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Effects of Personal Characteristics on Language Processing: The Case of Political Ideology

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The undersigned certify that they have read and recommend to the Faculty of Arts for acceptance, a thesis entitled *Effects of Personal Characteristics on Language Processing: The Case of Political Ideology*, submitted by Lindsay Chopiuk in partial fulfillment of the requirements for the degree of Bachelor of Arts.

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## ABSTRACT

This thesis examines the effect of political ideology on language processing. While it is well established that the semantics of language have an effect on language users' comprehension process, there is little research on the effect of personal characteristics, particularly political ideology, on language processing. This study investigated participants' responses to sentences containing causality-biased verbs (for example, *fear* and *frighten*) in the cases of bias-congruent and -incongruent male and female pronouns through a self-paced reading experiment. The experiment measured whether participants' response times to sentences containing congruent and incongruent male and female pronouns differed in relation to their scores on a conservative-to-liberal political ideology scale. It was hypothesized that more conservative individuals, typically having stronger reactions against novel ideas, would have a marked response to unexpected information in sentences. In other words, more conservative participants were expected to have a longer response time to sentences with bias-inconsistent pronouns than to those with bias-consistent pronouns. In this experiment, it was found that implicit causality congruence had an effect on reading time to the pronoun and following (spill-over) segments. While there was an interaction of implicit causality congruence and pronoun gender in the pronoun segment, in the spill-over segment, reading time depended on both the gender of the subject of the previous clause (NP1) and the participants' political ideology: more conservative participants had more difficulty resolving the pronoun when it was incongruent with the implicit causality bias and when NP1 was female rather than male. The results suggest there is a relationship between political orientation and language processing. This study aims to contribute to a better understanding of how personal characteristics influence our mental representation of language.

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## CHAPTER 1. INTRODUCTION AND BACKGROUND

As listeners and readers, our interpretations of language depend not only on the semantics of the words that we are taking in, but also on our world knowledge, experiences, personal and social factors. Comprehending language is a complex process which is the culmination of many processes including taking in words, building representations of words and sentences, and integrating our own experiences and personalities into our interpretation of any given linguistic message. There is presently a dearth of research on how extra-linguistic factors related to personal experience and world view influence language comprehension; the bulk of language processing research has been carried out on neutral language, rather than exploring stimulating and morally charged language (Van Berkum et al. 2009). The present study aims to add to the body of knowledge on how personal experience affects language processing by investigating the comprehension process of a particular type of language—implicit causality verbs—and whether individuals’ political ideology affects that comprehension. Implicit causality verbs include words such as *fear* or *frighten*; they are transitive verbs which take two characters and carry a bias in terms of our expectations for which character is the cause of the verb’s action. In a sentence beginning *He frightened her*, English speakers typically expect the cause of the fright to be the first character (that is, we expect the sentence to continue as *He frightened her because he...*). If the same sentence were to continue with *she*, we would be experiencing an incongruity in the character expected to be causing the verb’s action. In contrast to *frighten*’s first-character bias, *fear* carries a second-character bias. The congruent case of *fear* would attribute action to the second character (as in *He feared her because she...*). Whether presented in congruent or incongruent constructions, it has been found that implicit causality verbs differ in how individuals process them in relation to their own personal attributes (e.g., Niemi et al. 2019).

In this study, I will primarily focus on exploring individuals' processing of implicit causality verbs in relation to their political orientation. The present study aims to investigate correlations between participants' political ideology, i.e. whether they lean more towards conservatism or progressivism, and how they interpret implicit causality verbs. With the knowledge that more conservative individuals tend to hold on to traditions, reject novel ideas, and react more strongly against new ideas (Jost et al. 2003; Graham et al. 2009; Murray & Schaller 2016), I hypothesize that more conservative individuals will have a more difficult time processing incongruent, bias-inconsistent language information.

In what follows, I will first provide a background on the research that has been done on prediction in language processing, the effects of extra-linguistic factors including personal characteristics on language comprehension, and an overview of implicit causality verbs as well as how we process them. Then I will describe the present experiment which gave participants the opportunity to work through sentences containing implicit causality verbs in a self-paced listening test, as well as surveys to gauge personal characteristics.

## **1.1 Effects of extra-linguistic factors on language comprehension**

There are a number of factors other than strictly lexical and syntactic information that inform our interpretations of language, and specifically on our interpretations of causality-biased verbs (Van Berkum et al. 2005, 2013; Niemi et al. 2019). Even individuals' moods can have an effect on how they process language: Van Berkum et al. (2013) carried out an EEG study on how participants' levels of implicit causality-driven anticipation differed depending on whether they were in a happy or sad mood.



### 1.1.1 Prediction in online language processing

It is well established that prediction plays a role in sentence interpretation (Mitchell 1994; Van Berkum et al. 2005; Federmeier 2007; Traxler 2014). Prediction comes from the necessity of using anticipation in carrying out day-to-day functioning (Van Berkum et al. 2005), and is present as language users make use of general knowledge of discourse to anticipate upcoming words; prediction allows for active integration of new information into prior context. Listeners make use of existing knowledge to predict potential interpretations of utterances rapidly as they experience sentences. Rather than waiting for an utterance to be completed to form an interpretation, speakers tend to anticipate upcoming input and make predictions as to which continuations would be more or less likely (Traxler 2014). This happens not after an utterance has been completed, but actively as speech is happening (Otten & Van Berkum 2008). This is seen not only in verbal speech but visually processed language as well; as readers process words and understand their meanings, they use those meanings to build an interpretation of the sentence as it is unfolding, activating lexical features that might appear in the upcoming sentence (Federmeier 2007). This anticipation can be seen, for example, in how readers tend to skip more predictable words more often (Rayner 1998). There is evidence that this prediction is done in part through top-down processing by the production system, in that readers run utterances through their own language production systems to construct their own mental representations on which they base predictions about how a sentence will unfold (Federmeier 2007; Pickering & Gambi 2018).

### 1.1.2 Studies of prediction in language processing

One way in which researchers have studied prediction in language processing is by constructing language samples to prompt certain expectations, and then contradict them. For example, Van Berkum and colleagues (2005) presented Dutch-speaking participants with phrases that they would expect to continue in a certain way, for example, *The burglar had no trouble locating the family safe. It was*

*situated behind a ...* Subjects were expected to anticipate *painting*, and following *behind a* were either presented with an adjective whose inflectional suffix would agree with the anticipated *painting* or would disagree. Violated expectations elicited an N400 ERP effect; participants were anticipating the word *painting* early enough in the sentence for this effect to be observable on an adjective that would precede the noun, that is, they expected to encounter *painting* before reaching that point in the sentence (see also DeLong et al. 2005). People may not predict parts of a word in equal magnitude. Ito et al. (2020) carried out a study in which participants were shown to have greater responses to gender mismatches than they did to mismatches in other phonological aspects of words, indicating that gender may be anticipated more quickly than other aspects.

## **1.2 Effects of personal factors on language comprehension**

Language comprehension is not only affected by the language users' interpretation system and their predictions, but also by individual factors including participants' moral beliefs and their own personality traits (Van Berkum et al. 2009; Hubert 2019; Hubert & Järvikivi 2019). Little research has been done on the interaction of personality and language comprehension, and more research is needed to reach a better understanding of this interaction. The present study has considered the effects of political values in particular on language comprehension.

### **1.2.1 Political values**

Individuals' political values include their opinions on social issues including abortion, welfare programs, and healthcare. More conservative values are associated with what are considered more traditional or politically right-wing concepts. Conservatism and progressivism do not necessarily align with any one political party, but are linked to the level of attachment to more traditional values (Murray & Schaller 2016), where more progressive individuals tend to value welfare programs, the concept of labour

unions, and more accessible healthcare, while more conservative individuals tend to value traditional family structures, adherence to customs, and free market economies. The adherence to tradition in conservative-leaning individuals may be associated with a stronger reaction to new or unexpected information (Murray & Schaller 2016), including unexpected information in language processing. Van Berkum et al. (2009) found evidence for the elicitation of a neural response while participants read statements that clashed with their individual value system. While having EEG data recorded, participants—either from a strict Christian political party or non-Christians who opposed the platform of the other party—completed surveys on morally-charged issues including drugs and social conduct which included statements such as *I think euthanasia is an acceptable course of action*. Van Berkum and colleagues found that the first word that clashed with the participants' value system (acceptable vs. unacceptable) elicited an early positivity between 200-250 ms, an N400 response peaking at 400 ms, and a late positivity at 500-650 ms. The N400 clash indicates difficulty in making sense of a statement, which in this study was not owing to semantic or grammatical errors, but to the statement's misalignment with the participants' personal values. This study is significant for providing evidence for moral evaluation of language as soon as it is presented; the values provoked by Van Berkum and colleagues are not only of moral significance, but of political consequence as well, which we are investigating in the current study.

Additional research on political ideology in relation to language processing was done by Niemi and colleagues (2019); this study investigated how political opinions affect processing of implicit causality verbs, showing that participants interpreted the causality of verbs based on their own political preferences rather than on the lexical qualities of the verbs. Participants, who identified themselves as supporters of either Hillary Clinton or Donald Trump in the 2016 U.S. Presidential Election, were asked to make causal judgments of events involving both candidates. Both Clinton and Trump supporters attributed the cause of positive events to their preferred candidate, and the cause of negative events to their nonpreferred candidate. This study is of significance in that it provided support for both liberal- and

conservative-leaning individuals to experience an effect of their personal characteristics (specifically political orientation) on how they understood language in this given scenario.

### 1.3 Implicit causality bias

Implicit causality (IC) verbs are transitive verbs that take two arguments (NP1 and NP2, respectively), and when read or heard in a sentence including a *because* clause, carry a bias for which argument readers expect to be the cause of an event (Pyykkönen & Järvikivi 2010). This distinction can be seen in the comparison of sentences such as the following from Bott & Solstad (2014):

(1) *Mary fascinated John because she...*

(2) *Mary admired John because he...*

This implicit causality bias is the tendency to expect either *he* or *she* following *because*; in (1), the explanation for John's fascination is attributed to something to do with the object of his fascination, Mary, while in (2), the explanation for Mary's admiration is attributed to something to do with John's personality or actions. While these phrases both have the same surface structure (NP1 + verb + NP2 + *because* [...]), the reader's understanding of the verbs will differ; *fascinate* is a NP1-biased verb, while *admire* is a NP2-biased verb. As phrase (1) above has an NP1-biased IC verb and is followed by a pronoun that refers to the NP1 (i.e., *she* clearly refers to *Mary*), this is an example of an implicit causality-congruent phrase. Similarly in phrase (2), the NP2-biased verb *admired* is followed by *he*, a referent to the NP2 (*he* refers to *John*). Incongruent versions of these phrases would be *Mary fascinated John because he...* and *Mary admired John because she...*. The bias in the verbs creates an understanding of the causal relationship between the NP1 and NP2 characters.

Further evidence that readers expect sentences containing implicit causality verbs to continue in a certain direction, or for the verb to be biased in a given direction, is present in studies where participants have been presented with both congruent and incongruent sentences containing implicit causality verbs

(e.g., Caramazza et al. 1977, Koornneef & Van Berkum 2006). Incongruent sentences, for example, *David praised Linda because he ...* slowed down reading time for participants at, and immediately following the incongruent pronoun (*he*). The effect carried over from the pronoun and had an effect on slowing down the remainder of the sentence following the incongruent pronoun; that is, participants had a harder time processing entire sentences when a sentence contained an implicit causality verb and incongruent pronoun (Koornneef & Van Berkum 2006). The incongruent pronoun caused problems for participants in retroactively integrating the incongruent segments as the sentence carried on.

Implicit causality bias is an unconscious effect that comes from the semantics of these verbs, and has been shown to affect participants (readers) differently depending on their own personal characteristics. More conservative-learning participants were shown to have a different experience of IC verbs than progressive participants (Marrville 2017).

#### **1.4 Research question**

As discussed above, researchers have provided strong evidence to establish that language processing happens dynamically and incrementally as we experience language. However, not much research has been done on how moral and political values affect the comprehension process. If more conservative individuals have a stronger reaction to unexpected information (Murray & Schaller 2016) and implicit causality verbs can be used to construct sentences in a way that can violate biases and manufacture unexpected information, then we would expect that more conservative individuals would have a marked response to incongruent implicit causality sentences. In this study, I will investigate whether political orientation has an effect on online language comprehension, specifically in the case of implicit causality verbs through the manipulation of male/female pronouns in sentences such as *Heather encouraged Jack because lately he was feeling down.*

## CHAPTER 2. METHODS

Online tasks such as self-paced reading experiments (SPR) can provide valuable insight into the language comprehension process, as such experiments return timed results from given points in time as the participant progresses through the experiment. This style of measurement is useful for studying ambiguous language as it is processed incrementally throughout a sentence. SPR returns not only the processing time of a target word, but of successive words and can therefore provide information on how participants parse language at given points throughout sentences (Roberts 2012). The present study made use of a self-paced reading experiment in order to analyze online processing of a target word (in this case, the pronoun that refers to a sentence's NP1 or NP2 as discussed above), as well as the subsequent segments. The way in which test sentences were divided into segments is outlined below in Section 2.2.2. The test items for this experiment are 80 sentences, each constructed to include a unique implicit causality verb, and a male and a female character. The sentences were constructed to be modifiable to create congruent and incongruent pronoun environments, as shown in Table 2.2. With this style of experiment we are able to observe online processing times as participants work through the test sentences; the male and female character names and pronouns will be swapped to investigate whether there is a different effect depending on the role of the male or female characters in the sentences.

### 2.1 Participants

The participants in this experiment were 72 post-secondary students from the undergraduate linguistics pool at the University of Alberta. Data from non-native speakers of English was not included in the analysis; as a result, the given data was obtained from 58 native speakers of North American English. Participants self-reported age, gender, nationality, and languages spoken; final participants

included **33 males, 58 females, and 2 non-binary participants** with an age range of 16-35 years and a mean age of 20.3 years.

## 2.2 Materials

### 2.2.1 Verb selection

A total of 80 implicit causality-biased verbs were selected from Ferstl et al. (2011). Verbs were chosen for overall balance in specific elements including the direction and degree of bias (NP1 vs. NP2), verb thematic role (experiencer vs. agent-patient/agent-evocator), and valence (positive vs. negative). Verb bias is the directionality associated with a verb's meaning, as in the distinction between *fear* and *frighten* discussed above in Section 1 (*fear* is NP2-biased, *frighten* is NP1-biased). The implicit causality bias as seen in Table 2.1 below shows the strength of the verb's bias towards attributing its cause to the first or second noun phrase, where a value closer to 0 shows a weaker bias towards either the subject noun NP1 (IC bias > 0), or the object noun NP2 (IC bias < 0). Verbs with bias values farthest from zero were favoured in verb selection. The verbs' thematic roles (categorized into experiencer and non-experiencer) and valence (the positivity or negativity of the verb) were chosen for a balanced selection of test sentences.

Verb	Verb Bias	Implicit Causality Bias	Category	Valence
lauded	NP2	-37	agent-evocator	-1.5
defamed	NP1	34	agent-evocator	-1.6
admonished	NP2	-32	agent-patient	-0.4
battled	NP1	47	agent-patient	-2.0
calmed	NP2	-53	experiencer	1.6
intimidated	NP1	73	experiencer	-1.8

**Table 2.1:** Sample verbs and their direction and amount of bias, category, and valence

### 2.2.2 Sentence construction

80 sentence stimuli were created around the selected verbs. Each sentence had two characters: one female and one male, one of which was also referred to by either a *he* or *she* pronoun. Male and female characters were chosen to avoid ambiguity in identifying a pronoun’s referent. Names were chosen from Marrville (2017) with the removal of names that would seem unusual or gender-ambiguous to a North American English speaker (top male/female names from United States Social Security Administration database, 1990<sup>1</sup>). For comparability, each sentence was constructed with nine segments in the same syntactic order, as outlined in Table 2.2 below.

Each sentence was presented in four different iterations, shown in each row in Table 2.2, to gauge the different effect between congruent and incongruent pronouns, as well as controlling for effects of gender; each sentence appeared for each participant either as iteration (1) or (4), with the pronoun congruent with the verb’s bias (*lauded* is a NP2-biased verb, so the pronoun following *because* should match the second noun phrase, i.e. the second character), with either a male or a female pronoun in the critical NP2 position, or as (2) or (3), with either an incongruent male or

	NP1	Implicit Causality Verb	NP2	Because	Adverb	Pronoun	Spill	Penultimate	Wrapup
(1)	Maria	lauded	Richard	because	suddenly	he	had become	a successful	entrepreneur.
(2)	Maria	lauded	Richard	because	suddenly	she	had become	a successful	entrepreneur.
(3)	Richard	lauded	Maria	because	suddenly	he	had become	a successful	entrepreneur.
(4)	Richard	lauded	Maria	because	suddenly	she	had become	a successful	entrepreneur.

**Table 2.2:** Template used for sentence construction, with example sentences.

<sup>1</sup> <https://www.ssa.gov/oact/babynames/limits.html>



female pronoun. Both male and female pronouns were included in both congruent and incongruent conditions to control for gender bias.

Congruent test items have pronouns that agree with the verb's bias. *Derided* is an NP2-biased verb; that is, we expect the cause of the derision to come from the person who is the object in the sentence rather than the subject. A reader would typically expect that a sentence beginning *Daniel derided Nancy because* would continue with *she*, a pronoun that refers to Nancy. A congruent test item then, for example, would be *Daniel derided Nancy because lately she had been making ineffective decisions*, while its incongruent counterpart would be *Daniel derided Nancy because lately he had been making ineffective decisions*, in which the pronoun *he* refers to the NP1 (subject) of the sentence, *Daniel*.

The experiment was programmed using E-Prime experimental software (Psychology Software Tools Inc. 2012). Each participant was presented with one of four lists. Each list included 80 test stimuli (see Appendix A for the full list) and 60 filler sentences, all of which included unique verbs and character names. The four iterations of each sentence (seen as options 1, 2, 3, and 4 in Table 2.2 above) were counter-balanced equally across each of the lists; a participant would not be presented with a sentence in more than one iteration.

### **2.3 Procedure**

Participants were briefed on the experiment and seated at a desktop computer. They were initially presented with three practice items in the same format as the test items, for example, *Tina noticed Curtis because today he was wearing a bright colour*, and given an opportunity to ask the researcher questions about the procedure before continuing on with the test. During the test procedure, each participant was presented with 140 consecutive sentences presented in nine segments as discussed above and shown in Table 2.2. Participants were instructed to read the words on-screen and to press the computer keyboard's space bar as soon as they comprehended the present word(s). At the conclusion of the nine segments

(following each complete sentence), participants were either presented with a screen prompting them to press a key to proceed to the next trial, or, after a portion of the items, asked a yes/no comprehension question to ensure attention to the experiment and accurate comprehension of the sentences, as shown in Table 2.3.

Test Item	Yes/No Question
Ray distracted Joel because otherwise he would witness the theft.	Was Ray knowingly involved in the crime?
Lynn snubbed Tommy because last week they had a serious falling out.	Did Lynn and Tommy have a fight?

**Table 2.3:** Sample test items and their respective comprehension questions.

## 2.4 Post-tests

Because this experiment aimed to gauge the effect of participants’ personal characteristics on their comprehension of implicit causality verbs, they were given a series of post-tests to assess the relevant personal factors. Following the self-paced reading test, all participants completed a political questionnaire, a disgust sensitivity assessment, the HEXACO Personality Inventory, and a language background assessment. Full tests can be found in Appendix B. Only the results of the political questionnaire will be reported in this study.

### 2.4.1 Political questionnaire

To gauge participants’ attitudes towards social and political issues, they were given a modified version of the Political Ideology Questionnaire from Louisiana State University School of Social Work (in Marrville 2017). The questionnaire includes 25 scaling questions that were used to determine an overall summed score for each participant. Participants responded whether they were for or against social

issues on a scale from 1 to 6; issues included national healthcare, aid for the homeless, and capital punishment. Participants were also presented with statements to which they were asked to rate their reaction from strongly disagree (1) to strongly agree (6); statements included *The traditional family must be preserved at all costs*, *Sometimes revolutions are necessary*, and *Helping the poor encourages laziness*. Each response was scored from -3 to 3, where a *strongly disagree* response to *Helping the poor encourages laziness* would be assigned a -3, and a *strongly agree* response +3. Participants received an overall score from that denoted either more conservative-leaning or progressive-leaning ideology.

#### 2.4.2 Language Background

To ensure participants had the best possible grasp on the nuances of how implicit causality verbs are used in English, for this experiment only native English speakers were included in the results. The language background questionnaire assessed whether the participants were native English speakers, as well as their educational backgrounds and other languages spoken (Appendix B).

## CHAPTER 3. RESULTS

Results were analyzed through fitting linear-mixed effects models (LMERs) in R (Package *lme4*, version 1.1-19, Bates et al., 2015; R version 3.5.1, R Core Team, 2018) with response times (RTs, log transformed) as the dependent variable. Significance values were obtained with package *lmerTest* (version 3.0-1, Kuznetsova et al., 2017). Of interest in the analysis were the pronoun and spill-over segments, as previous studies have found effects in these segments as a response to semantic and pragmatic errors in language, where processing delays were seen not only at the target segment but in the remainder of the sentence as well (De Vincenzi et al. 2003). Data was inspected using density plots, through which outliers were removed, 3.5% on the target and 7.0% on the spill-over region. All models included random intercepts for participant and item as well as by-participant random-slopes for implicit causality congruence. Models were fitted using a backward stepwise procedure, comparing each model iteration (function `anova()` in R). Factors that were tested included implicit causality congruence (congruent, incongruent), pronoun gender (female, male), verb bias (NP1, NP2), and participant's political ideology as a continuous numerical predictor. In addition, trial number was included in the model to account for any learning effects during the experiment, and previous segment log transformed response time was included to guard against influences due to autocorrelation. After reaching the best model to include significant predictors and variables, by-subject random-slopes were tested for implicit causality congruence and NP1 gender.

To analyze participants based on political orientation, results from the political questionnaire were centred and scored on a scale from -3 to 3, where participants with scores greater than 0 were associated with a more conservative ideology and scores less than 0 identified participants as more progressive-leaning.

### 3.1 Target segment

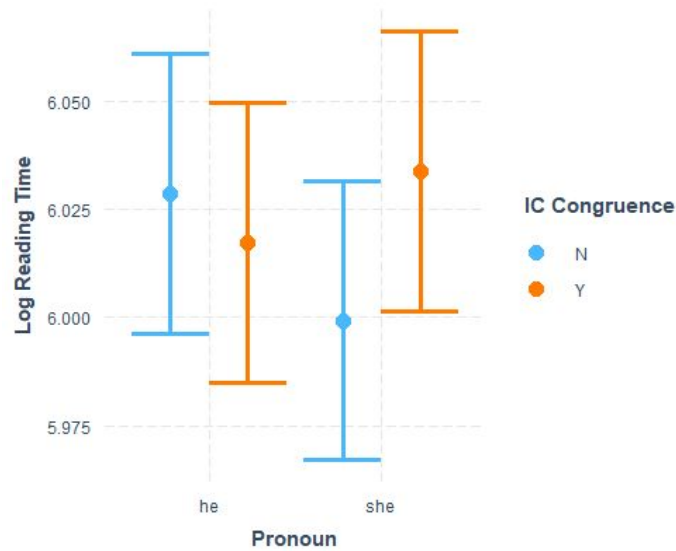
In the analysis, we will consider the different segments of the test sentences separately. Of particular interest, as discussed above, are the target and the spillover segment. The target segment of the test items is the point of the trial where participants were presented with the pronoun that referred to either the NP1 or the NP2 of a sentence, as in *Marcus grieved April because recently she had passed away*. If implicit causality has an effect on processing very early in the sentence, we would expect an effect on the processing time of an incongruent pronoun.

As shown by the linear mixed effects model output in Table 3.1, in the target segment there was a significant effect of pronoun gender ( $\beta = -0.0292$ ,  $SE = 0.00992$ ,  $t = -2.943$ ). The significant trial effect indicates that participants increased the speed of their responses over the course of the experiment, and the log segment reaction time indicates a correlation between participants' response times from one segment to the next. In the target segment, we observed a two-way interaction between congruence and pronoun gender ( $\beta = 0.04561$ ,  $SE = 0.01405$ ,  $t = 3.247$ ). This interaction is also seen in Figure 3.1 below.

Figure 3.1 demonstrates that participants showed similar reading times of the male pronoun *he* in both congruent and incongruent cases, while for the female pronoun *she*, there was a significant difference in reading times for the congruent and incongruent cases. When the female pronoun was incongruent with implicit causality bias, participants took longer to process the pronoun *she*. In other words, there was an early effect of implicit causality congruence on the pronoun segment, but only for the female pronoun.

	Estimate	Std. Error	df	t-value	Pr(> t )
(Intercept)	4.087e+00	6.789e-02	1.750e+03	60.205	< 2e-16 ***
CongruenceY	-1.123e-02	9.936e-03	4.106e+03	-1.130	0.25854
Pronoun(She)	-2.920e-02	9.920e-03	4.102e+03	-2.943	0.00327 **
Political Ideology	8.456e-03	2.359e-02	5.079e+01	0.358	0.72148
NP1 Gender(Male)	1.310e-02	7.023e-03	4.096e+03	1.865	0.06221
Verb Bias(NP2)	-4.901e-03	8.059e-03	7.740e+01	-0.608	0.54481
Trial	-1.835e-03	9.853e-05	4.198e+03	-18.625	< 2e-16 ***
log(seg5RT)	3.348e-01	9.899e-03	4.177e+03	33.826	< 2e-16 ***
CongruenceY : Pronoun(She)	4.561e-02	1.405e-02	4.096e+03	3.247	0.00118 **

**Table 3.1:** Summary of linear mixed effects model of the target segment.



**Figure 3.1:** Effect of implicit causality congruence on reading time of the target segment.

### 3.2 Spill-over segment

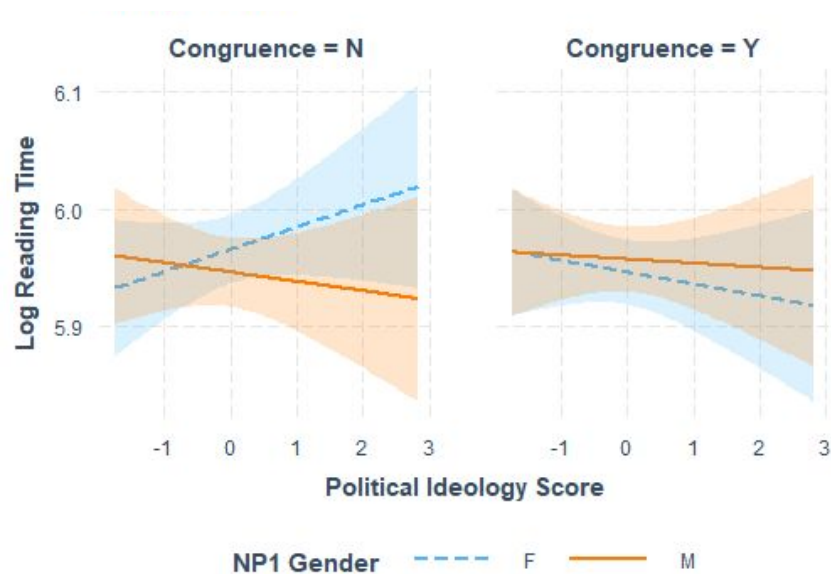
The spill-over segment is the part of the sentence immediately following the target segment, seen in the *Spill* segment in Table 2.2. Marrville (2017) found that encountering pronouns inconsistent with participants' expectations for given verbs caused them to take additional time to process not only the pronoun, but the segment immediately following the pronoun as well. By extension, in the present study we would expect to see an effect of slowed processing time on the spill-over segment in test items with incongruent pronouns.

	Estimate	Std. Error	df	t-value	Pr(> t )
(Intercept)	3.446e+00	7.505e-02	2.282e+03	45.920	< 2e-16 ***
CongruenceY	-1.974e-02	1.052e-02	1.449e+02	-1.877	0.06256
Political Ideology	1.907e-02	2.260e-02	5.396e+01	0.844	0.40247
NP1 Gender(Male)	-1.968e-02	9.602e-03	4.077e+03	-2.049	0.04052 *
Trial	-1.868e-03	9.427e-05	4.166e+03	-19.820	< 2e-16 ***
logRT6	4.429e-01	1.146e-02	4.067e+03	38.657	< 2e-16 ***
CongruenceY : Political Ideology	-2.919e-02	1.050e-02	1.452e+02	-2.781	0.00615 **
CongruenceY : NP1 Gender(Male)	3.077e-02	1.359e-02	4.055e+03	2.264	0.02360 *
Political Ideology : NP1 Gender(Male)	-2.709e-02	9.517e-03	4.091e+03	-2.846	0.00445 **
CongruenceY : Political Ideology : NP1 Gender (Male)	3.373e-02	1.359e-02	4.040e+03	2.481	0.01313 *

**Table 3.2:** Summary of linear mixed effects model of the spill-over segment

The same significant trial and log segment reaction time effects are observed in the spill-over segment as in the target segment (Table 3.1). As shown in Table 3.2, in the case of the spill-over

segment, there was a significant effect of NP1 gender ( $p = 0.04052$ ): when the pronoun gender was male, participants showed faster reaction times. There were significant two-way interactions between congruence and political ideology ( $p = 0.00615$ ), congruence and NP1 gender ( $p = 0.02360$ ), and political ideology and NP1 gender ( $p = 0.00445$ ). Additionally, there was a significant three-way interaction between these three predictors (congruence, political ideology, and NP1 gender) ( $p = 0.01313$ ), also shown in Figure 3.2 below.



**Figure 3.2:** Three-way interaction between participants' political ideology, pronoun congruence, and NP1 gender for reading time in the spill-over segment.

The spill-over segment shows a three-way interaction between participants' political ideology, pronoun congruence, and NP1 gender. While reading time is similar for both congruent male and female pronouns across the range of participants' political ideologies (shown in the Congruence = Y portion of Figure 3.2 above; see Table 3.3 for separate analysis of congruent pronouns which shows no effect of NP1 gender), reading time increases for incongruent pronouns as participants' conservatism increases, but only when the subject of the preceding main clause (NP1) is female. This is shown in the Congruence



= N portion of Figure 3.2 where the line indicating female NP1 gender lies significantly outside of the error margins (orange shaded area) of response for male NP1 gender on the positive (conservative) side of the Political Ideology Score.

	Estimate	Std. Error	df	t-value	Pr(> t )
(Intercept)	3.203e+00	1.016e-01	1.635e+03	31.523	<2e-16 ***
Political Ideology	-7.147e-03	1.891e-02	4.582e+01	-0.378	0.707
NP1 Gender (Male)	1.009e-02	9.622e-03	2.007e+03	1.048	0.295
Trial	-1.783e-03	1.342e-04	2.083e+03	-13.287	<2e-16 ***
logRT6	4.796e-01	1.595e-02	1.905e+03	30.063	<2e-16 ***

**Table 3.3:** Fixed effects for congruent pronouns.

As seen in Table 3.4, separate analyses for the congruent pronouns shows an effect of NP1 gender and a two-way interaction between political ideology and NP1 gender. This indicates that not only was there a correlation between participants' political ideologies and how they processed the IC verb, but this correlation differed depending on whether the test sentence's NP1, i.e., the subject, was male or female.

Across both segments discussed above (target and spill-over), there was no main effect found of political ideology on reading time. However, a three-way interaction was found between Implicit Causality Congruence, NP1 Gender, and Political Ideology score. Depending on participants' political ideology, congruence was found to have an effect on performance resolving incongruent pronouns. The time to process an incongruent pronoun, as in *Heather encouraged Jack because lately she...* was longer in more conservative-leaning participants than it was in more progressive participants, as well as compared to processing time of congruent pronouns by all participants, regardless of their political orientation.

	Estimate	Std. Error	df	<i>t</i> -value	Pr(>  <i>t</i>  )
(Intercept)	3.507e+00	1.032e-01	1.729e+03	33.981	< 2e-16 ***
Political Ideology	1.795e-02	2.296e-02	5.051e+01	0.782	0.43791
NP1 Gender (Male)	-1.927e-02	9.636e-03	2.003e+03	-2.000	0.04563 *
Trial	-1.860e-03	1.338e-04	2.080e+03	-13.905	< 2e-16 ***
logRT6	4.327e-01	1.613e-02	2.045e+03	26.832	< 2e-16 ***
Political Ideology: NP1 Gender(Male)	-2.587e-02	9.543e-03	2.012e+03	-2.710	0.00678 **

**Table 3.4:** Fixed effects for incongruent pronouns.

In the models shown above, the experiment trial was shown to have a significant effect, in that participants responded to segments more quickly over the course of the experiment. This is shown in the LMER output Tables 3.1 and 3.2 above in the highly significant effect (indicated by \*\*\*). In Tables 3.3 and 3.4, the positive *t*-value on the logRT6 segment (the reaction time of the target, or pronoun, segment) indicates that how a participant processes the previous segment positively correlates with how they will answer the present segment; that is, their longer response on a previous segment correlates positively with a longer response on the present segment.

## CHAPTER 4. DISCUSSION

This study examined the effect of personal characteristics, particularly political ideology, on individuals' performance on a self-paced reading experiment based on implicit causality verbs. Particular attention was paid to the gender of the pronoun in a sentence such as *Daniel derided Nancy because lately she/he...*, as well as the processing time of the pronoun and the words immediately following the pronoun. From the self-paced reading experiment, support was found for the presence of an effect of implicit causality congruence on the pronoun segment, for participants' political ideology on their response times to incongruent pronouns, and on the spill-over segment immediately following the pronoun. For the spill-over segment, this effect depended on the gender of the subject name of the first clause (NP1) and the political orientation of the participant, in that there was a longer reading time for more conservative-leaning participants' processing of the incongruent pronoun when the first noun was female than when it was male in gender. On the pronoun segment, the effect of implicit causality congruence was limited to female pronouns (*she*). These observations suggest that there is a relationship between political orientation and language processing; specifically, this result indicates that incongruent male pronouns are more acceptable and easier to comprehend than incongruent female pronouns. The results further suggest that when the pronoun is incongruent, the processing difficulty is increased for more conservative-leaning participants when the subject of the preceding clause is female.

The present study, making use of online processing observations, also supports that language processing is done incrementally as a sentence is unfolding. The observation of the difficulty processing incongruencies emerged at early points in the trials (i.e. participants showed slowed reaction times as soon as they were presented with incongruent pronouns). Based on Van Berkum's (2005) study, participants may have been making predictions for how the sentence would continue to unfold, and when these predictions were contradicted by bias-incongruent pronouns, experienced more

effortful—slowed—processing. In addition, the different interactions on the pronoun and the spill-over segments provides support for the dynamic integration of information as a sentence unfolds. Information is taken into individuals' mental representations of sentences as they are experiencing language, a finding which is also present in other implicit causality studies (McDonald & MacWhinney 1995; Pyykkönen & Järvikivi 2010; Marrville 2017).

The study mentioned above in Section 1.2.1, which also investigated political orientation and implicit causality verbs, likewise found an effect of participants' political leanings on how they processed implicit causality verbs (Niemi et al. 2019). The finding was that participants attributed the cause of positive events to their preferred political candidate and of negative events to their nonpreferred candidate. This provided evidence for individuals' political leanings to play a role in their interpretation of IC verbs, shown in participants' attribution of cause based on their personal political biases rather than on the objective lexical biases of the verbs themselves. Both the present study and Niemi's suggest that individual political orientations play a role in how we understand language. The finding of the present study that sentences with causality bias-congruent pronouns are processed more quickly than bias-incongruent are also supported by Marrville (2017) in an eye-tracking study. Marrville found that participants' gazes moved more quickly across congruent cases, but slowed down (indicating slower and more effortful processing) in incongruent cases, or when aspects of a character (including gender and verb-based emotional dominance) conflicted with the participant's expectations.

## CHAPTER 5. CONCLUSION

This study, through an online self-paced reading task, found support for individuals' political orientations having an effect on how they process implicit causality verbs. On the pronoun segment, earlier in a sentence such as *Stella exasperated Jacob because once again she lied about quitting smoking*, we found an two-way interaction of implicit causality congruence and pronoun gender, indicating that participants had more difficulty processing incongruent female pronouns. On the spillover segment immediately following the pronoun, we found a three-way interaction of participant political orientation, implicit causality congruence, and NP1 gender. This three-way interaction specifically showed that more conservative participants were slower to process incongruent pronouns, but only when the grammatical subject of the main clause was female. The findings of this paper support previous findings for the incremental style of language processing, and that personal characteristics of language users have an effect on how they process language. More research is needed, however, to better understand the effects of political ideology on language processing.

## REFERENCES

- Bates, D., Maechler, M., Bolker, B., Walker, S., Christensen, R. H. B., Singmann, H., ... & Bolker, M. B. (2015). Package 'lme4'. *Convergence*, 12(1), 2.
- Bott, O., & Solstad, T. (2014). From verbs to discourse: A novel account of implicit causality. In *Psycholinguistic approaches to meaning and understanding across languages* (pp. 213-251). Springer, Cham.
- Caramazza, A., Grober, E., Garvey, C., & Yates, J. (1977). Comprehension of anaphoric pronouns. *Journal of verbal learning and verbal behavior*, 16(5), 601-609
- Carreiras, M., Garnham, A., Oakhill, J., & Cain, K. (1996). The use of stereotypical gender information in constructing a mental model: Evidence from English and Spanish. *The Quarterly Journal of Experimental Psychology Section A*, 49(3), 639-663.
- Cupples, L. (2002). The structural characteristics and on-line comprehension of experiencer-verb sentences. *Language and Cognitive Processes*, 17(2), 125-162.
- De Vincenzi, M., Job, R., Di Matteo, R., Angrilli, A., Penolazzi, B., Ciccarelli, L., & Vespignani, F. (2003). Differences in the perception and time course of syntactic and semantic violations. *Brain and language*, 85(2), 280-296.
- DeLong, K. A., Urbach, T. P., & Kutas, M. (2005). Probabilistic word pre-activation during language comprehension inferred from electrical brain activity. *Nature neuroscience*, 8(8), 1117-1121.
- Federmeier, K. D. (2007). Thinking ahead: The role and roots of prediction in language comprehension. *Psychophysiology*, 44(4), 491-505.
- Ferstl, E. C., Garnham, A., & Manouilidou, C. (2011). Implicit causality bias in English: A corpus of 300 verbs. *Behavior Research Methods*, 43(1), 124-135.
- Garnham, A., Traxler, M., Oakhill, J., & Gernsbacher, M. A. (1996). The Locus of Implicit Causality Effects in Comprehension. *Journal of memory and language*, 35(4), 517-543.
- Graham, J., Haidt, J., & Nosek, B. A. (2009). Liberals and conservatives rely on different sets of moral foundations. *Journal of personality and social psychology*, 96(5), 1029.
- Hubert, I. (2019). "It's personal and disgusting: Extra-linguistic information in language comprehension." PhD thesis. University of Alberta.
- Hubert, I. & Järviokivi, J. (2019). Dark forces in language comprehension: The case of neuroticism and disgust in a pupillometry study. *Proceedings of the 41st Annual Meeting of the Cognitive Science Society*, 450-456. Montreal, QB: Cognitive Science Society.
- Ito, A., Gambi, C., Pickering, M. J., Fuellenbach, K., & Husband, E. M. (2020). Prediction of phonological and gender information: An event-related potential study in Italian. *Neuropsychologia*, 136, 107291.
- Jost, J. T., Glaser, J., Kruglanski, A. W., & Sulloway, F. J. (2003). Political conservatism as motivated social cognition. *Psychological bulletin*, 129(3), 339.
- Koornneef, A. W., & Sanders, T. J. (2013). Establishing coherence relations in discourse: The influence of implicit causality and connectives on pronoun resolution. *Language and cognitive processes*, 28(8), 1169-1206.
- Koornneef, A. W., & Van Berkum, J. J. (2006). On the use of verb-based implicit causality in sentence comprehension: Evidence from self-paced reading and eye tracking. *Journal of Memory and Language*, 54(4), 445-465.
- Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: tests in linear mixed effects models. *Journal of statistical software*, 82(13).

- Marrville, C. (2017). "Gender and dominance in action: World view and emotional affect in language processing and use." PhD thesis. University of Alberta.
- McDonald, J. L., & MacWhinney, B. (1995). The time course of anaphor resolution: Effects of implicit verb causality and gender. *Journal of memory and language*, 34, 543-543.
- Mitchell, D. C. (1994). Sentence parsing. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp. 375–409). New York: Academic Press.
- Murray, D. R., & Schaller, M. (2016). The behavioral immune system: Implications for social cognition, social interaction, and social influence. In *Advances in experimental social psychology* (Vol. 53, pp. 75-129). Academic Press.
- Niemi, L., Roussos, G., & Young, L. (2019). Political Partisanship Alters the Causality Implicit in Verb Meaning. *Journal of Language and Social Psychology*, 38(5-6), 809-819.
- Otten, M., & Van Berkum, J. J. (2008). Discourse-based word anticipation during language processing: Prediction or priming?. *Discourse Processes*, 45(6), 464-496.
- Pickering, M. J., & Gambi, C. (2018). Predicting while comprehending language: A theory and review. *Psychological Bulletin*, 144(10), 1002
- Psychology Software Tools Inc. (2012). *E-Prime 2.0*.
- Pyykkönen, P., & Järvikivi, J. (2010). Activation and persistence of implicit causality information in spoken language comprehension. *Experimental Psychology* 57(1), 5-16.
- R Core Team (2018). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Austria: Vienna. url: <https://www.R-project.org/>.
- Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological bulletin*, 124(3), 372.
- Roberts, L. (2012). Psycholinguistic techniques and resources in second language acquisition research. *Second Language Research*, 28(1), 113-127.
- Traxler, M. J. (2014). Trends in syntactic parsing: Anticipation, Bayesian estimation, and good-enough parsing. *Trends in cognitive sciences*, 18(11), 605-611.
- Van Berkum, J. J., Brown, C. M., Zwitserlood, P., Kooijman, V., & Hagoort, P. (2005). Anticipating upcoming words in discourse: evidence from ERPs and reading times. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 31(3), 443.
- Van Berkum, J. J., De Goede, D., Van Alphen, P., Mulder, E., & Kerstholt, J. H. (2013). How robust is the language architecture? The case of mood. *Frontiers in psychology*, 4, 505.
- 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.

## APPENDIX A: Experiment stimuli

### A.1: List of stimuli used in self-paced reading test

1. John persecuted Susan because defiantly [PN] wouldn't follow the procedure.
2. James deprecated Mary because foolishly [PN] was acting like a child.
3. Robert disparaged Linda because boldly [PN] hoped to undermine the authority.
4. Michael denigrated Barbara because boorishly [PN] wanted to withhold the necessary assistance.
5. Richard lauded Maria because suddenly [PN] had become a successful entrepreneur.
6. Joseph defamed Margaret because ruthlessly [PN] wanted to win the election.
7. Thomas reproached Dorothy because again [PN] used inappropriate language in the report.
8. Chris mocked Lisa because daftly [PN] didn't understand the art.
9. Daniel derided Nancy because lately [PN] had been making ineffective decisions.
10. Pail vilified Karen because remorselessly [PN] wanted to discredit the opposition.
11. Mark reviled Betty because yesterday [PN] showed callous behaviour to their colleagues.
12. Donald forgave Helen because honestly [PN] hoped the argument would be finished.
13. George blessed Sandra because faithfully [PN] had attended the church for a decade.
14. Kenneth victimized Donna because cruelly [PN] wanted to obliterate the rival party.
15. Steven apologized to Carol because graciously [PN] took the blame for their accident.
16. Edward slandered Ruth because callously [PN] showed no consideration for others' feelings.
17. Brian welcomed Sharon because happily [PN] had shown up for a visit.
18. Ronald praised Michelle because genuinely [PN] did a fantastic job on the project.
19. Anthony recompensed Laura because honestly [PN] appreciated the extra effort on the assignment.
20. Kevin snubbed Sarah because last week [PN] decided to stop their budding relationship.
21. Jason exalted Kimberley because lately [PN] had shown excellent work performance.
22. Matthew admonished Deborah because unfortunately [PN] was running late for their date.
23. Gary tailed Jessica because furtively [PN] wanted to know what his partner was hiding.
24. Tim abandoned Shirley because frankly [PN] was tired of dealing with the drama.
25. Jeffrey battled Angela because always [PN] had to take responsibility for their actions.
26. Scott advised Amy because often [PN] turned to a friend for guidance.
27. Eric defied Anna because adamantly [PN] refused to cast a favourable vote.
28. Stephen banished Rebecca because frankly [PN] had betrayed the family for the last time.
29. Andrew disobeyed Kathleen because finally [PN] was tired of being told what to do.
30. Gregory alienated Pamela because unfortunately [PN] didn't dress with good taste.
31. Joshua yelled at Martha because foolishly [PN] was driving distractedly that night.
32. Jerry provoked Amanda because subtly [PN] implied they were applying for the same position.
33. Walter accompanied Stephanie because unfortunately [PN] needed an adult to see the movie.
34. Patrick freed Caroline because annoyingly [PN] was unable to get untangled from the net.
35. Peter divorced Christine because cruelly [PN] had cheated in their marriage.
36. Harold compensated Marie because fortunately [PN] appreciated the help and extra labour.
37. Douglas harmed Janet because carelessly [PN] didn't take enough time ensuring their safety.



38. Harry lied to Catherine because frankly [PN] was afraid of the truth.
39. Arthur protected Ann because thoughtlessly [PN] hadn't brought a raincoat to help stay dry.
40. Ryan guided Joyce because cautiously [PN] wanted help choosing a path to follow.
41. Roger tantalized Diane because enticingly [PN] told a story full of mystery.
42. Joseph flattered Alice because thoughtfully [PN] offered an invitation to the party.
43. Jack encouraged Heather because lately [PN] needed inspiration to keep working.
44. Albert incensed Theresa because mercilessly [PN] argued about politics and religion.
45. Justin pained Julie because offhandedly [PN] shared the news of their father's death.
46. Keith chilled Cheryl because often [PN] told ghost stories.
47. Ralph plagued Joan because regularly [PN] refused to attend any of the lectures.
48. Brandon reassured Nicole because inwardly [PN] understood what it was like.
49. Adam consoled Judy because still [PN] felt an overwhelming sense of loss.
50. Henry cheered Christina because woefully [PN] needed some encouragement.
51. Fred relaxed Kathy because naturally [PN] had an aura of calmness.
52. Jeremy calmed Rose because unusually [PN] was stressed about the exam.
53. Alan intimidated Louise because shockingly [PN] threatened to share the scandal with the journalist.
54. Thomas confronted Lynn because recently [PN] had been feeling very upset.
55. Martin invigorated Laurie because excitingly [PN] had a fresh perspective on life.
56. Brent peevied Vivian because annoyingly [PN] liked to play practical jokes.
57. Marcus grieved April because recently [PN] had passed away.
58. Theodore pacified Amber because truly [PN] hoped to avoid another heated argument.
59. Kylie shook Sylvia because urgently [PN] needed to be woken up.
60. Jacob moved Grace because begrudgingly [PN] refused to do it alone.
61. Allen venerated Shannon because frequently [PN] showed saintly qualities.
62. Brent dreamed about Lauren because fervently [PN] enjoyed the time they spent together.
63. Joel yearned for Charlotte because before now [PN] had never experienced such a connection.
64. Jay forgot Danielle because unfortunately [PN] didn't make a powerful impression.
65. Ernest delighted June because last night [PN] put on an inspirational performance.
66. Jerome liked Gail because truly [PN] had a wonderful sense of humour.
67. Gordon disliked Audrey because in the past [PN] had let their group down.
68. Zachary attracted Jilly because always [PN] showed desirable qualities.
69. Warren feared Samantha because often [PN] flaunted his collection of firearms.
70. Greg fascinated Amber because frequently [PN] posed thought-provoking questions.
71. Calvin charmed Daniella because regularly [PN] gave thoughtful gifts.
72. Raymond pitied Emma because unfortunately [PN] kept choosing incorrect test questions.
73. Marcus appreciated Sara because caringly [PN] understood what the family was going through.
74. Troy Angered Gabriella because repeatedly [PN] displayed different priorities.
75. Jacob exasperated Stella because once again [PN] lied about quitting smoking.
76. Louis dreaded Eleanor because often [PN] made offensive jokes.
77. Don pleased Christine because today [PN] baked a spectacular birthday cake.
78. Liam loathed Cheryl because always [PN] would make false promises.
79. Ben repulsed Louise because regularly [PN] refused to bathe himself.

80. Frederick resented Georgia because recently [PN] had questioned whether they were equals.

A.2: List of fillers used in self-paced reading test (Marrville 2017)

1. Howard chastised Steve because again he caught him acting naughty.
2. Carlos defamed Russell because angrily he was jealous of all his success.
3. Jacqueline confessed to Andrea because rationally she was tired of lying.
4. Martin corrected Ernest because notably he excelled in his field of study.
5. Herman echoed Maurice because eagerly he wanted to impress him.
6. Laurie answered Katie because normally she knew the right answer.
7. Vanessa defied Kristen because today she thought she was doing the right thing.
8. Anna dreamed about Vivian because instinctively she felt she was in trouble.
9. Jon missed Ronnie because absently he lost track of the time.
10. Wayne bothered Billy because aggressively he pushed him into the wall.
11. Lori bored Jane because constantly she told the same stories all the time.
12. Holly intrigued Brittany because casually she spoke whatever was on her mind.
13. Sam jolted Rick because silently he fell asleep at the wheel.
14. Shane angered Hector because generally he was rather rude.
15. Lester rebuked Brent because normally he trusted him to do his job.
16. Ramon rewarded Lauren because thankfully they found the lost puppy.
17. Melanie blamed Alma because already she gave up before the game had ended.
18. Zachary honoured Jill because proudly they came in first in the talent show.
19. June mocked Marion because unfortunately she misunderstood sarcasm.
20. Gordon excused Tim because afterwards he practiced for the big game.
21. Jerome complimented Gail because recently they started dating monogamously.
22. Audrey praised Erica because thankfully she appreciated help around the house.
23. Lynn snubbed Tommy because last week they had a serious falling out.
24. Dean victimized Greg because supposedly he was self conscious about himself.
25. Warren reprimanded Derek because aggravatingly he arrived late once again this morning.
26. Tom saluted Cathy because appropriately they followed the work place protocol.
27. Alvin pardoned Floyd because accidentally he knocked into him on the street.
28. Stacy called Samantha because anxiously she needed to hear the news immediately.
29. April approached Leslie because awkwardly she stood right in the doorway.
30. Marcus deserted Jay because sadly he injured his leg and could not keep up.
31. Bill chased Alex because callously he stole the laptop from the classroom.
32. Darlene avoided Veronica because unfortunately she smelled absolutely awful.
33. Clifford helped Eleanor because methodically they worked together to solve the puzzle.
34. Bernard hugged Debbie because romantically they celebrated their anniversary.
35. Theodore left Joanne because contently they were returning to their homes after work.
36. Amber warned Barry because seriously they were both in real danger.
37. Dustin played with Annette because coincidentally they went to the same preschool.
38. Meghan pitied Alicia because ignorantly she ignored the instructions on the exam.
39. Pedro feared Wesley because dangerously he thought he was a murderer.

40. Leroy idolized Alexander because habitually he acted like a father figure.
41. Clara noticed Lucille because remarkably she toned down her makeup.
42. Sara disliked Anne because sourly she smiled at her through gritted teeth.
43. Valerie envied Danielle because recently she won the provincial lottery.
44. Calvin trusted Oscar because always he acted quite truthfully.
45. Lloyd respected Jim because officially he had the highest participation mark.
46. Randall forgot Hazel because honestly they had not seen each other in years.
47. Rhonda treasured Troy because faithfully they committed to each other in marriage.
48. Don fancied Emma because coincidentally they shared a love for jazz music.
49. Pauline deplored Edwin because previously they attended the same junior high.
50. Jamie revered Michael because recently they went through the cult's initiation rites.
51. Sheila insulted Ethel because truthfully she said what she was thinking.
52. Kim shook Victoria because unintentionally she fell asleep on the couch
53. Alfred flattered Melvin because recently he got a new hair cut.
54. Carrie exhausted Charlotte because playfully she acted like a child.
55. Joel distracted Ray because otherwise he would witness the theft.
56. Shannon wounded Lee because confidently they ran to catch the fly ball at once.
57. Kyle surprised Ellen because slowly they entered the room full of hiding guests.
58. Sylvia encouraged Jeff because gladly they worked as a team.
59. Thelma concerned Jacob because unfortunately they had been down this road before.
60. Grace affected Allen because sensibly they were in tune with each other's moods.

A.3: List of comprehension questions (Marrville 2017)

1. Was Bill a thief?
2. Were Bernard and Debbie siblings?
3. Did Theodore and Joanne live together?
4. Is Annette in high school?
5. Did Alicia do well on the exam?
6. Did Wesley think Pedro was a killer?
7. Did Sarah like Annette?
8. Did Valerie win the lottery?
9. Did Oscar lie?
10. Did Jim have the lowest participation mark?
11. Do Hazel and Randall see each other often?
12. Did Emma hate jazz?
13. Did Jamie fear Michael?
14. Did Kim fall asleep?
15. Did Alfred have a new hair style?
16. Was Charlotte acting her age?
17. Was Ray knowingly involved in the crime?
18. Was Lee playing hockey?
19. Did Jacob concern Thelma?

20. Was Jay hurt?
21. Did Veronica smell bad?
22. Were Clifford and Eleanor a team?
23. Was Amber in danger?
24. Was Alexander older than Leroy?
25. Does Lucille wear makeup?
26. Were Rhonda and Troy in love?
27. Did Pauline and Edwin go to school together?
28. Was Sheila rude?
29. Did Kyle plan a surprise party for Ellen?
30. Did Jeff team up with Sylvia?
31. Did Allen sense Grace's mood?
32. Did Tim have a big game coming up?
33. Did Erica help Audrey around the house?
34. Did Lynn and Tommy have a fight?
35. Did Derek arrive late?
36. Did Ana think Vivian was in trouble?
37. Had Rick been driving?
38. Was Hector rude?
39. Were Melanie and Alma playing a game?

A.4: Practise trials for self-paced reading test

1. Jonathan blamed Melissa because carelessly she had lost their lab results.
2. Katie celebrated Haley because finally she graduated from university.
3. Tina noticed Curtis because today he was wearing a bright colour.

## APPENDIX B: Post-tests

### B.1: Items in the Language Background Questionnaire

1. Gender
2. Occupational status
3. Highest educational qualification
4. Country of birth
5. Primary language spoken
6. First language learned
7. Other languages spoken & proficiency
8. Native language & proficiency

### B.2: Items in the Political Ideology Questionnaire

1. For the following, provide a response on a scale from 1 (for) to 6 (against):
  - a. Prayer in schools
  - b. Abortion
  - c. Cuts to welfare programs
  - d. National healthcare
  - e. Sex education in elementary schools
  - f. Gun control
  - g. Stronger labour unions
  - h. Contraception
  - i. Food stamp programs
  - j. Same-sex marriage
  - k. Aid/care for the homeless
  - l. Minimum wages
  - m. Political correctness
  - n. Racial quotas in the workplace
  - o. Capital punishment
2. For the following statements, provide a response on a scale from 1 (strongly disagree) to 5 (strongly agree)
  - a. It is better to keep things the way they are
  - b. People are essentially selfish; they need to be controlled
  - c. Individuals have free will; they are responsible for their own lives and problems
  - d. The traditional family must be preserved at all costs
  - e. Government regulations are needed to control monopolies
  - f. A free market economy is the best way to ensure prosperity and fulfillment of individual needs
  - g. Sometimes revolutions are necessary

- h. This country would be better off if most government programs were eliminated
- i. People are basically good but can be corrupted
- j. The free market economic system is basically exploitative and inherently unfair to working people
- k. Helping the poor encourages laziness
- l. If the rich continue to get richer and the poor continue to get poorer, I would support a violent revolution to correct the inequality