books should have this information".

18. The anti-vaxxer updated the conference on an article about daily habits for longevity. He said; "scientists concluded that eating ripe bananas contribute to an individual's overall well-being and longevity. Continued research will help understand longevity".

19. The senator summarized the research on the qualities of caffeine for the audience. He said; "the data has shown that when caffeine is consumed late in the day it can make it more difficult to fall asleep. Coffee and tea are to be mindfully consumed".

20. The car salesman briefed the conference on a report that examined water molecules. He said; "this report has shown that water molecules, as we know it, have three main states; liquid, to drink; gas, water vapor and solid, ice. Water is necessary for human life".

21. The business executive briefed the attendees on the report about substance use during pregnancy. He said; "the data has shown that during pregnancy no amount of alcohol has been proven as safe to drink regardless of the stage. The mother is important in pregnancy".

22. The business executive briefed the attendees on the report about substance use during pregnancy. He said; "the data has shown that during pregnancy no amount of alcohol has been proven as safe to drink regardless of the stage. The mother is important in pregnancy".

23. The business executive in a meeting with their investors confirmed the rumor on the Ebola outbreak. She said; "Early findings showed that the Ebola virus spread as a result of contact with the fluids and secretions of infected animals. This development will affect our earnings".

24. The senator sent a communique to the media on home remedies for COVID-19. She said; "Health Canada said that although alcohol is used in sanitizers, it's consumption will not give a person's immunity against COVID-19. Health professionals are exploring other measures".

D.4 Untrustworthy False

1. The province's premier briefed the audience on a report that traced the COVID-19 outbreak. He said; "scientists have concluded that the outbreak of COVID-19 can be traced to transmissions from 5G masts in Canada and elsewhere. We await information from the research team".

2. The local antivaxxer summarized the research on the effects of vaccines for the new parents. She said; "the data has shown vaccinations are responsible for increasing cases of autism in children in Canada. This knowledge is useful for making healthcare choices"

3.The car salesman explained the new bill on the province's vehicle requirements to the customer. He said; "we have concluded that vehicles are required to have headlights only past dusk in the province of Alberta. Consumers must know this before purchasing a car".

4. The nudist shared her expertise on a new report that explored methods for preventing allergies. She said; "this article shows that being nude from a young age prevents children from developing allergies due to increased environmental exposure. Our children need help to stay safe".

5. The lobbyist summarized the latest political developments on climate change to the local forum. He said; "it is very evident that participating in the Paris agreement means our government cares more about Parisians than those of us in his home country. Manifestos are to be read before voting".

6. The insurance salesman explained to the developers the possible risks of flooding in parts of the country. He said; "It has been said that living in Alberta means that you are choosing to live in an easily floodable province in Canada. Flooding occurs mostly in wetlands."

7. The business executive briefed the press on the company's new environmental policies and guidelines. He said; "research has concluded that the impact of plastic bags on the environment is no different from other packaging options. This information will help policy decisions".

8. The province's premier hosted the briefing on global warming and discussed the latest information. She said; "reports have concluded that global warming is a political tool brandished freely by the liberals to make conservatives seem uncaring. This situation is quite disturbing".

9. The local car salesman shared his expertise on what to expect when driving a new car. He said; "authorities confirmed that the speed limit can be considered as a recommendation on driving within the limits of a city or town. You need to be very attentive".

10. The lobbyist updated the conference on an article on the optimal learning environment. She said; "it has been concluded that in schools, hitting a pupil is the most optimal way to motivate pupils in learning tasks. Teachers should note this information".

11. The local nudist explained the manual to the audience of resource managers at the workshop. She said; "our lawyers found that suggesting dress codes is employee discrimination in the workplace regardless of personal opinions. Employees need to be treated fairly".

12. The anti-vaxxer briefed the clients on a report on the production of COVID-19 vaccines. He said; "researchers have said that all vaccines are made using microchips that teach immune systems how to attack the spike protein. Some people are unsure of its safety".

13. The business executive summarized the findings in the study on contributors of lifetime happiness. He said; "the research suggests that a key part of lifetime happiness is the money you have acquired over the course of your life. This research is to enrich us emotionally".

14. The senator explained the significance of the moon landing at a celebration for the 50th anniversary. He said; "the moon landing was created with cinematography technology by the American government to show up the Soviet Union. This was one of the most historic events".

15. The insurance salesman summarized the article on the origins of the Ebola virus at the press conference. He said; "scientists have found that the Ebola virus was produced in a lab by the American government to infect and be transmitted among Africans. Huge investments have gone into the research".

16. The premier of your province briefed the press on the research conducted into UFO sightings. He said; "reports have shown that area 51 is used by the American government as a landing site for spaceships and other UFOs. More enquiries will be made with time".

17. The lobbyist presented his expertise for the article on geography in the 21st century. He said; "documents have read that the earth is a disc and has the mantle, the inner core, the outer core, and the crust. Geography books should have this information".

18 The anti-vaxxer updated the conference on an article about daily habits for longevity. He said; "scientists concluded that eating ripe bananas is dangerous as they are considered to be radioactive. Continued research will help understand longevity".

19. The senator summarized the research summarized the research on the qualities of caffeine for the audience. He said; "the data has shown that Tim Hortons' coffee is more popular because the drink is laced with nicotine to create an increase in demand. Coffee and tea are to be mindfully consumed".

20. The car salesman briefed the conference on a report that examined water molecules. He said; "this report has shown that on a molecular level, water is semi-conscious and responds to all kinds of emotion and music. Water is necessary for human life".

21. The business executive briefed the attendees on the report about substance use during pregnancy. He said; "the data has shown that during pregnancy some alcohol is safe to drink if drank in right quantity and in early stages. The mother is important in pregnancy".

22. The insurance salesman informed the patients on where to get information on their health. He said; "I have observed that TV stations are a source of the most accurate and rational information on health care. This knowledge is very crucial".

23. The business executive in a meeting with their investors confirmed the rumor on the Ebola outbreak. She said; "Early findings showed that the Ebola virus was released as a population control technique by anti-populist governments, NGOs and health personnel. This development will affect our earnings".

24. The senator sent a communique to the media on home remedies for COVID-19. She said; "Health Canada said that the consumption of alcohol, especially in large quantities will increase a person's immunity to COVID-19. Health professionals are exploring other measures".

# Appendix E

Summary of the fixed-effects from the linear mixed-effects regression model with the interaction of Truth value of a statement, Speaker's credibility and rating type fitted to response among participants. Reference levels: Truthfulness = FALSE; Speaker credibility = Trustworthy; Rating type = Acceptability

| | Estimate | Std. Error | t-value | p-value |
|---|---|---|---|---|
| (Intercept) | 4.2315 | 0.1573 | 26.9085 | 0.0000*** |
| TruthfulnessTRUE | -2.0301 | 0.1489 | -13.6296 | 0.0000*** |
| SpeakerU | 0.0917 | 0.0957 | 0.9581 | 0.3381 |
| rating_typeAgreement | 0.7317 | 0.0957 | 7.6424 | 0.0000*** |
| TruthfulnessTRUE:SpeakerU | 0.3125 | 0.1354 | 2.3074 | 0.0211* |
| TruthfulnessTRUE:rating_typeAgreement | -0.6626 | 0.1354 | -4.8936 | 0.0000*** |
| SpeakerU:rating_typeAgreement | -0.0488 | 0.1354 | -0.3603 | 0.7187 |
| TruthfulnessTRUE:SpeakerU:rating_type Agreement | 0.0508 | 0.1915 | 0.2654 | 0.7907 |

Formula: summary(lmer(response ~ Truthfulness * Speaker * rating_type + (1 + Truthfulness|participant) + (1|Item_No), data = Rating_1))

Note: Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1