Semantic Reversal Anomalies under the Microscope: Task and Modality Influences on Language-Related ERP components

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Abstract

Semantic reversal anomalies (SRAs) – sentences where an implausibility is created by reversing participant roles – have attracted a great deal of attention in the literature on the electrophysiology of language. In spite of being syntactically well-formed but semantically implausible, these structures unexpectedly elicited a monophasic P600 effect in English and Dutch rather than an N400 effect. Subsequent research revealed variability in the presence/absence of an N400 effect to SRAs depending on the language examined and the choice of verb type in English. However, most previous studies employed the same presentation modality (visual) and task (acceptability judgement). Here, we conducted two experiments and three statistical analyses to investigate the influence of stimulus modality, task demand, and statistical modelling on ERP response patterns to SRAs in English. We reproduced a previous study's procedure and analysis (Bourguignon et al., 2012), aiming to replicate their findings. We further introduced between-subjects factors of task type and modality and conducted linear mixed effects modelling to analyse the data. We observed an N400 effect to typical English SRAs, in contrast to the existing literature and not predicted by existing theories that accounts for SRA processing. Task demand quantitively and qualitatively modulated the ERPs elicited by SRAs, while auditory presentation led to increased comprehension accuracy and a more broadly distributed ERP. Finally, the statistical methods used influenced the presence/absence of ERP effects. Our results suggest the sensitivity of language-related ERP patterns to methodological parameters and we conclude that future experiments should take this into careful consideration.

1. Introduction

Semantic reversal anomalies (SRAs) and the ERPs they elicit have played an important role in building psycholinguistic theory over the past fifteen years. SRAs arise when the role assignment of two nouns are reversed in a syntactically well-formed sentence, leading to an implausible interpretation (Kim & Osterhout, 2005). For example, the sentence *"The pill will swallow the child with hot tea"* becomes implausible at the verb, "*swallow"* (Bourguignon, Drury, Valois, & Steinhauer, 2012). While "*pill"* is an acceptable direct object (i.e. *"The child will swallow the pill…"*), its inanimacy makes it unsuitable for the subject role, causing a linguistic violation (Bourguignon et al., 2012).

Early SRA experiments observed a P600 rather than the expected N400 to such semantically anomalous verbs (Hoeks, Stowe, & Doedens, 2004; Kim & Osterhout, 2005; Kolk, Chwilla, Van Herten, & Oor, 2003; Kuperberg, Sitnikova, Caplan, & Holcomb, 2003; van Herten, Chwilla, & Kolk, 2006; Van Herten, Kolk, & Chwilla, 2005). These findings challenged the beliefs of a one-to-one mapping of ERPs onto linguistic processes, where the N400 was thought to reflect semantic processing and the P600 was thought to reflect syntactic processing (Hagoort, Brown, & Groothusen, 1993; Kutas & Hillyard, 1980; Osterhout & Holcomb, 1992, 1993). In response, two distinct interpretations arose: (1) that very basic assumptions about the timecourse of sentence processing must be rethought, or (2), that the underlying functions which the N400 are thought to reflect must be re-evaluated.

Supporting the first interpretation, Kim and Osterhout (2005) suggested that in SRAs, "semantic attraction" dominates combinatory analysis and overwhelms unambiguous syntactic cues, leading to a semantic analysis. This "semantic attraction" hypothesis conflicts with both modular and interactive views of sentence comprehension (Fodor, 1983; Marslen-Wilson, 1975), and requires a reanalysis of the timecourse of sentence processing. Other studies challenge this interpretation, showing that a P600 can also be elicited by SRA sentences without semantic attraction (Kolk et al., 2003; Van Herten et al., 2005). An alternate interpretation is that the N400 indexes lexical pre-activation (Stroud & Phillips, 2012) or the retrieval of lexical information from memory (Brouwer, Fitz, & Hoeks, 2012; Lau, Phillips, & Poeppel, 2008) rather than a more complex aspect of sentence

processing. This interpretation suggests that the absence of an N400 effect is due to word and context priming, where the facilitation of verb retrieval is approximately equal for semantically plausible and anomalous phrases (Brouwer et al., 2012). This has implications for how the N400 can be used to conceptualise sentence processing, and is not supported by recent studies finding an N400 response to SRAs (Bornkessel-Schlesewsky et al., 2011; Bourguignon et al., 2012).

The above interpretations share one similarity, in that they depend on the findings of a monophasic P600 elicited by SRAs. However, more recent results suggest a variability of the ERP response to SRAs across and within languages. Across languages, the presence versus absence of the N400 has been attributed to whether word order is the dominant cue to sentence interpretation or not (Bornkessel-Schlesewsky & Schlesewsky, 2019). In languages which do not rely on word order for interpretation ("sequence-independent", i.e. German, Turkish, Mandarin Chinese), an N400 is elicited by SRAs at the verb (Bornkessel-Schlesewsky et al., 2011). Previous research has focused predominantly on English and Dutch, which rely more heavily on word order as the main cue to sentence interpretation (i.e. "sequence-dependent" languages; see MacWhinney, Bates, & Kliegl, 1984). This suggests a cross-linguistic ERP response based on the cues used for sentence interpretation.

Within a language, the N400 has been manipulated by verb type (Bornkessel-Schlesewsky et al., 2011; Bourguignon et al., 2012). An Icelandic investigation found that the N400 and P600 are differentially elicited depending on the combination of verb class and case marking (Bornkessel-Schlesewsky et al., 2011). When "alternating" verbs are used, role assignment is determined by word order and which noun is placed in the subject position, similarly to sentence processing in English or Dutch. When "non-alternating" verbs are used, role assignment is determined by a combination of verb class and case, similarly to German, Turkish, and Mandarin Chinese. Bornkessel-Schlesewsky et al. (2011) found that SRAs involving alternating verbs elicited a P600, patterning with English and Dutch. SRAs involving non-alternating verbs elicited an N400-late positivity pattern, as in German, Turkish and Mandarin Chinese (Bornkessel-Schlesewsky et al., 2011).

In English, Bourguignon et al. (2012) reported novel findings where SRAs involving experiencer subject verbs (ESVs; i.e. *The gifts have loved the children…)* elicited a biphasic N400-

late positivity in contrast to typical SRA constructions which elicited a P600. They suggested that thematic aspects play a role in SRA processing, and ESVs were less informative to processing because they can be mapped to both subject and object positions (Bourguignon et al., 2012). They interpreted the N400 observed in the ESV condition as reflecting lexical identification of the verb (Bourguignon et al., 2012).

Verb-class dependent findings in Icelandic and English provide evidence against the suggestions of Brouwer et al. (2012), Kim & Osterhout (2005) and Stroud & Phillips (2012). When subject and object can be mapped to more than one plausible thematic role (Icelandic alternating verbs, English ESVs) the ERP response is modulated. It is evident that the N400 and P600 do not map one-to-one onto basic lexical processes, but index more complex processing during sentence comprehension. To investigate the verb-class effects on the presence or absence of the N400 and P600, we aim to reproduce the findings of Bourguignon et al. (2012).

1.1. Task effects

A monophasic P600 has consistently been reported at the verb position of SRAs in sequence-dependent languages (English and Dutch; see Hoeks et al., 2004; Kim & Osterhout, 2005; Kolk et al., 2003; Kuperberg et al., 2003; van Herten et al., 2006; Van Herten et al., 2005), with all but one existing study using visual stimulus presentation combined with an acceptability judgement task[1]. Given the sensitivity of late positivities to task effects and experimental environment, the observed P600 is likely modulated by the design of these experiments (Sassenhagen, Schlesewsky, & Bornkessel-Schlesewsky, 2014). Some suggest the P600 to linguistically deviant stimuli may be a domain-general, late P3 component in response to target events (Coulson, King, & Kutas, 1998; Kutas, Neville, & Holcomb, 1987; Kutas, Van Petten, & Kluender, 2006; Sassenhagen et al., 2014; Van Herten et al., 2005).

An active judgement task increases the saliency of SRA violation verbs, as that is the point where the sentence becomes “unacceptable” and a judgement can be made (Schacht, Sommer, Shmuilovich, Martíenz, & Martín-Loeches, 2014). It has been shown that the P600 response to linguistic violations is larger when combined with an active judgement task compared to passive comprehension (Osterhout, Allen, Mclaughlin, & Inoue, 2002; Osterhout & McKinnon, 1996), a lexical decision

(Roehm, Bornkessel-Schlesewsky, Rösler, & Schlesewsky, 2007) identifying the letter case (Gunter & Friederici, 1999), or a probe verification task (Schacht et al., 2014). Thus, in typical delayed-response sentence-processing experiments, a positivity is expected following a task-relevant violation ((Sassenhagen et al., 2014; see Kotz, Frisch, Von Cramon, & Friederici, 2003 for an alternate view).

It is likely that the P600 in SRA experiments is influenced by task demands and stimulus salience, reflecting domain-general rather than higher-order language processes. Bourguignon et al. (2012) also recommended that their verb-type manipulation be retested without an overt judgement task, to determine if the ERP differences between ASV and ESV persist. To address the possibility of P600 effects being task-related, we included a delayed comprehension question task in the present study. When questions cannot be prepared for during comprehension, a task-dependent P600 should be diminished in this condition.

1.2. Modality effects

The modality of linguistic stimuli has also been found to influence ERP amplitude, latency, and topography (Domalski, Smith, & Halgren, 1991; Hagiwara, Soshi, Ishihara, & Imanaka, 2007; Holcomb, Coffey, & Neville, 1992; Holcomb & Neville, 1990; Wolff, Schlesewsky, Hirotani, & Bornkessel-Schlesewsky, 2008). In a semantic priming and lexical decision task, Holcomb & Neville (1990) found significant cross-modal differences in the topography of N400s to unrelated words, where visual ERPs were right-lateralised and auditory ERPs were spread across hemispheres. However, others have found no differences between auditory and visual N400s elicited by semantic violations (although the low number of electrodes limits topographical conclusions; Balconi & Pozzoli, 2004). A third modality to consider is sign language, where ERPs elicited by American Sign Language semantic anomalies show differences in latency and morphology compared to both auditory and visual English stimuli (Neville et al., 1997; Neville, Mills, & Lawson, 1992). In the same way that co-articulation effects in the speech stream can provide predictive information about upcoming words, the transition phrase prior to a critical sign provides predictive information in sign language (Hosemann, Herrmann, Steinbach, Bornkessel-Schlesewsky, & Schlesewsky, 2013). This suggest that auditory and sign language may pattern together, as the continuous input stream provids information differently to visual stimulus presentation. When reading, word information is available instantly, and

the commonly used method in ERP studies is rapid serial visual presentation (RSVP). RSVP, where single words are presented sequentially on a screen, inherently differs from natural auditory language. When presenting stimuli visually, the RSVP parameters (i.e. the duration that the word is displayed for and/or the duration between each word) may influence the timing of resultant ERPs (Hagoort & Brown, 2000).

Current neurobiological models of sentence processing are based upon the auditory system, and do not make predictions about reading processes (Bornkessel-Schlesewsky & Schlesewsky, 2013; Bornkessel-Schlesewsky, Schlesewsky, Small, & Rauschecker, 2015; Friederici, 2011, 2012). The auditory system may be more sensitive in detecting irregularities or violations in the speech stream compared to reading, as auditory language processing abilities are developed earlier than visual language processing (Holcomb & Neville, 1990). Supporting this, research into semantic borderline anomalies (violations on the borderline of detection) found that violations were detected at a higher rate when stimuli were presented auditorily compared to visually (Bohan, 2007). It is unclear whether we can confidently generalise ERP findings from the visual modality (specifically RSVP) to broader models of natural sentence processing. To investigate the influence of stimulus modality on ERP effects, we developed both a visual and auditory version of the present study for comparison.

1.3. The present study

The present study comprises two experiments partially reproducing that of Bourguignon et al. (2012), who used a 2 x 2 design with factors Verb Type (ASV versus ESV) and Animacy (of the Subject NP). In Experiment 1, we added a between-subjects factor of Task (Judgement or Comprehension) thus employing a 2 x 2 x 2 design (Animacy x Verb Type x Task). Experiment 2 matched Experiment 1, using auditory stimulus presentation rather than visual. Example stimuli are outlined in Table 1. The aims of the present study are: 1) attempt to replicate Bourguignon et al.'s 2012 novel finding of differential ERP patterns to SRAs across verb classes in English, and 2) systematically examine the effects of task and modality on the ERPs elicited by SRAs. We predict (H1) that our study will reproduce the behavioural and ERP results of Bourguignon et al. (2012). The main findings of Bourguignon et al. (2012) were: (a) Participants effectively discriminated grammatical from ungrammatical (violation) sentences and were more accurate for ASV than ESV.

(b) At the first noun, a significant N400 was elicited for inanimate compared to animate Subject NPs, most prominent at the midline. (c) At the verb, animacy reversals elicited an N400 effect for ESV only, and elicited a P600 effect for both ASV and ESV.

Table 1 here

1.3.1. Experiment 1: Task. We included the between-subjects factor of task to compare the ERPs elicited in a judgement versus comprehension task. The crucial difference between tasks is that the comprehension question could not be predicted prior to presentation. The judgement task employed the same question after each sentence, therefore a decision could be made during sentence presentation. If the P600 observed in SRA studies relates to task-relevance, it should be diminished when the task is unpredictable. We hypothesise (H2) that a P600 will be elicited at the Verb with an Animacy effect and that the amplitude of this P600 will be larger for the Judgement compared to Comprehension condition.

1.3.2. Experiment 2: Modality. Experiment 2 matched Experiment 1, but sentence stimuli were presented auditorily via loudspeakers rather than with RSVP. To test the predictions of current models of sentence processing which are based on auditory processing, we developed an auditory stimulus set with the same sentences as Experiment 1. We hypothesise (H3) that the topography of the N400 effect will differ across modality, with the auditory condition showing more broadly distributed ERP topography.

2. Experiment 1: Visual modality

2.1. Methods

2.1.1. Participants

Forty-eight right-handed (Edinburgh Handedness Inventory), native English-speaking adults (32 female, mean age = 23.2 ± 0.77, age range 18-40) with normal vision and no history of psychiatric, neurological, cognitive, or language disorders participated after giving informed consent. All participants had normal or corrected-to-normal vision. Participants were offered an honorarium for their participation.

2.1.2. Stimuli

Stimuli were adapted from Bourguignon et al. (2012) with minor alterations listed below. See Bourguignon et al. (2012, pg. 181-183) for further information. Table 1 provides example stimuli, and Appendix A lists all sentence material.

2.1.2.1. Tense alteration. The stimuli created by Bourguignon et al. (2012) were in the present perfect tense *("The hikers have used the compass…"*). They aimed to have natural sounding sentences for both verb types while including a functional category (i.e. the auxiliary *"has/have"*) to minimize carry-over ERP effects from the Subject NP to the Verb. The aspect of the present perfect tense varied across the critical conditions (ASV and ESV), potentially confounding results (for further discussion see Bourguignon et al., 2012; Brennan & Pylkkänen, 2010). To avoid this while keeping natural sentences with a functional auxiliary, ASV, ESV, and filler EOV stimuli were adapted to the future indefinite tense (i.e. *"The hikers will use the compass"*). This allowed the consistent use of the auxiliary *"will"* for all critical stimuli, rather than using either *"has"* and *"have".*

2.1.2.2. Re-norming. Word frequency of the adapted future indefinite verbs was recalculated using the British National Corpus (*The British National Corpus, version 3*, 2007). ASV and ESV did not differ in orthographic length or frequency. Animate and Inanimate ESV and ASV Subject NPs also did not differ in orthographic length or frequency (all *p's* > .1).

2.1.2.3. Lists. The two complementary stimuli lists were replicated, with eight pseudorandomised versions developed for each task conditions (300 sentences per list, 16 randomisations total). Parameters for pseudorandomisation of the Judgement task condition were: minimum distance of two between condition, no more than three consecutive violations, minimum distance of ten between item number, minimum difference of two between item number. Additional parameters for pseudorandomisation of the Comprehension task condition were: no more than three of the same question type consecutively, no more than two of a correct answer type consecutively, and no more than three repetitions of correct answer location (left/right of screen) consecutively.

2.1.2.4. Comprehension task. The Comprehension task comprised three question types: (1) probing for the Subject Noun, (2) probing for the Object Noun, or (3) a filler yes/no probe question. Below the comprehension question, two answers were presented on the screen, either two nouns or "yes" and "no". See Table 2 for example comprehension questions. Question type was

pseudorandomly allocated to sentence condition and balanced within each presentation list. For each sentence condition within a list, 10 of each question type were allocated to correct sentences and 10 of each to violation sentences. The exception was the phrase structure violation (PSV) filler condition, where the syntax violation made it difficult to create Undergoer and Actor questions, and was allocated a higher ratio of yes/no probe questions[2].

Table 2 here

2.1.3. Procedure

The procedure matched that of Bourguignon et al. (2012) with minor alterations as below. The eye-blink prompt was represented by the symbol "!!!". The font of stimuli was altered to the monospaced font Courier New (size 26), to allow for accurate calculation of spacing between the two comprehension answer choices. Participants were seated 70cm from the computer monitor, and were not shown their EEG artefacts. Sentence presentation and the judgement task condition matched that of Bourguignon et al. (2012, pg. 183). The comprehension condition presented a question with two potential answers below. Participants were instructed to select the answer they deemed correct by pressing either the left or right mouse button to select the left- or right-side answer. Prior to the main experiment, participants undertook eight unrelated practice trials (two with linguistic violations) to become familiar with the procedure. The entire testing session lasted between 2 and 2.5 hours.

2.1.4. EEG recording and preprocessing

EEG was continuously recorded from 64 cap-mounted Ag/AgCl active electrodes online referenced to the left mastoid (Acticap, Brain Products, Gilching, Germany). Horizontal and vertical eye movements and blinks were monitored with electrode pairs placed above/below the left eye and at the outer canthi of both eyes. Impedance for each electrode was kept below 5 kOhm. All channels were amplified using a Brain Products ActiChamp amplifier at a 500 Hz sampling rate. Offline data pre-processing and averaging was carried out with MNE-Python version 0.18.2 (Gramfort et al., 2014). EOG artefacts were identified using the 'mne.preprocessing.find_eog_events' function and were removed. Epochs with peak-to-peak amplitude over 75 microvolts or under 5 microvolts were excluded. Trial-by-trial mean prestimulus voltage (-200 to 0 ms) was included as a covariate in the statistical analyses rather than applying a baseline correction (see Alday, 2017).

Data for Experiment 1 were analysed via two pipelines: (1) reproducing the original analysis conducted by Bourguignon et al. (2012), and (1) using linear mixed effect models (LMMs) which can specify random effect structures and examine the data trial-by-trial (Bates, Mächler, Bolker, & Walker, 2014). The reproduction analysis examined the Judgement task subset of participants (*n* = 23). A digital phase true-finite impulse response (FIR) band-pass filter (0.4 – 30 Hz) was applied and individual average ERPs were computed for each condition at each electrode in epochs from -100ms to 1100 ms relative to target word onset. A response-contingent analysis was conducted, where only trials followed by a correct response were analysed. Average amplitude was calculated for the 300-500ms (N400), 700-900ms and 900-1100ms (P600) time-windows. For the LMM analysis, data for both task conditions were included, with all trials included irrespective of behavioural response. The FIR band-pass filter was set at 0.1 – 30 Hz, and all other settings were unchanged.

2.1.5. Data analysis

R version 3.5.2 (R Core Team, 2018) was used for all statistical analyses with the packages *tidyverse* version 1.2.1 (Wickham, 2017), *car* version 3.0.2 (Fox & Weisberg, 2019), *lme4* version 1.1.21 (Bates, Maechler, Bolker & Walker, 2015), *effects* version 4.1.0 (Fox, 2019), *reshape2* version 1.4.3 (Wickham, 2007) and *ez* version 4.4.0 (Lawrence, 2016). To produce model output tables, *lmerOut* version 0.5 (Alday, 2018) was used.

2.1.5.1. Behavioural data. For the reproduction analysis, we subjected judgement acceptability ratings to a global` ANOVA with factors Animacy of Subject NP (Animate or Inanimate) and Verb Type (ASV or ESV). Animate Subject NPs corresponded to grammatical sentences, while inanimate corresponded to ungrammatical sentences in ASV and ESV (this was opposite for control condition EOV). For the LMM analysis, generalized linear mixed effect models were conducted separately for each task group (Judgement or Comprehension). Model structures included Animacy and Verb Type. For the Comprehension group, Question Type (Actor or Undergoer probe) was also included. Intercepts were grouped by Participant ID. Judgement accuracy (Correct or Incorrect) was specified as the dependent variable.

2.1.5.2. EEG data. For the reproduction, global ANOVAs for the ERP data included factors Animacy and Verb Type. Forty-two electrodes were analysed in each time window separately for

lateral and midline electrodes. The midline included Fz, FCz, Cz, CPz, Pz, and POz, reflected by the factor Anterior-Posterior (6 levels). Lateral electrodes included 36 electrodes (18 over each hemisphere) along three columns of six electrodes each: (1) medial (F1/2, FC1/2, C1/C2, CP1/2, P1/2, PO1/2); (2) intermediate (F3/4, FC3/4, C3/4, CP3/4, P3/4, PO3/4); (3) lateral (F5/6, FC5/6, C5/6, CP5/6, P5/6, PO5/6). Thus, topographical factors included in the ANOVAs were Hemisphere (2 levels), Column (3 levels) and Anterior-Posterior (6 levels). Significant interactions ($p < .05$) were followed by step-down analyses. The Greenhouse-Geisser correction is reported where necessary.

For the LMM analysis, LMMs fit by restricted maximum likelihood were undertaken for average amplitude in each ERP time window. Fifty-two electrodes were analysed, with the midline containing 13 (F1/z/2, FC1/2, C1/z/2, CP1/z/2, Pz, POz) electrodes. Lateral electrodes included 30 electrodes (15 over each hemisphere). Electrodes were assigned to the left, midline, or right laterality and anterior, central or posterior location sagitality. For the left laterality, anterior contained electrodes F7, F5, F3, FT7, FC5 and FC3, central contained T7, C5, C3, TP7, CP5 and CP3, while posterior contained PO7, PO3 and O1. For the right laterality, anterior contained electrodes F8, F6, F4, FT8, FC6 and FC4, central contained T8, C6, C4, TP8, CP6 and CP4, while posterior contained PO8, PO4 and O2. Model structures included Animacy (Animate or Inanimate), Verb Type (ASV or ESV), Laterality (Left, Midline, Right), Sagitality (Anterior, Central, Posterior) and scaled Prestimulus Amplitude. Intercepts were grouped by Participant ID and Item.

2.2. Results

2.2.1. Behavioural data

2.2.1.1. Reproduction. Acceptability rates for grammatical sentences were 89.67% for ASV and 80.98% for ESV, and for ungrammatical sentences were 7.91% for ASV and 15.48% for ESV. A repeated measures ANOVA included a significant main effect of Animacy ($F(1,21) = 1194.65$; $p < .001$), showing that participants effectively discriminated grammatical and ungrammatical sentences. A significant Animacy X Verb Type interaction ($F(1,21) = 62.81$; $p < .001$) showed that discrimination was more successful in the ASV condition. Follow up ANOVAs were conducted separately for grammatical and nongrammatical conditions, each showing a significant effect of Verb

Type. This showed the ASV advantage holds for accepting grammatical (F (1,21) = 11.63; p = .003) and rejecting ungrammatical sentences (F (1,21) = 20.98; p < .001).

2.2.1.2. LMM. Response accuracy was analysed rather than acceptance ratings, and coded by correct acceptance, incorrect acceptance, correct rejection, or incorrect rejection. The task groups were analysed separately, as the Comprehension group included the additional factor of Question Type. For the Judgement condition, a significant interaction effect of Animacy x Verb Type was observed ($\chi^2(1) = 4.95$, p =.026), where accuracy was higher for ASV than ESV. For Comprehension, a significant effect of Animacy x Verb Type x Question Type was observed ($\chi^2(1) = 434.75$, p <.001). When probed for the Actor (e.g. "Who/what will eat?"), participants performed similarly for grammatical and ungrammatical ASV sentences, but were significantly more accurate for grammatical compared to ungrammatical ESV sentences. When probed for the Undergoer (e.g. "Who/what will be eaten?), participants were most accurate for grammatical compared to ungrammatical sentences. See Table 3 for response accuracy percentages.

Table 3 here

2.2.2. ERP data

2.2.2.1. Reproduction. For the Subject NP, a negative deflection was observed in the N400 time-window (300-500ms) for inanimate compared to animate Subject NPs in ASV and ESV sentences. A global ANOVA showed a main effect of Animacy on the midline (F(1,21) = 7.89; p = .011) with a follow-up ANOVA showing this was most significant at posterior regions (e.g. Pz, F(1,21) = 9.83; p = .005). An Animacy x Column interaction (F(1.07,22.42) = 7.17, p = 0.12) indicated that the N400 was more prominent near the midline (F1/2 columns, F(1,21) = 8.31, p = .009; F3/4 columns, F(1,21) = 8.44, p = .008) compared to the lateral electrodes (F5/6 columns, F(1,21) = 6.55, p = .018). No statistically significant Animacy effects were observed in the 700-900 or 900-1100ms time-windows, as reported in Bourguignon et al. (2012), who posited that this reflects an absence of difference in the auxiliary preceding the verb.

In the verb N400 time-window, an ANOVA including both sentence conditions did not show a significant Animacy x Verb Type interaction for the midline or lateral electrode factors. An Animacy x Anterior-Posterior interaction was significant (F(1.46,30.64) = 3.88, p = .044), with

follow-up analyses showing this was significant at the most posterior electrodes (PO row, $F(1,21) = 5.40$, $p = .03$). A Verb Type x Hemisphere interaction ($F(1,21) = 11.23$, $p = .003$) was observed. Separate analyses for each Verb Type showed a significant effect of Hemisphere for both ASV ($F(1,21) = 28.17$, $p < .001$), and ESV ($F(1,21) = 11.38$, $p = .002$) where the N400 effect was larger in the right hemisphere.

In the verb 700-900ms time-range, an Animacy x Midline effect was observed, where violations elicited a positivity at the midline ($F(1.60,33.67) = 3.68$, $p = 0.45$). Follow-up analyses revealed no significant effects at a single electrode of the midline. At lateral electrodes, an interaction of Animacy x Verb Type x Column x Hemisphere was observed ($F(1.58, 33.18) = 9.25$, $p = .001$). Follow-up analyses separated by Verb Type did not show a main effect of Animacy or an interaction of Animacy x Hemisphere. The ASV condition showed a significant Animacy x Column effect ($F(1.16,24.46) = 12.16$, $p = .001$) where the positivity was largest at medial compared to lateral electrodes. An Animacy x Anterior-Posterior effect ($F(1.58,33.10) = 7.59$, $p = .004$) was observed, and was significant at posterior regions (P row, $F(1,21) = 4.77$, $p = .041$, PO row, $F(1,21) = 4.73$, $p = .041$). See Figure 1 for ERP plots at the Subject NP and Figure 2 for ERP plots at the verb.

Figures 1 and 2 here (ERP plots)

2.2.2.2. LMM. In the Subject NP N400 time-window, a main effect of Animacy ($\chi^2(1) = 149.43$, $p < .001$) showed that Inanimate Subject NPs elicited a negative effect compared to Animate Subject NPs. An Animacy x Task effect ($\chi^2(1) = 120.99$, $p < .001$) was observed, which was larger for the Judgement compared to Comprehension condition. An interaction of Animacy x Laterality ($\chi^2(2) = 20.86$, $p < .001$) shows that the N400 was larger in the right hemisphere. In the P600 time-window, we observed an Animacy x Task effect ($\chi^2(1) = 44.90$, $p < .001$). This interacted with Laterality (Animacy X Task x Laterality, $\chi^2(2) = 8.66$, $p = .013$) and Sagitality (Animacy X Task x Sagitality, $\chi^2(2) = 6.87$, $p = .032$). In the later window (900-1100ms) a main effect of Animacy ($\chi^2(2) = 63.94$, $p < .001$) was observed. However, the interactions in the 700-900 and 900-1100ms windows did not resolve to simple effects in any topographical region upon visual inspection of the model plots (see Figure 3; see Appendix B for model summaries).

Figure 3 here

For the Verb, in the 300-500ms time-window, an interaction of Animacy x Verb Type x Task ($\chi^2(1) = 117.37$, $p < .001$) indicated that for ASV sentences, violations elicited an N400 for the Judgement condition only. For ESV sentences, we observed a tendency to a polarity reversal across task, where an N400 was elicited for the Comprehension but not Judgement condition. This interacted with Laterality (Animacy x Verb Type x Task x Laterality, $\chi^2(2) = 23.99$, $p < .001$) and Sagitality (Animacy X Verb Type Task x Sagitality, $\chi^2(2) = 6.00$, $p = .050$) and the N400 effect was largest for electrodes at middle/right Laterality and anterior/central Sagitality. In the 700-900ms time-window, an interaction of Animacy x Verb Type x Task ($\chi^2(1) = 22.41$, $p < .001$) indicated a significant positivity for violation ASV sentences in the Comprehension group. An interaction with Laterality (Animacy x Verb Type x Task x Laterality ($\chi^2(1=2) = 11.70$, $p = .003$), showed left-lateralisation of this effect. Visual inspection of the ERP plots (see Figure 2) suggests a positivity in this time-window for violation ASV sentences in the Judgement group, but this was not statistically significant (although a significant interaction was observed in the reproduction analysis). Model plots are included in Figure 4.

Figure 4 here

3. Experiment 1: Visual modality summary

Using ANOVAs, we reproduced Bourguignon et al.'s behavioural results and N400 effect for inanimate Subject NPs. At the verb, we did not find an Animacy x Verbtype effect in the N400 time-window, with violations eliciting a negativity in both ASV and ESV rather than ESV only as predicted. Replicating the previous study, violations also elicited a P600 effect at the verb for both sentence conditions.

The LMM analysis showed the same behavioural results and ERP effects at the Subject NP. The N400 at the Subject NP was larger for the Judgement compared to the Comprehension condition. At the verb, ASV violations elicited an N400 for the Judgement condition, while ESV violations elicited a negativity for the Comprehension condition. The lack of N400 effect for ESV violations in the Judgement condition was unexpected. In the Verb P600 time window, a significant positivity was observed for violation ASV sentences in the Comprehension condition only. We did not find a P600 effect for either task group in the ESV condition, differential to the reproduction ANOVA analysis.

4. Experiment 2: Auditory modality

4.1. Methods

4.1.1. Participants

Forty-eight right-handed (Edinburgh Handedness Inventory), native English-speaking adults (27 female, M(SE) age 24.9(0.8), age range 18-39) participated after giving informed consent. Participants fulfilled the same inclusion criteria as Experiment 1, with the added criterion of no self-reported hearing impairments. They were offered an honorarium for participation.

4.1.2. Stimuli

Stimuli were recorded in a silent room using professional recording equipment (16-bit 44.1 kHz Wav format) by a female native English speaker. Initial recording was split over two consecutive days, and the speaker returned on a third day to re-record a subset of stimuli that possessed some external disturbance, poor voice quality or intonation. All stimuli were recorded in a natural and neutral prosody that did not give cues to violations or the nature of the sentence. Individual sentences were extracted from the larger recording chunks manually. The intensity of all audio files was averaged to a mean value to normalise the intensity of each individual file. The duration and pitch of recordings was not altered to retain the naturalness of stimuli.

4.1.2.1. Acoustic analyses. Speech-analysis program Praat (Boersma, 2006) was used to measure the duration, intensity, and fundamental frequency (F_0)/pitch of each word.

4.1.2.1.1. Duration. Duration analyses were performed for the Subject NP, auxiliary, and verb of critical sentences. Mean and standard deviation values are presented in Table 4. ANOVAs were computed to determine significant differences across conditions. At the Subject NP, a significant difference (p = .002) in duration between ASV and ESV was observed where Subject NPs were longer in violation ESV sentences than in violation and control ASV sentences. For the auxiliary (always the word “will”), a significant Verb Type x Violation interaction was observed (p = .017). There was a significant difference between ASV and ESV (p = .02) but not between control and violation sentences either between or within conditions (p <.05)[3]. No significant differences were observed in duration between ASV and ESV verbs (all p’s < .1).

Table 4 here

4.1.2.1.2. Intensity (dB). ANOVAs were computed for the critical conditions to observe the effect of condition and violation on the intensities of the Subject NP, auxiliary, and verb. Table 5 shows the mean and standard deviation intensities. No significant difference in intensity was found between conditions for the Subject NP or auxiliary. For the verb, a significant effect of condition (p = .017) indicated that ESV had a higher mean sound intensity than ASV, although mean values differ by only 0.5 dB.

Table 5 here

4.1.2.1.3. Fundamental frequency/pitch (Hz). As the fundamental frequency (F_0) differences between words gives rise to the perception of intonation or prosody, the minimum, maximum, and mean F_0 values were measured. These values were analysed using ANOVAs for the Subject NP, auxiliary, and verb. No significant differences in pitch mean were found (all *p's* <.1). For pitch minimum, a significant difference was found at the Subject NP, where control nouns had a higher mean pitch minimum than violation (p = .018). For pitch maximum, a significant difference across conditions was found at the auxiliary (p = .03) where ASV had a higher mean pitch maximum than ESV. See Table 6 for mean and standard deviations of F_0.

Table 6 here

4.2. Procedure

The procedure was matched to Experiment 1, with the only change being the presentation of sentence stimuli via loudspeakers (mono front speaker format). Each trial comprised a 200ms blink prompt, followed by a fixation cross presented for 500ms pre-stimulus onset. While the audio was presented, the fixation cross remained onscreen. Judgement and comprehension questions were presented visually as in Experiment 1.

4.3. Data analysis

Data analysis was identical to that of the LMM analysis for Experiment 1.

4.4. Results

4.4.1. Behavioural data

For the Judgement condition, significant main effects of Animacy ($\chi_2(1) = 6.68$, p =.009) and Verb Type ($\chi_2(1) = 5617.05$, p <.001) were observed, with accuracy significantly higher for ASV than

ESV, and higher for grammatical than ungrammatical. For the Comprehension condition, a significant effect of Animacy x Verb Types x Question Type was observed ($\chi^2(1) = 4.52$, $p = .003$). When probed for the Actor, participants were more accurate in for grammatical sentences compared to ungrammatical sentences. When probed for the Undergoer participants were most accurate for grammatical compared to ungrammatical sentences. Accuracy percentages are reported in Table 7.

Table 7 here

4.4.2. ERP data

4.4.2.1. Subject NP. In the N400 time-window, an interaction effect of Animacy x Task ($\chi^2(1) = 31.30$, $p < .001$) showed that inanimate Subject NPs elicited a negative effect compared to animate, larger for the Judgement compared to the Comprehension condition. An Animacy x Sagitality interaction ($\chi^2(2) = 114.82$, $p < .001$) indicated that this negativity was maximal at posterior and central regions. In the P600 time-window, there was an interaction of Animacy X Task x Laterality ($\chi^2(2) = 6.13$, $p = .047$). In the later window (9900-1100ms) the same interaction was observed ($\chi^2(2) = 9.95$, $p = .007$). Interactions in the 700-900 and 900-1100ms windows did not resolve to simple effects upon visual inspection of the ERP (see figure 5) or model plots (see Figure 6).

Figures 5 and 6 here

4.4.2.2. Verb. In the 300-500ms time-window, an interaction effect of Animacy x Verb Type ($\chi^2(1) = 7.62$, $p = .006$) was observed. There were also interactions of Animacy x Task x Laterality ($\chi^2(2) = 19.50$, $p < .001$), and Verb Type x Task x Laterality ($\chi^2(2) = 9.58$, $p = .008$). ERP and model plots show no N400 effect for the Comprehension condition. For the Judgement condition, violations for ASV and ESV elicited an N400 effect, most prominent in the right hemisphere. Visual inspection of the ERPs suggests this effect was larger for ESV verb than ASV verbs (see Figure 7 for ERP plots and Figure 8 for model plots).

In the 700-900ms time-window, there was an interaction effect of Animacy x Verb Type x Task x Laterality ($\chi^2(2) = 9.71$, $p = .008$). Violations at the verb elicited a positivity for ASV, maximal in the right hemisphere and larger for the Judgement compared to the Comprehension condition. Visual inspection of the ERPs (Figure 7) show an ongoing negativity towards violation ESV sentences in the Comprehension group.

Prior to verb onset, visual inspection of the ERP data shows a difference in prestimulus amplitude between correct and violation sentences. To investigate this, we plotted the ERP data time-locked to onset of the Subject NP and continuing past the onset of the verb. This showed that the prestimulus negativity prior to verb onset was the continuous negativity elicited by inanimate Subject NPs. See Appendix C for these ERP plots, and Appendix B for model summaries.

Figures 7 and 8 here

5. Experiment 2: Auditory modality summary

We replicated the behavioural results of Experiment 1's LMM analysis. The ERP results at the Subject NP also showed the same pattern as Experiment 1 where inanimate Subject NPs elicited an N400 effect, larger for the Judgement condition. At the verb, no effects were was found in the N400 time-window for the Comprehension condition. For the Judgement condition, we found an N400 effect to ASV and ESV violations, with visual inspection of the ERP plots showing it appeared larger for ESV. Violations at the verb also elicited a P600 effect for violation ASV sentences in both task groups. No significant effects were found in the verb P600 window for ESV.

6. Discussion

This paper aimed to reproduce the novel findings of Bourguignon et al. (2012), where verb class modulated the ERP response to English SRAs. Here, we investigated the effect of task demand and stimulus modality on the ERPs elicited by SRAs. We found that SRAs in English elicited both N400 and P600 effects at the critical verb position, and the N400 effect was elicited in both verb types. While the reproduction ANOVA analysis showed a P600 effect to ESV violations, the linear mixed model (LMM) analysis did not. Both task and modality modulated the ERPs elicited in a quantitative and qualitative manner.

6.1. Behavioural Results: Auditory input increases comprehension accuracy

Response accuracy was higher for the auditory over visual modality, Judgement over Comprehension task, ASV over ESV verb type, and grammatical over ungrammatical sentences. In the Judgement condition, a higher accuracy for ASV is likely due to violation saliency being stronger than in ESV, as suggested by Bourguignon et al. (2012). Comprehension task accuracy was much higher for the auditory compared to visual modality, with mean accuracy scores between 3.74% and

20.45% higher for auditory, following the modality-specific pattern of semantic anomalies reported by (Bohan, 2007).

6.2. ERP results

6.2.1. The subject animacy N400. As hypothesised, we observed an N400 effect for inanimate compared to animate Subject NPs in Experiments 1 and 2. For Experiment 1 (visual), the reproduction analysis found the effect most prominent near the midline, while the LMM analysis found the effect right-lateralised. For Experiment 2 (auditory), the N400 was largest at posterior and central regions. The N400 effect likely reflects the increased processing cost incurred by an inanimate noun occurring in the position most commonly filled by the sentential subject in English (Bornkessel-Schlesewsky et al., 2011).

6.2.2. The "verb type-independent N400". For ASV and ESV, we observed an N400 effect at the verb for violation conditions, modulated by task and modality (see Table 8 for an overview of ERP effects across experiments). We had predicted an N400 for ESV violations, and replicated the results reported by Bourguignon et al. (2012). Visual ESV violations elicited an N400 for the Judgement condition (in the reproduction analysis, but not the LMM analysis) as well as in the Comprehension condition. Auditory ESV violations elicited an N400 in the Comprehension condition only.

We also observed an N400 effect to visual and auditory ASV violations in the Judgement condition, although inspection of the ERP plots suggests a smaller amplitude than the N400 to ESV violations. The presence of an N400 effect to an ASV violation was unexpected, as current theories are built upon findings of a monophasic P600 to similar English and Dutch SRAs (Hoeks et al., 2004; Kim & Osterhout, 2005; Kolk et al., 2003; Kuperberg et al., 2003; van Herten et al., 2006; Van Herten et al., 2005). While our findings of a "verb type-independent N400" to SRAs support Bornkessel-Schlesewsky et al.'s (2011) claim that monophasic P600 effects are not the only index of SRA processing, the presence of an N400 effect to typical SRA constructions in English falsifies all current theoretical approaches, including our own (Bornkessel-Schlesewsky et al., 2011). Bornkessel-Schlesewsky et al. (2011) discuss a cross-linguistic perspective where cues to sentence interpretation vary in their dominance depending on the language in question (Bornkessel-Schlesewsky &

Schlesewsky, 2019). Our ASV N400 finding invalidates the hypothesis that the sequence-dependency of English, a language that relies primarily on word order for argument role assignments, necessarily leads to the absence of an N400 to SRAs.

One possibility is that some dialectal aspect of Australian English contributed to the differential ERP effects observed. To our knowledge, this is the first SRA investigation in Australian English, with all other English studies examining speakers of North American English (Bourguignon et al., 2012; Kim & Osterhout, 2005). Two observations support the idea that Australian English behaves differently to North American English: behavioural response differences, and recent findings of dialect-based ERP differences in German (Dröge et al., 2019). Compared to Bourguignon et al. (2012), our participants were 5.53% more likely to reject grammatical constructions, and 4.31% more likely to accept ungrammatical structures than North American participants. This suggests some meaningful difference in the way that Australian English speakers perceive the acceptability of SRA constructions. Dröge et al. (2019) found qualitative differences in the ERPs elicited by ambiguous object-first sentences across Standard German, Zurich German, and Fering (a North Frisian dialect). They found that the presence or absence of ERP effects was influenced by the most prominent cue to sentence interpretation in each dialect – either case marking or animacy (Dröge et al., 2019). With this recent finding of within-language differences depending on dialect, it is possible that dialectal differences in Australian English play a role in our results. However, we acknowledge that this is a post-hoc interpretation of our results that will require further investigation in future research.

Table 8 here

6.2.3. The "verb type-dependent P600". A significant P600 effect was elicited by violation sentences for the ASV condition only. For the Judgement condition, a P600 was observed in the visual (reproduction analysis only) and auditory modalities. For the Comprehension condition, a P600 was observed in both modalities. These results fit with previous findings of a P600 to SRAs (although previous research reports only a monophasic P600; (Hoeks et al., 2004; Kim & Osterhout, 2005; Kolk et al., 2003; Kuperberg et al., 2003; van Herten et al., 2006; Van Herten et al., 2005).

The complete absence of a P600 to ESV violations was unexpected. While Bourguignon et al. (2012) found a P600 elicited by this verb type, their use of an Experiencer verb was novel. It is

possible that ESV violations were less salient than violations in the filler sentences, leading to a diminished ERP response, as suggested by Bourguignon et al. (2012) and Steinhauer & Drury (2012).

6.2.4. The quantitative and qualitative influence of task. We hypothesised (H2) a P600 at the Verb (with an Animacy effect). We predicted that the P600 effect would be larger for the Judgement task, due to the task-salience of the violation verb for grammaticality judgements (Schacht et al., 2014). Violations or perceived errors are still salient aspects for comprehension, so we expected a P600 for the Comprehension condition also, albeit with a smaller amplitude. While we predicted quantitative task-related differences, the observed qualitative differences were unexpected. In Experiment 1, there was a P600 effect in the Comprehension condition but no significant P600 for the Judgement condition, thus not supporting our hypothesis. However, we did see a significant P600 for the Judgement condition in the replication analysis. In Experiment 2, we observed a P600 effect to auditory ASV violations in both task conditions, larger for the Judgement compared to Comprehension group, supporting our hypothesis.

Further, we found no evidence of a P600 to ESV violations for any modality or task, where we had predicted a P600 as reported in Bourguignon et al. (2012). In the 700-900ms time-window we observed a right-anterior negativity for ESV violations in the auditory Comprehension group. This is in line with the findings of Schacht et al. (2014) who found that by replacing a judgement task with a probe task, the P600 effect was replaced with a significant frontal negativity elicited by syntactic violations. They interpreted this negativity as representing semantic reinterpretation, which could fit with our results, although it does not explain the absence of a P600 in the auditory Judgement condition (Schacht et al., 2014).

6.2.5. Modality influences comprehension and EEG topography. We hypothesised a difference in N400 topography based on modality, where stimuli presented auditorily would produce more broadly distributed ERP patterns. We had no hypotheses regarding behavioural responses, but Judgement and Comprehension accuracy were higher in the auditory experiment. This behavioural difference may be due to a facilitation of comprehension from the additional information in a natural speech stream. Speakers use disambiguating prosody in natural speech, and this information contributes to sentence comprehension (Marslen-Wilson, Tyler, Warren, Grenier, & Lee, 1992; Price,

Ostendorf, Shattuck-Hufnagel, & Fong, 1998; Schafer, Speer, Warren, & White, 2000; Steinhauer, Alter, & Friederici, 1999). Prosody can also affect interpretation prior to the onset of an ambiguous phrase, aiding prediction of upcoming information (Snedeker & Trueswell, 2003). This auditory advantage was most pronounced for comprehension questions regarding ungrammatical (violation) sentences, suggesting prosodic information may have helped comprehension of semantically implausible constructions.

At the Subject NP, we observed a topographical difference in the animacy-based N400 effect, where the visual ERP was right-lateralised, spanning the middle and right columns. In the auditory modality, the N400 was spread across all columns in central and posterior sagitality. The results at the Subject NP support our hypothesis that the ERP patterns would be more distributed in the auditory condition, and match with previous topography findings (Holcomb & Neville, 1990).

At the verb it is difficult to compare N400 topography across modalities, as task and verb type influenced topography. Overall, for the auditory modality, the N400 was spread across more topographical regions than in the visual modality. At the Subject NP, where differences are clearest, the N400 had a broader distribution across saggitality when stimuli were presented auditorily. At the Verb, the N400 to auditory ASV and ESV violations appears to be more broadly spread, encompassing a larger number of topographical regions.

6.2.6. Statistical analysis decisions qualitatively affect results. There are two instances in our results where the analysis method used affects the presence/absence of a statistically significant ERP effect. Whereas the reproduction analysis using ANOVAs shows a significant N400 effect to ESV violations, and a significant P600 effect to ASV violations, the visual LMM does not show these effects.

There are several potential explanations for these differences. Firstly, some have argued that high-pass filters over 0.1 Hz distort the data (Tanner, Norton, Morgan-Short, & Luck, 2016). The 0.4 Hz filter used in the reproduction may be more likely to introduce spurious components into the ERP waveform, compared to the relatively conservative 0.1 Hz filter used in the LMM analysis (Tanner et al., 2016). The influence of filter settings on these ERPs is unlikely however, as the LMM results of Experiment 2 displayed the two “missing” ERPS using a 0.1 Hz filter (presence of an N400 to ESV

violations and P600 to ASV violations for judgement task). Secondly, the reproduction analysis was response-contingent, including only trials followed by a correct response. Though we did not expect this to have a significant effect on the presence/absence of the visual ESV N400 and ASV P600 in the Judgement condition, we conducted a response-contingent LMM for Experiment 1. The resultant LMMs for the time-windows of interest (Verb N400 and P600) showed no meaningful change from the original results.

6.2.7. Item-based variability may drive differences in results. The modelling of item-based variability is a major difference between ANOVA and LMM analyses. ANOVA analyses aggregate by participant and remove any variance caused by item variability. This is less than ideal, as each item in linguistic material (e.g. a word or sentence) is unique, even if the stimuli have been matched on parameters such as length or frequency (Janssen, 2012). On the other hand, LMM analyses do not aggregate, instead analysing trial-by-trial data while taking participant and item variability into account. The sensitivity of LMMs to item variability may explain the absence of these two ERP effects for the Judgement task. Regarding the ESV N400, the nature of ESV sentences, which lack the "concreteness" of ASV sentences, mean that the ERP response is likely to significantly vary across items. Item-specific effects such as the concreteness of word meaning or number and frequency of lexical associates have been shown to influence the amplitude of the N400 (Laszlo & Federmeier, 2011; Van Petten, 2014). Concrete, imageable words elicit a greater N400 amplitude than abstract words (Barber, Otten, Kousta, & Vigliocco, 2013; Gullick, Mitra, & Coch, 2013), thus the N400 amplitude in our study may have fluctuated depending on verb imageability (e.g. ESV "enjoy" may be more imageable than "regret"). Regarding the ASV P600, it is also likely that item-based variance is driving the lack of a significant P600 effect. Visual inspection of the ERP plots shows a positivity in the 700-900ms time-window, suggesting that the significant findings in the reproduction ANOVA are meaningful. Our data show larger item-based variance than subject-based variance on the intercept of the LMM (see Appendix D for an example). It is possible that the replication analysis is reflecting an N400 effect to ESV violations, and P600 effect to ASV violations which do not occur consistently across items, and this inter-item variance is being considered by the LMM analysis.

In line with the current view that linguistic P600 effects may be at least partly driven by task-salience (Sassenhagen et al., 2014), we recommend that linguistic experiments integrate alternate tasks, such as probe or comprehension questions. We also suggest a continued investigation into the potential behavioural and ERP differences that arise across stimulus modalities. As it appears that naturalistic auditory sentences increase the level of comprehension, future research could investigate whether this behavioural advantage continues outside of semantic anomalies. Finally, as shown by our direct comparison of ANOVAs and LMMs, the statistical analyses selected, and their potential influence on ERP results, should be considered when developing future research.

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Footnotes

[1] Wassenaar & Hagoort (2007) employed a picture-matching task, with a picture presented prior to auditory sentence presentation in a control and clinical population. They observed an N400 – late positivity in control subjects to violations of semantically irreversible active and semantically reversible passive sentences. As the image was presented prior to the sentence, it is possible that the positivity observed was a task-related response when mapping the conceptualisation of the image onto the presented sentence.

[2] For List 1: 19 Subject probes, 6 Object probes, 35 Yes/No probes; for List 2: 16 Subject probes, 6 Object probes, 38 Yes/No probes.

[3] However, given that ASV and ESV are not directly compared at the Subject NP or auxiliary (instead, animate and inanimate Subject NPs are compared collapsed across conditions) the reported differences in duration are acceptable.

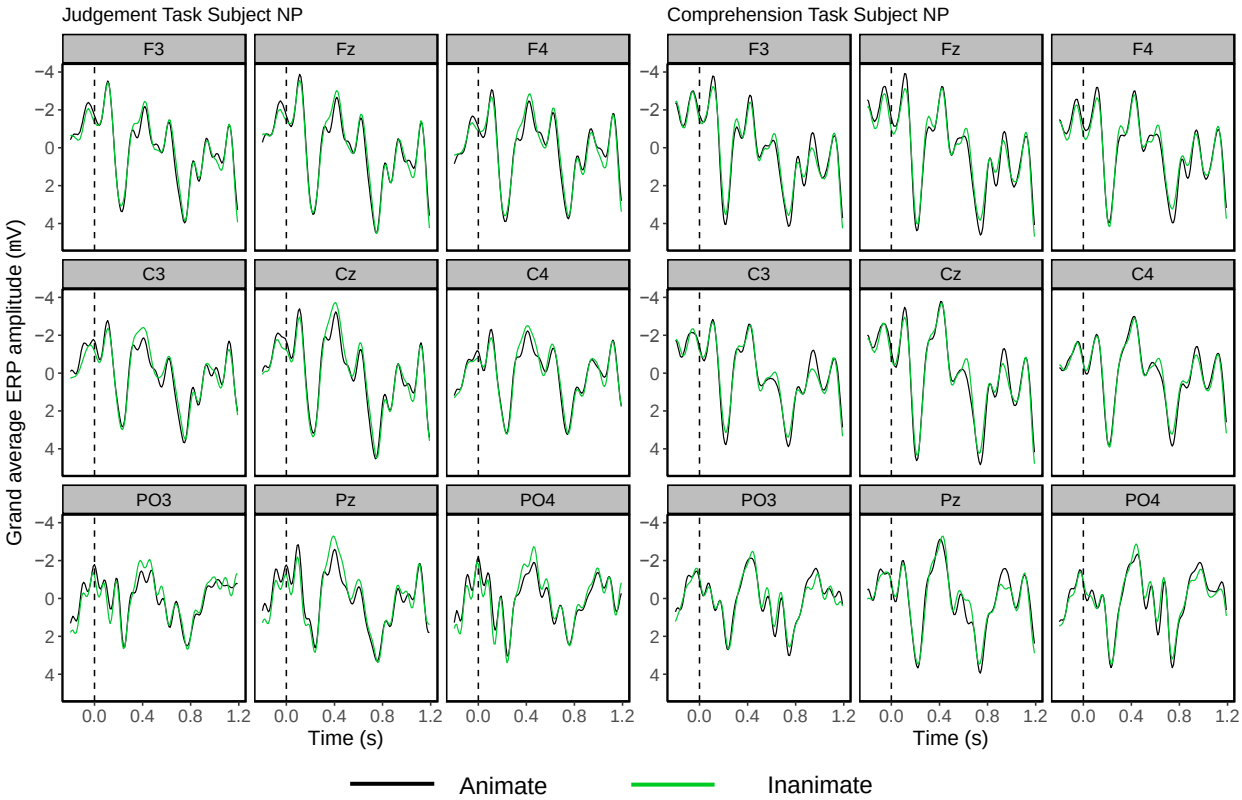

Figure 1. Grand average waveform of the visual ERPs elicited at the Subject NP of Agent- and Experiencer-Subject Verb sentences (conditions collapsed) for the Judgement and Comprehension task conditions. Black lines represent animate Subject NPs while green lines represent inanimate Subject NPs. Negativity is plotted upwards and waveforms are time-locked to the onset of the noun with a -200ms to 0ms prestimulus interval. Inanimate Subject NPs elicited an N400 effect relative to animate Subject NPs, and this effect was larger for the Judgement condition compared to comprehension condition. No significant effects in the 700-900 or 900-1100ms time windows were observed.

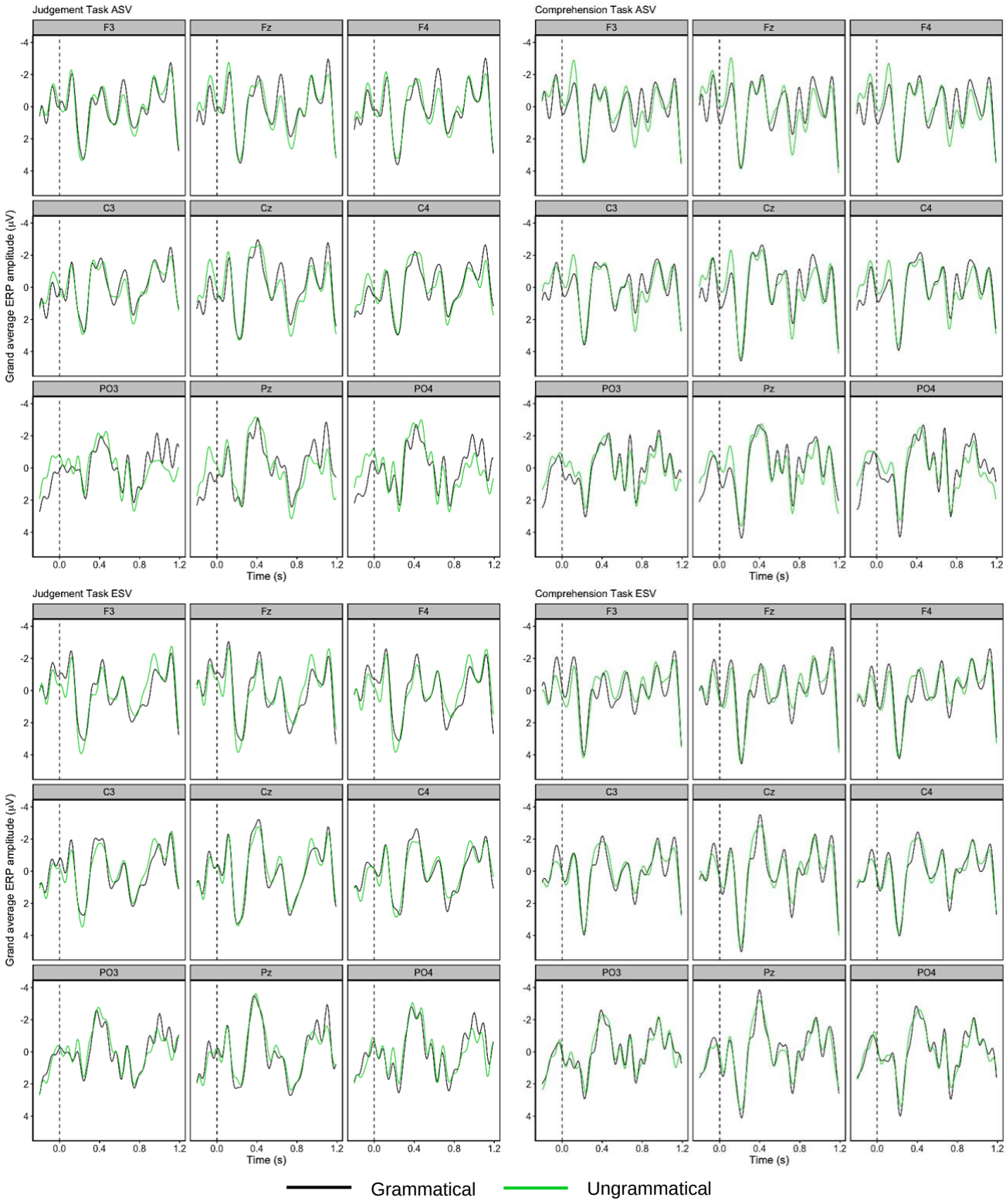

Figure 2. Grand average waveform of the visual ERPs elicited at the verb of Agent Subject Verb (ASV) and Experiencer Subject Verb (ESV) sentences for the Judgement and Comprehension task conditions. Black lines represent correct/grammatical sentences while green lines represent incorrect/ungrammatical sentences. Negativity is plotted upwards and waveforms are time-locked to the onset of the verb with a -200ms to 0ms prestimulus interval. In the N400 time-window, ASV violations elicited a significant effect for the Judgement condition only, while ESV violations elicited a significant effect for the Comprehension condition only. In the P600 time-window, ASV violations elicited a significant effect for the Comprehension group only, with visual inspection of the plots showing a non-significant positivity for the Judgement group also. No effects were observed in the P600 time-window for ESV violations.

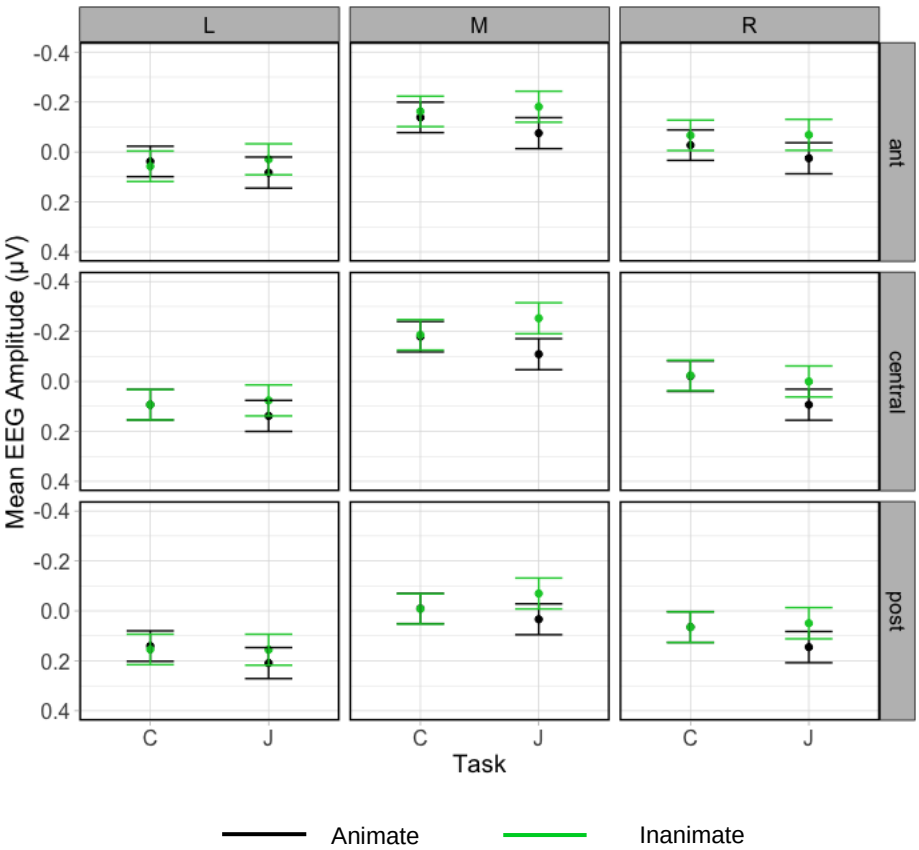

Figure 3. Interaction of Subject NP animacy, task type and region of interest on mean EEG amplitude for the Subject NP N400 time window in the visual experiment. Bars indicate 95% confidence intervals. Effects are shown for nine topographical regions of interest. L = left, M = midline, R = right, ant = anterior, post = posterior.

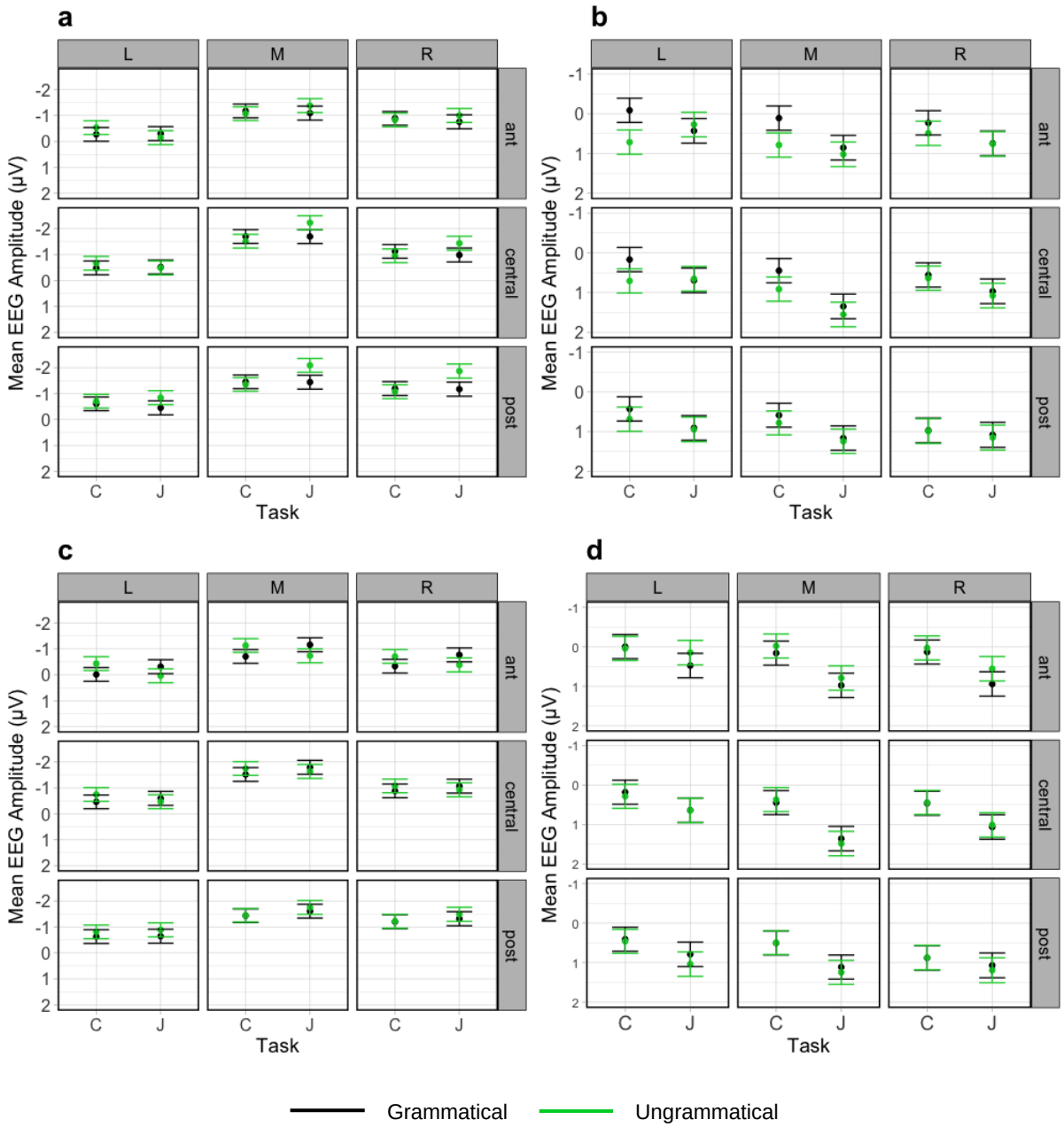

Figure 4. Interaction of sentence grammaticality, task type and region of interest on mean EEG amplitude for the Subject NP N400 time window in the visual experiment. Bars indicate 95% confidence intervals. Effects are shown for nine topographical regions of interest. L = left, M = midline, R = right, ant = anterior, post = posterior. **A.** Agent Subject Verb (ASV) condition N400 time-window. **B.** ASV condition P600 time-window. **C.** Experiencer Subject Verb (ESV) condition N400 time-window. **D.** ESV condition P600 time-window.

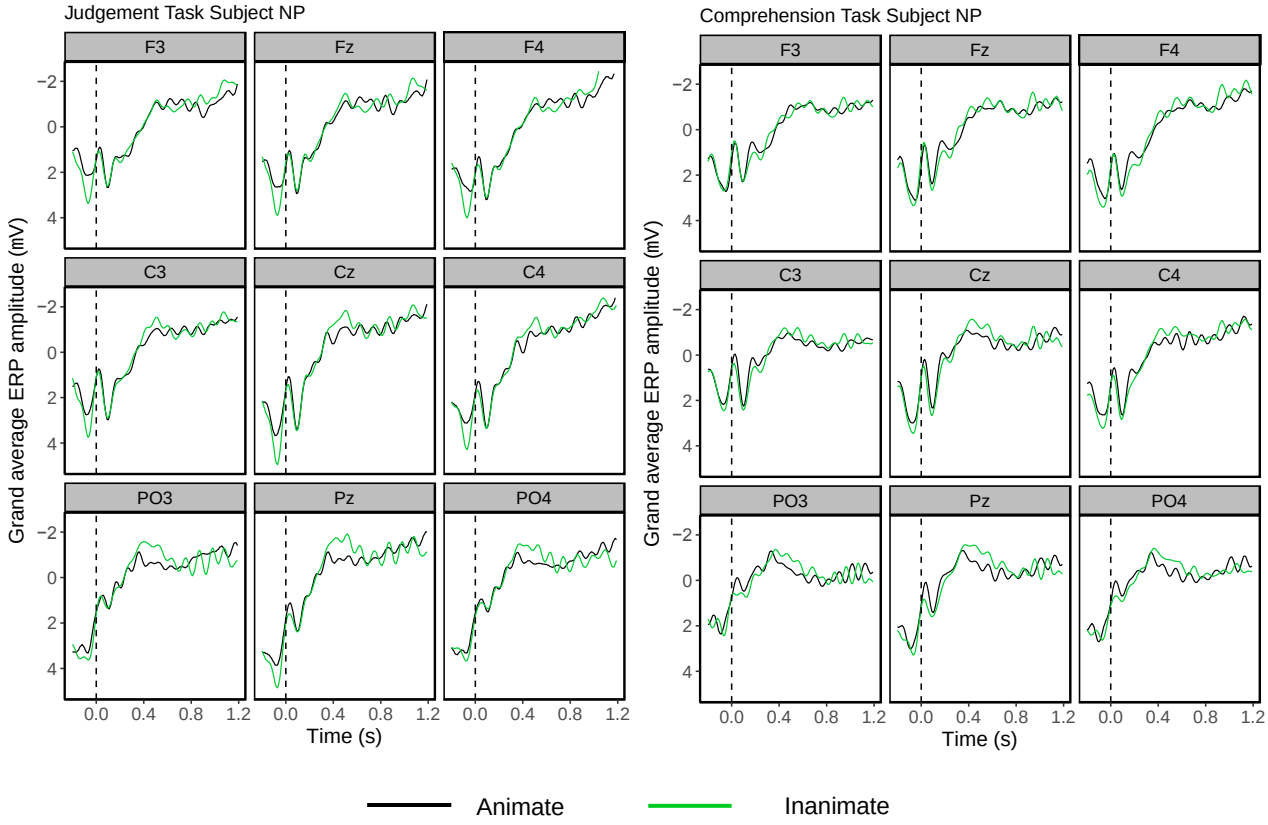

Figure 5. Grand average waveform of the auditory ERPs elicited at the Subject NP of Agent Subject Verb and Experiencer Subject Verb sentences (conditions collapsed) Judgement and Comprehension task conditions. Black lines represent animate Subject NPs while green lines represent inanimate Subject NPs. Negativity is plotted upwards and waveforms are time-locked to the onset of the noun with a -200ms to 0ms prestimulus interval. Inanimate Subject NPs elicited an N400 effect relative to animate Subject NPs, and this effect was larger for the Judgement condition compared to Comprehension condition. No significant effects in the 700-900 or 900-1100ms time windows were observed.

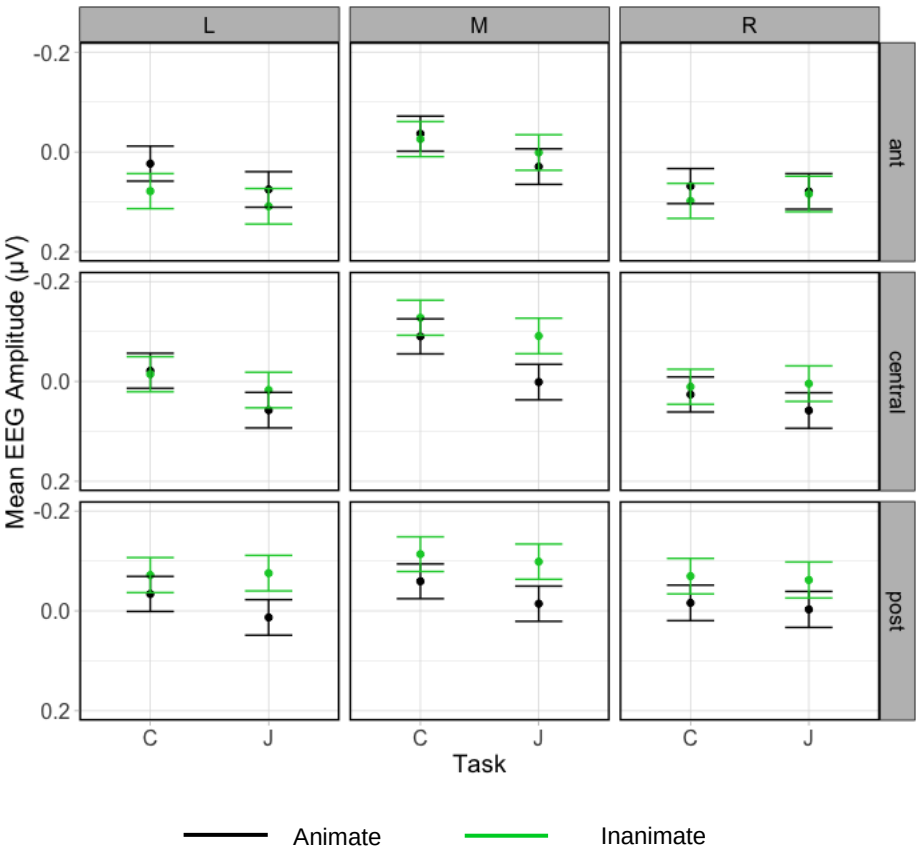

Figure 6. Interaction of Subject NP animacy, task type and region of on mean EEG amplitude for the Subject NP N400 time window in the auditory experiment. Bars indicate 95% confidence intervals. Effects are shown for nine topographical regions of interest. L = left, M = midline, R = right, ant = anterior, post = posterior.

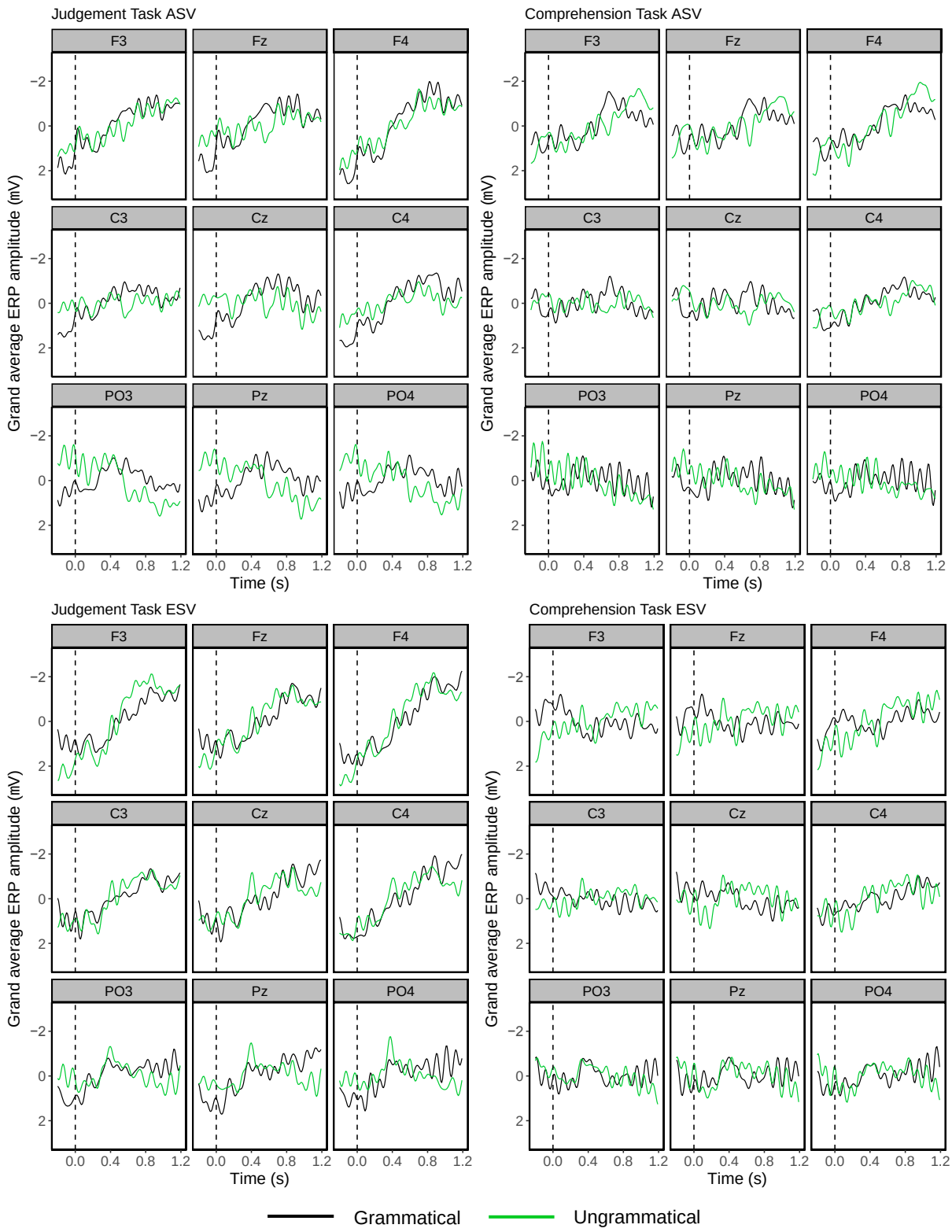

Figure 7. Grand average waveform of the auditory ERPs elicited at the Verb of Agent Subject Verb (ASV) and Experiencer Subject Verb (ESV) sentences for the Judgement and Comprehension task conditions. Black lines represent correct/grammatical sentences while green lines represent incorrect/ungrammatical sentences. Negativity is plotted upwards and waveforms are time-locked to the onset of the verb with a -200ms to 0ms prestimulus interval. In the N400 time-window, ASV and ESV violations elicited a significant effect for the Judgement condition only. In the P600 time-window, ASV violations elicited a significant effect for the Judgement and Comprehension groups. No significant effects were observed in the P600 time-window for ESV violations, although visual inspection of the plots shows an ongoing negativity toward ESV violations in the Comprehension group.

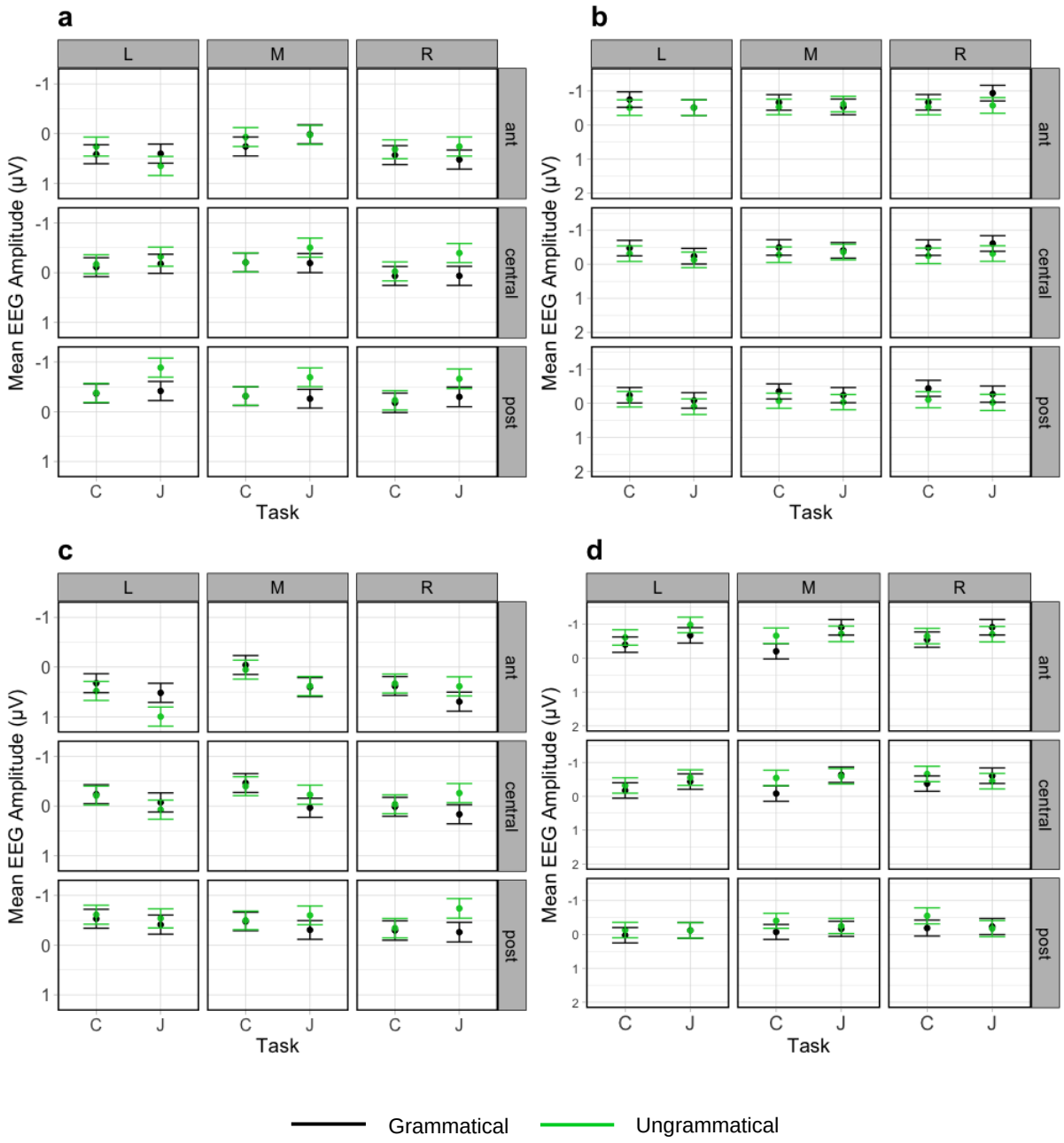

Figure 8. Interaction of sentence grammaticality, task type and region of on mean EEG amplitude for the Subject NP N400 time window in the auditory experiment. Bars indicate 95% confidence intervals. Effects are shown for nine topographical regions of interest. L = left, M = midline, R = right, ant = anterior, post = posterior. **A.** Agent Subject Verb (ASV) condition N400 time-window. **B.** ASV condition P600 time-window. **C.** Experiencer Subject Verb (ESV) condition N400 time-window. **D.** ESV condition P600 time-window.

Table 1: Summary of Linear Mixed Model for the Visual Subject NP N400 time-window (300-500ms).

Linear mixed model fit by REML

REML criterion at convergence: 682660

Scaled residuals:

Min	1Q	Median	3Q	Max
-11.85	-0.58	0.02	0.6	14.4

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.088347
subj	(Intercept)	0.198117
Residual		0.960993

Number of obs: 247212, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.0045	0.032	0.14
animacy[Animate]	0.023	0.0019	12
task[C]	−0.011	0.03	−0.37
lat.[L]	0.1	0.0027	37
lat.[R]	0.015	0.0028	5.4
sag.[ant]	−0.045	0.0028	−16
sag.[post]	0.073	0.0028	26
scale(prestim)	−0.16	0.002	−78
animacy[Animate]:task[C]	−0.021	0.0019	−11
animacy[Animate]:lat.[L]	−0.012	0.0027	−4.4
animacy[Animate]:lat.[R]	0.0036	0.0028	1.3
task[C]:lat.[L]	0.0016	0.0027	0.57
task[C]:lat.[R]	−0.01	0.0028	−3.6
animacy[Animate]:sag.[ant]	0.0013	0.0027	0.49
animacy[Animate]:sag.[post]	−0.0037	0.0028	−1.3
task[C]:sag.[ant]	0.0017	0.0027	0.62
task[C]:sag.[post]	0.0014	0.0028	0.52
lat.[L]:sag.[ant]	−0.0087	0.0039	−2.2
lat.[R]:sag.[ant]	−0.0087	0.0039	−2.2
lat.[L]:sag.[post]	−0.014	0.0039	−3.5
lat.[R]:sag.[post]	−0.012	0.004	−2.9
animacy[Animate]:task[C]:lat.[L]	0.0045	0.0027	1.6
animacy[Animate]:task[C]:lat.[R]	0.0012	0.0028	0.43
animacy[Animate]:task[C]:sag.[ant]	0.0039	0.0027	1.4
animacy[Animate]:task[C]:sag.[post]	−0.0011	0.0028	−0.39
animacy[Animate]:lat.[L]:sag.[ant]	−0.0041	0.0039	−1.1
animacy[Animate]:lat.[R]:sag.[ant]	0.005	0.0039	1.3
animacy[Animate]:lat.[L]:sag.[post]	0.0024	0.0039	0.61
animacy[Animate]:lat.[R]:sag.[post]	0.00041	0.004	0.1
task[C]:lat.[L]:sag.[ant]	0.0036	0.0039	0.92
task[C]:lat.[R]:sag.[ant]	0.0068	0.0039	1.7
task[C]:lat.[L]:sag.[post]	−0.0093	0.0039	−2.4
task[C]:lat.[R]:sag.[post]	0.0036	0.004	0.89
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	−0.0052	0.0039	−1.3
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	0.0026	0.0039	0.67
animacy[Animate]:task[C]:lat.[L]:sag.[post]	0.0011	0.0039	0.29
animacy[Animate]:task[C]:lat.[R]:sag.[post]	−0.003	0.004	−0.74

Table 2: Summary of effects in Visual Subject NP N400 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	149.4332763	1	0.0000000
task	0.1268921	1	0.7216764
lat.	2176.1595845	2	0.0000000
sag.	741.6849905	2	0.0000000
scale(prestim)	6037.4513278	1	0.0000000
animacy:task	120.9877247	1	0.0000000
animacy:lat.	20.8612250	2	0.0000295
task:lat.	16.5965105	2	0.0002490
animacy:sag.	1.9763367	2	0.3722579
task:sag.	1.3301025	2	0.5142472
lat.:sag.	125.4410661	4	0.0000000
animacy:task:lat.	4.8417369	2	0.0888444
animacy:task:sag.	2.0762795	2	0.3541128
animacy:lat.:sag.	3.0216683	4	0.5542058
task:lat.:sag.	13.7468891	4	0.0081483
animacy:task:lat.:sag.	2.6615909	4	0.6159522

Table 3: Summary of Linear Mixed Model for the Visual Subject NP P600 time-window (700-900ms).

Linear mixed model fit by REML

REML criterion at convergence: 627630

Scaled residuals:

Min	1Q	Median	3Q	Max
-11.39	-0.59	-0.01	0.59	8.72

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.069133
subj	(Intercept)	0.162525
Residual		0.859796

Number of obs: 247212, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.0032	0.026	−0.12
animacy[Animate]	−0.00077	0.0017	−0.44
task[C]	−0.034	0.024	−1.4
lat.[L]	−0.042	0.0025	−17
lat.[R]	−0.01	0.0025	−4.2
sag.[ant]	0.025	0.0025	10
sag.[post]	−0.041	0.0025	−17
scale(prestim)	−0.48	0.0018	−2.7e+02
animacy[Animate]:task[C]	0.012	0.0017	6.7
animacy[Animate]:lat.[L]	0.0022	0.0024	0.89
animacy[Animate]:lat.[R]	−0.00041	0.0025	−0.16
task[C]:lat.[L]	0.0057	0.0024	2.3
task[C]:lat.[R]	0.02	0.0025	8.1
animacy[Animate]:sag.[ant]	−0.0035	0.0024	−1.4
animacy[Animate]:sag.[post]	0.0044	0.0025	1.8
task[C]:sag.[ant]	−0.0053	0.0024	−2.2
task[C]:sag.[post]	0.012	0.0025	5
lat.[L]:sag.[ant]	0.003	0.0035	0.86
lat.[R]:sag.[ant]	−0.012	0.0035	−3.4
lat.[L]:sag.[post]	0.013	0.0035	3.8
lat.[R]:sag.[post]	0.032	0.0036	9
animacy[Animate]:task[C]:lat.[L]	−0.0068	0.0024	−2.8
animacy[Animate]:task[C]:lat.[R]	0.0057	0.0025	2.3
animacy[Animate]:task[C]:sag.[ant]	0.0045	0.0024	1.8
animacy[Animate]:task[C]:sag.[post]	−0.0062	0.0025	−2.5
animacy[Animate]:lat.[L]:sag.[ant]	−0.003	0.0035	−0.87
animacy[Animate]:lat.[R]:sag.[ant]	0.0025	0.0035	0.72
animacy[Animate]:lat.[L]:sag.[post]	0.0022	0.0035	0.64
animacy[Animate]:lat.[R]:sag.[post]	−0.0013	0.0036	−0.36
task[C]:lat.[L]:sag.[ant]	0.011	0.0035	3.2
task[C]:lat.[R]:sag.[ant]	−0.012	0.0035	−3.5
task[C]:lat.[L]:sag.[post]	−0.018	0.0035	−5.1
task[C]:lat.[R]:sag.[post]	0.011	0.0036	3.1
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	−0.002	0.0035	−0.57
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	0.0014	0.0035	0.41
animacy[Animate]:task[C]:lat.[L]:sag.[post]	0.0017	0.0035	0.49
animacy[Animate]:task[C]:lat.[R]:sag.[post]	−0.00065	0.0036	−0.18

Table 4: Summary of effects in Visual Subject NP P600 time window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	2.786004e-01	1	0.5976200
task	2.116144e+00	1	0.1457531
lat.	5.195130e+02	2	0.0000000
sag.	3.260107e+02	2	0.0000000
scale(prestim)	7.218434e+04	1	0.0000000
animacy:task	4.489726e+01	1	0.0000000
animacy:lat.	9.597734e-01	2	0.6188535
task:lat.	1.194496e+02	2	0.0000000
animacy:sag.	3.786609e+00	2	0.1505734
task:sag.	2.415743e+01	2	0.0000057
lat.:sag.	2.092156e+02	4	0.0000000
animacy:task:lat.	8.676110e+00	2	0.0130619
animacy:task:sag.	6.868445e+00	2	0.0322505
animacy:lat.:sag.	9.305887e-01	4	0.9201319
task:lat.:sag.	3.117718e+01	4	0.0000028
animacy:task:lat.:sag.	4.337143e-01	4	0.9796247

Table 5: Summary of Linear Mixed Model for the Visual Subject NP later P600 time-window (900-1100ms).
Linear mixed model fit by REML

REML criterion at convergence: 632803

Scaled residuals:

Min	1Q	Median	3Q	Max
-10	-0.58	0	0.57	13.23

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.077873
subj	(Intercept)	0.114158
Residual		0.868874

Number of obs: 247212, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.0032	0.02	0.16
animacy[Animate]	−0.014	0.0018	−8
task[C]	−0.0023	0.017	−0.13
lat.[L]	−0.0024	0.0025	−0.97
lat.[R]	−0.0014	0.0025	−0.57
sag.[ant]	0.031	0.0025	12
sag.[post]	−0.033	0.0025	−13
scale(prestim)	−0.47	0.0018	−2.6e+02
animacy[Animate]:task[C]	−0.0022	0.0018	−1.3
animacy[Animate]:lat.[L]	0.0017	0.0025	0.68
animacy[Animate]:lat.[R]	0.00047	0.0025	0.19
task[C]:lat.[L]	−0.0029	0.0025	−1.2
task[C]:lat.[R]	0.0097	0.0025	3.8
animacy[Animate]:sag.[ant]	−0.0026	0.0025	−1
animacy[Animate]:sag.[post]	0.0046	0.0025	1.8
task[C]:sag.[ant]	0.0097	0.0025	3.9
task[C]:sag.[post]	−0.004	0.0025	−1.6
lat.[L]:sag.[ant]	−0.026	0.0035	−7.3
lat.[R]:sag.[ant]	0.021	0.0035	5.9
lat.[L]:sag.[post]	0.033	0.0035	9.4
lat.[R]:sag.[post]	−0.034	0.0036	−9.3
animacy[Animate]:task[C]:lat.[L]	−0.0013	0.0025	−0.54
animacy[Animate]:task[C]:lat.[R]	0.0033	0.0025	1.3
animacy[Animate]:task[C]:sag.[ant]	0.0017	0.0025	0.7
animacy[Animate]:task[C]:sag.[post]	−0.0019	0.0025	−0.76
animacy[Animate]:lat.[L]:sag.[ant]	−0.0026	0.0035	−0.74
animacy[Animate]:lat.[R]:sag.[ant]	−0.0029	0.0035	−0.81
animacy[Animate]:lat.[L]:sag.[post]	0.002	0.0035	0.56
animacy[Animate]:lat.[R]:sag.[post]	−0.00077	0.0036	−0.21
task[C]:lat.[L]:sag.[ant]	0.0071	0.0035	2
task[C]:lat.[R]:sag.[ant]	−0.0078	0.0035	−2.2
task[C]:lat.[L]:sag.[post]	−0.01	0.0035	−3
task[C]:lat.[R]:sag.[post]	0.0075	0.0036	2.1
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	0.0029	0.0035	0.82
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	0.00033	0.0035	0.094
animacy[Animate]:task[C]:lat.[L]:sag.[post]	−0.0018	0.0035	−0.51
animacy[Animate]:task[C]:lat.[R]:sag.[post]	−0.00078	0.0036	−0.21

Table 6: Summary of effects in Visual Subject NP late P600 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	6.393670e+01	1	0.0000000
task	2.419440e-02	1	0.8763912
lat.	2.192118e+00	2	0.3341856
sag.	2.041582e+02	2	0.0000000
scale(prestim)	6.898213e+04	1	0.0000000
animacy:task	1.698273e+00	1	0.1925139
animacy:lat.	8.917087e-01	2	0.6402770
task:lat.	1.453250e+01	2	0.0006987
animacy:sag.	3.408618e+00	2	0.1818981
task:sag.	1.583216e+01	2	0.0003648
lat.:sag.	1.235275e+02	4	0.0000000
animacy:task:lat.	1.746089e+00	2	0.4176780
animacy:task:sag.	6.512998e-01	2	0.7220579
animacy:lat.:sag.	2.996742e+00	4	0.5583707
task:lat.:sag.	1.084400e+01	4	0.0283744
animacy:task:lat.:sag.	1.160792e+00	4	0.8845107

Table 7: Summary of Linear Mixed Model for the Visual Verb N400 time-window (300-500ms).

Linear mixed model fit by REML

REML criterion at convergence: 1442980

Scaled residuals:

Min	1Q	Median	3Q	Max
-7.99	-0.59	0.02	0.6	9.42

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.44030
subj	(Intercept)	0.81663
Residual		4.14556

Number of obs: 253800, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.99	0.13	−7.4
animacy[Grammatical]	0.055	0.0083	6.7
verbtype[ASV]	−0.048	0.0083	−5.8
task[C]	0.046	0.12	0.37
lat.[L]	0.49	0.012	42
lat.[R]	−0.034	0.012	−2.9
sag.[ant]	0.32	0.012	28
sag.[post]	−0.2	0.012	−17
scale(prestim)	−0.53	0.0084	−63
animacy[Grammatical]:verbtype[ASV]	0.024	0.0083	3
animacy[Grammatical]:task[C]	−0.0014	0.0083	−0.16
verbtype[ASV]:task[C]	0.018	0.0083	2.2
animacy[Grammatical]:lat.[L]	0.003	0.012	0.26
animacy[Grammatical]:lat.[R]	−0.0025	0.012	−0.21
verbtype[ASV]:lat.[L]	0.046	0.012	4
verbtype[ASV]:lat.[R]	−0.031	0.012	−2.6
task[C]:lat.[L]	−0.077	0.012	−6.6
task[C]:lat.[R]	0.024	0.012	2
animacy[Grammatical]:sag.[ant]	−0.033	0.012	−2.9
animacy[Grammatical]:sag.[post]	0.044	0.012	3.8
verbtype[ASV]:sag.[ant]	−0.069	0.012	−5.9
verbtype[ASV]:sag.[post]	0.057	0.012	4.8
task[C]:sag.[ant]	−0.05	0.012	−4.3
task[C]:sag.[post]	0.056	0.012	4.8
lat.[L]:sag.[ant]	−0.07	0.016	−4.3
lat.[R]:sag.[ant]	−0.0037	0.017	−0.22
lat.[L]:sag.[post]	0.0047	0.017	0.29
lat.[R]:sag.[post]	−0.087	0.017	−5.1
animacy[Grammatical]:verbtype[ASV]:task[C]	−0.089	0.0083	−11
animacy[Grammatical]:verbtype[ASV]:lat.[L]	−0.021	0.012	−1.8
animacy[Grammatical]:verbtype[ASV]:lat.[R]	0.0099	0.012	0.83
animacy[Grammatical]:task[C]:lat.[L]	0.062	0.012	5.3
animacy[Grammatical]:task[C]:lat.[R]	−0.032	0.012	−2.7
verbtype[ASV]:task[C]:lat.[L]	−0.03	0.012	−2.6
verbtype[ASV]:task[C]:lat.[R]	0.0083	0.012	0.7
animacy[Grammatical]:verbtype[ASV]:sag.[ant]	−0.007	0.012	−0.6
animacy[Grammatical]:verbtype[ASV]:sag.[post]	0.011	0.012	0.93
animacy[Grammatical]:task[C]:sag.[ant]	0.089	0.012	7.6
animacy[Grammatical]:task[C]:sag.[post]	−0.091	0.012	−7.7
verbtype[ASV]:task[C]:sag.[ant]	−0.022	0.012	−1.9
verbtype[ASV]:task[C]:sag.[post]	0.0038	0.012	0.33
animacy[Grammatical]:lat.[L]:sag.[ant]	−0.0034	0.016	−0.21
animacy[Grammatical]:lat.[R]:sag.[ant]	0.0019	0.017	0.11
animacy[Grammatical]:lat.[L]:sag.[post]	0.013	0.017	0.76
animacy[Grammatical]:lat.[R]:sag.[post]	−0.0018	0.017	−0.1
verbtype[ASV]:lat.[L]:sag.[ant]	0.0038	0.016	0.23
verbtype[ASV]:lat.[R]:sag.[ant]	−0.012	0.017	−0.75
verbtype[ASV]:lat.[L]:sag.[post]	−0.0085	0.017	−0.51
verbtype[ASV]:lat.[R]:sag.[post]	0.013	0.017	0.76
task[C]:lat.[L]:sag.[ant]	0.015	0.016	0.88
task[C]:lat.[R]:sag.[ant]	−0.0011	0.017	−0.068
task[C]:lat.[L]:sag.[post]	−0.015	0.017	−0.9
task[C]:lat.[R]:sag.[post]	0.018	0.017	1.1
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]	0.057	0.012	4.9
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]	−0.023	0.012	−1.9
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[ant]	−0.022	0.012	−1.9
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[post]	0.026	0.012	2.2
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[ant]	0.0077	0.016	0.47
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[ant]	−0.0024	0.017	−0.15
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[post]	−0.0061	0.017	−0.37
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[post]	0.0042	0.017	0.25
animacy[Grammatical]:task[C]:lat.[L]:sag.[ant]	−0.0011	0.016	−0.068
animacy[Grammatical]:task[C]:lat.[R]:sag.[ant]	0.002	0.017	0.12
animacy[Grammatical]:task[C]:lat.[L]:sag.[post]	−0.015	0.017	−0.9
animacy[Grammatical]:task[C]:lat.[R]:sag.[post]	0.0029	0.017	0.17
verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	0.01	0.016	0.63
verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	−0.014	0.017	−0.82
verbtype[ASV]:task[C]:lat.[L]:sag.[post]	−0.0051	0.017	−0.31
verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.019	0.017	1.1
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	0.01	0.016	0.61
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.00019	0.017	0.012
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[post]	−0.023	0.017	−1.4
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.0032	0.017	0.19

Table 8: Summary of effects in Visual Verb N400 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	44.2891262	1	0.0000000
verbtype	33.9697060	1	0.0000000
task	0.1440723	1	0.7042657
lat.	2279.6515937	2	0.0000000
sag.	764.4105757	2	0.0000000
scale(prestim)	4018.6987914	1	0.0000000
animacy:verbtype	9.0600078	1	0.0026126
animacy:task	0.0133787	1	0.9079170
verbtype:task	4.6664490	1	0.0307575
animacy:lat.	0.0730806	2	0.9641192
verbtype:lat.	16.6767921	2	0.0002392
task:lat.	46.5600488	2	0.0000000
animacy:sag.	15.6638306	2	0.0003969
verbtype:sag.	39.2266419	2	0.0000000
task:sag.	26.8992688	2	0.0000014
lat.:sag.	100.8296264	4	0.0000000
animacy:verbtype:task	117.3738631	1	0.0000000
animacy:verbtype:lat.	3.2127004	2	0.2006185
animacy:task:lat.	28.1576323	2	0.0000008
verbtype:task:lat.	7.1917109	2	0.0274372
animacy:verbtype:sag.	0.8620652	2	0.6498377
animacy:task:sag.	78.7881366	2	0.0000000
verbtype:task:sag.	3.9033157	2	0.1420384
animacy:lat.:sag.	0.7923180	4	0.9394750
verbtype:lat.:sag.	0.8371297	4	0.9334021
task:lat.:sag.	2.3855455	4	0.6652410
animacy:verbtype:task:lat.	23.9872011	2	0.0000062
animacy:verbtype:task:sag.	5.9971223	2	0.0498588
animacy:verbtype:lat.:sag.	0.2661260	4	0.9918946
animacy:task:lat.:sag.	1.3047662	4	0.8605664
verbtype:task:lat.:sag.	1.6878784	4	0.7929183
animacy:verbtype:task:lat.:sag.	2.3336524	4	0.6746490

Table 9: Summary of Linear Mixed Model for the Visual Verb P600 time-window (700-900ms).

Linear mixed model fit by REML

REML criterion at convergence: 1426081

Scaled residuals:

Min	1Q	Median	3Q	Max
-6.9	-0.59	-0.01	0.59	9.64

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.36410
subj	(Intercept)	0.63174
Residual		4.01008

Number of obs: 253800, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.69	0.11	6.5
animacy[Grammatical]	−0.045	0.008	−5.7
verbtype[ASV]	0.06	0.008	7.4
task[C]	−0.24	0.095	−2.5
lat.[L]	−0.21	0.011	−18
lat.[R]	0.073	0.011	6.3
sag.[ant]	−0.25	0.011	−22
sag.[post]	0.19	0.011	16
scale(prestim)	−2.2	0.0081	−2.7e+02
animacy[Grammatical]:verbtype[ASV]	−0.059	0.008	−7.4
animacy[Grammatical]:task[C]	−0.041	0.008	−5.1
verbtype[ASV]:task[C]	0.051	0.008	6.3
animacy[Grammatical]:lat.[L]	−0.02	0.011	−1.8
animacy[Grammatical]:lat.[R]	0.041	0.011	3.6
verbtype[ASV]:lat.[L]	−0.0006	0.011	−0.053
verbtype[ASV]:lat.[R]	−0.018	0.011	−1.6
task[C]:lat.[L]	0.086	0.011	7.7
task[C]:lat.[R]	0.032	0.011	2.8
animacy[Grammatical]:sag.[ant]	0.019	0.011	1.7
animacy[Grammatical]:sag.[post]	−0.0046	0.011	−0.4
verbtype[ASV]:sag.[ant]	0.028	0.011	2.5
verbtype[ASV]:sag.[post]	−0.024	0.011	−2.1
task[C]:sag.[ant]	0.014	0.011	1.2
task[C]:sag.[post]	0.035	0.011	3
lat.[L]:sag.[ant]	0.014	0.016	0.89
lat.[R]:sag.[ant]	−0.027	0.016	−1.7
lat.[L]:sag.[post]	0.038	0.016	2.4
lat.[R]:sag.[post]	0.077	0.016	4.7
animacy[Grammatical]:verbtype[ASV]:task[C]	−0.037	0.008	−4.7
animacy[Grammatical]:verbtype[ASV]:lat.[L]	0.005	0.011	0.45
animacy[Grammatical]:verbtype[ASV]:lat.[R]	0.018	0.011	1.6
animacy[Grammatical]:task[C]:lat.[L]	−0.044	0.011	−3.9
animacy[Grammatical]:task[C]:lat.[R]	0.026	0.011	2.3
verbtype[ASV]:task[C]:lat.[L]	−0.0058	0.011	−0.51
verbtype[ASV]:task[C]:lat.[R]	−0.0044	0.011	−0.39
animacy[Grammatical]:verbtype[ASV]:sag.[ant]	−0.061	0.011	−5.4
animacy[Grammatical]:verbtype[ASV]:sag.[post]	0.055	0.011	4.8
animacy[Grammatical]:task[C]:sag.[ant]	−0.058	0.011	−5.2
animacy[Grammatical]:task[C]:sag.[post]	0.048	0.011	4.3
verbtype[ASV]:task[C]:sag.[ant]	0.021	0.011	1.8
verbtype[ASV]:task[C]:sag.[post]	−0.018	0.011	−1.6
animacy[Grammatical]:lat.[L]:sag.[ant]	0.00089	0.016	0.056
animacy[Grammatical]:lat.[R]:sag.[ant]	0.012	0.016	0.72
animacy[Grammatical]:lat.[L]:sag.[post]	−0.0049	0.016	−0.31
animacy[Grammatical]:lat.[R]:sag.[post]	−0.016	0.016	−0.98
verbtype[ASV]:lat.[L]:sag.[ant]	−0.0031	0.016	−0.19
verbtype[ASV]:lat.[R]:sag.[ant]	0.0015	0.016	0.091
verbtype[ASV]:lat.[L]:sag.[post]	−0.00089	0.016	−0.055
verbtype[ASV]:lat.[R]:sag.[post]	0.0038	0.016	0.23
task[C]:lat.[L]:sag.[ant]	0.056	0.016	3.5
task[C]:lat.[R]:sag.[ant]	−0.073	0.016	−4.5
task[C]:lat.[L]:sag.[post]	−0.095	0.016	−5.9
task[C]:lat.[R]:sag.[post]	0.072	0.016	4.4
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]	−0.024	0.011	−2.2
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]	0.038	0.011	3.3
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[ant]	−0.0066	0.011	−0.59
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[post]	0.006	0.011	0.53
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[ant]	0.00021	0.016	0.013
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[ant]	0.0071	0.016	0.44
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[post]	0.00039	0.016	0.024
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[post]	−0.0095	0.016	−0.58
animacy[Grammatical]:task[C]:lat.[L]:sag.[ant]	−0.023	0.016	−1.5
animacy[Grammatical]:task[C]:lat.[R]:sag.[ant]	0.0065	0.016	0.41
animacy[Grammatical]:task[C]:lat.[L]:sag.[post]	0.033	0.016	2.1
animacy[Grammatical]:task[C]:lat.[R]:sag.[post]	−0.011	0.016	−0.67
verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	−0.0017	0.016	−0.11
verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.0022	0.016	0.14
verbtype[ASV]:task[C]:lat.[L]:sag.[post]	0.00094	0.016	0.059
verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.0012	0.016	0.075
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	−0.0048	0.016	−0.3
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.01	0.016	0.63
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[post]	0.0036	0.016	0.23
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[post]	−0.017	0.016	−1

Table 10: Summary of effects in Visual Verb P600 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
gray!6 animacy	3.268122e+01	1	0.0000000
verbtype	5.646322e+01	1	0.0000000
gray!6 task	6.502667e+00	1	0.0107713
lat.	3.345684e+02	2	0.0000000
gray!6 sag.	5.086857e+02	2	0.0000000
scale(prestim)	7.154057e+04	1	0.0000000
gray!6 animacy:verbtype	5.579660e+01	1	0.0000000
animacy:task	2.660804e+01	1	0.0000002
gray!6 verbtype:task	4.081853e+01	1	0.0000000
animacy:lat.	1.289445e+01	2	0.0015849
gray!6 verbtype:lat.	3.553852e+00	2	0.1691573
task:lat.	1.196444e+02	2	0.0000000
gray!6 animacy:sag.	3.185567e+00	2	0.2033588
verbtype:sag.	7.208070e+00	2	0.0272137
gray!6 task:sag.	1.837882e+01	2	0.0001021
lat.:sag.	6.750558e+01	4	0.0000000
gray!6 animacy:verbtype:task	2.241352e+01	1	0.0000022
animacy:verbtype:lat.	4.576921e+00	2	0.1014225
gray!6 animacy:task:lat.	1.514922e+01	2	0.0005133
verbtype:task:lat.	8.412724e-01	2	0.6566289
gray!6 animacy:verbtype:sag.	3.625314e+01	2	0.0000000
animacy:task:sag.	3.049065e+01	2	0.0000002
gray!6 verbtype:task:sag.	4.064257e+00	2	0.1310563
animacy:lat.:sag.	2.012101e+00	4	0.7335331
gray!6 verbtype:lat.:sag.	1.435270e-01	4	0.9975449
task:lat.:sag.	4.532160e+01	4	0.0000000
gray!6 animacy:verbtype:task:lat.	1.169523e+01	2	0.0028868
animacy:verbtype:task:sag.	5.345573e-01	2	0.7654598
gray!6 animacy:verbtype:lat.:sag.	4.911140e-01	4	0.9743602
animacy:task:lat.:sag.	4.818288e+00	4	0.3064555
gray!6 verbtype:task:lat.:sag.	6.259450e-02	4	0.9995203
animacy:verbtype:task:lat.:sag.	1.185476e+00	4	0.8804841

Table 11: Summary of Linear Mixed Model for the Auditory Subject NP N400 time-window (300-500ms).

Linear mixed model fit by REML

REML criterion at convergence: 1077034

Scaled residuals:

Min	1Q	Median	3Q	Max
-13.33	-0.57	0.01	0.57	12.11

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.074927
subj	(Intercept)	0.106288
Residual		0.973814

Number of obs: 386478, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.0053	0.018	−0.29
animacy[Animate]	0.014	0.0016	8.9
task[C]	−0.016	0.016	−1
lat.[L]	0.018	0.0022	8.2
lat.[R]	0.029	0.0023	13
sag.[ant]	0.054	0.0022	24
sag.[post]	−0.045	0.0022	−20
scale(prestim)	−0.17	0.0016	−1.1e+02
animacy[Animate]:task[C]	−0.0087	0.0016	−5.5
animacy[Animate]:lat.[L]	−0.0081	0.0022	−3.6
animacy[Animate]:lat.[R]	−0.0017	0.0023	−0.78
task[C]:lat.[L]	−0.0041	0.0022	−1.8
task[C]:lat.[R]	0.012	0.0023	5.3
animacy[Animate]:sag.[ant]	−0.023	0.0022	−10
animacy[Animate]:sag.[post]	0.017	0.0022	7.8
task[C]:sag.[ant]	0.0013	0.0022	0.56
task[C]:sag.[post]	0.0052	0.0022	2.3
lat.[L]:sag.[ant]	0.0045	0.0031	1.4
lat.[R]:sag.[ant]	0.0053	0.0032	1.7
lat.[L]:sag.[post]	−0.01	0.0031	−3.2
lat.[R]:sag.[post]	−0.016	0.0032	−4.8
animacy[Animate]:task[C]:lat.[L]	−0.0013	0.0022	−0.59
animacy[Animate]:task[C]:lat.[R]	0.003	0.0023	1.3
animacy[Animate]:task[C]:sag.[ant]	0.0016	0.0022	0.71
animacy[Animate]:task[C]:sag.[post]	0.0015	0.0022	0.66
animacy[Animate]:lat.[L]:sag.[ant]	−0.0053	0.0031	−1.7
animacy[Animate]:lat.[R]:sag.[ant]	0.0019	0.0032	0.6
animacy[Animate]:lat.[L]:sag.[post]	0.0082	0.0031	2.6
animacy[Animate]:lat.[R]:sag.[post]	−0.0016	0.0032	−0.5
task[C]:lat.[L]:sag.[ant]	−0.0021	0.0031	−0.67
task[C]:lat.[R]:sag.[ant]	0.0032	0.0032	1
task[C]:lat.[L]:sag.[post]	0.0036	0.0031	1.2
task[C]:lat.[R]:sag.[post]	−0.0068	0.0032	−2.1
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	0.003	0.0031	0.97
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	−0.002	0.0032	−0.64
animacy[Animate]:task[C]:lat.[L]:sag.[post]	−0.0043	0.0031	−1.4
animacy[Animate]:task[C]:lat.[R]:sag.[post]	0.0029	0.0032	0.88

Table 12: Summary of effects in Auditory Subject NP N400 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	81.719146	1	0.0000000
task	1.015062	1	0.3136932
lat.	449.549854	2	0.0000000
sag.	651.053843	2	0.0000000
scale(prestim)	11501.352186	1	0.0000000
animacy:task	31.301441	1	0.0000000
animacy:lat.	22.023251	2	0.0000165
task:lat.	30.209180	2	0.0000003
animacy:sag.	114.820995	2	0.0000000
task:sag.	10.473932	2	0.0053164
lat.:sag.	72.220851	4	0.0000000
animacy:task:lat.	1.591011	2	0.4513530
animacy:task:sag.	1.857321	2	0.3950825
animacy:lat.:sag.	8.318112	4	0.0805963
task:lat.:sag.	4.439888	4	0.3497349
animacy:task:lat.:sag.	1.983987	4	0.7387043

Table 13: Summary of Linear Mixed Model for the Auditory Subject NP P600 time-window (700-900ms).
Linear mixed model fit by REML

REML criterion at convergence: 987543

Scaled residuals:

Min	1Q	Median	3Q	Max
-13.86	-0.57	0	0.57	11.49

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.070547
subj	(Intercept)	0.080419
Residual		0.867349

Number of obs: 386478, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.0075	0.015	0.5
animacy[Animate]	−0.0011	0.0014	−0.77
task[C]	0.022	0.012	1.9
lat.[L]	−0.011	0.002	−5.6
lat.[R]	−0.024	0.002	−12
sag.[ant]	−0.052	0.002	−26
sag.[post]	0.065	0.002	33
scale(prestim)	−0.49	0.0014	−3.4e+02
animacy[Animate]:task[C]	0.0038	0.0014	2.7
animacy[Animate]:lat.[L]	−0.00061	0.002	−0.31
animacy[Animate]:lat.[R]	−0.0012	0.002	−0.61
task[C]:lat.[L]	−0.0022	0.002	−1.1
task[C]:lat.[R]	−0.0055	0.002	−2.7
animacy[Animate]:sag.[ant]	−0.00028	0.002	−0.14
animacy[Animate]:sag.[post]	0.00094	0.002	0.48
task[C]:sag.[ant]	−0.0027	0.002	−1.4
task[C]:sag.[post]	−0.0032	0.002	−1.6
lat.[L]:sag.[ant]	0.0023	0.0028	0.83
lat.[R]:sag.[ant]	−0.0052	0.0028	−1.8
lat.[L]:sag.[post]	0.0069	0.0028	2.5
lat.[R]:sag.[post]	0.013	0.0029	4.5
animacy[Animate]:task[C]:lat.[L]	0.0042	0.002	2.1
animacy[Animate]:task[C]:lat.[R]	−0.0044	0.002	−2.2
animacy[Animate]:task[C]:sag.[ant]	−0.0048	0.002	−2.4
animacy[Animate]:task[C]:sag.[post]	0.0017	0.002	0.87
animacy[Animate]:lat.[L]:sag.[ant]	0.00056	0.0028	0.2
animacy[Animate]:lat.[R]:sag.[ant]	−0.00038	0.0028	−0.13
animacy[Animate]:lat.[L]:sag.[post]	−0.0027	0.0028	−0.96
animacy[Animate]:lat.[R]:sag.[post]	0.0031	0.0029	1.1
task[C]:lat.[L]:sag.[ant]	0.00095	0.0028	0.34
task[C]:lat.[R]:sag.[ant]	−0.0079	0.0028	−2.8
task[C]:lat.[L]:sag.[post]	−0.0018	0.0028	−0.66
task[C]:lat.[R]:sag.[post]	0.0092	0.0029	3.2
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	−0.00026	0.0028	−0.092
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	0.0011	0.0028	0.39
animacy[Animate]:task[C]:lat.[L]:sag.[post]	−0.0004	0.0028	−0.14
animacy[Animate]:task[C]:lat.[R]:sag.[post]	−1.8e−05	0.0029	−0.0061

Table 14: Summary of effects in Auditory Subject NP P600 time window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	6.427599e-01	1	0.4227132
task	3.435148e+00	1	0.0638228
lat.	3.341138e+02	2	0.0000000
sag.	1.179268e+03	2	0.0000000
scale(prestim)	1.152882e+05	1	0.0000000
animacy:task	7.655099e+00	1	0.0056612
animacy:lat.	9.748431e-01	2	0.6142081
task:lat.	1.657472e+01	2	0.0002517
animacy:sag.	1.774324e-01	2	0.9151053
task:sag.	1.023917e+01	2	0.0059785
lat.:sag.	6.402255e+01	4	0.0000000
animacy:task:lat.	6.126951e+00	2	0.0467250
animacy:task:sag.	5.950831e+00	2	0.0510262
animacy:lat.:sag.	1.636647e+00	4	0.8021910
task:lat.:sag.	1.420959e+01	4	0.0066553
animacy:task:lat.:sag.	2.307863e-01	4	0.9938329

Table 15: Summary of Linear Mixed Model for the Auditory Subject NP later P600 time-window (900-1100ms).
Linear mixed model fit by REML

REML criterion at convergence: 996406

Scaled residuals:

Min	1Q	Median	3Q	Max
-9.86	-0.57	-0.01	0.57	9.58

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.064095
subj	(Intercept)	0.095641
Residual		0.877350

Number of obs: 386478, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.0051	0.016	0.31
animacy[Animate]	0.0036	0.0014	2.6
task[C]	0.02	0.014	1.4
lat.[L]	0.0096	0.002	4.8
lat.[R]	−0.036	0.002	−18
sag.[ant]	−0.05	0.002	−25
sag.[post]	0.064	0.002	32
scale(prestim)	−0.46	0.0015	−3.2e+02
animacy[Animate]:task[C]	0.0066	0.0014	4.7
animacy[Animate]:lat.[L]	0.0013	0.002	0.64
animacy[Animate]:lat.[R]	0.0031	0.002	1.5
task[C]:lat.[L]	0.00035	0.002	0.18
task[C]:lat.[R]	−0.0075	0.002	−3.7
animacy[Animate]:sag.[ant]	0.022	0.002	11
animacy[Animate]:sag.[post]	−0.02	0.002	−9.7
task[C]:sag.[ant]	−0.0021	0.002	−1.1
task[C]:sag.[post]	−0.0057	0.002	−2.8
lat.[L]:sag.[ant]	0.0096	0.0028	3.4
lat.[R]:sag.[ant]	−0.011	0.0028	−3.9
lat.[L]:sag.[post]	−0.0023	0.0028	−0.82
lat.[R]:sag.[post]	0.018	0.0029	6.2
animacy[Animate]:task[C]:lat.[L]	0.0044	0.002	2.2
animacy[Animate]:task[C]:lat.[R]	−0.0062	0.002	−3.1
animacy[Animate]:task[C]:sag.[ant]	−0.00066	0.002	−0.33
animacy[Animate]:task[C]:sag.[post]	−0.0016	0.002	−0.78
animacy[Animate]:lat.[L]:sag.[ant]	0.0012	0.0028	0.44
animacy[Animate]:lat.[R]:sag.[ant]	−5.8e−05	0.0028	−0.02
animacy[Animate]:lat.[L]:sag.[post]	−0.0016	0.0028	−0.55
animacy[Animate]:lat.[R]:sag.[post]	−0.0012	0.0029	−0.41
task[C]:lat.[L]:sag.[ant]	0.00092	0.0028	0.33
task[C]:lat.[R]:sag.[ant]	−0.0048	0.0028	−1.7
task[C]:lat.[L]:sag.[post]	−0.001	0.0028	−0.37
task[C]:lat.[R]:sag.[post]	0.0053	0.0029	1.8
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	−0.001	0.0028	−0.36
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	−0.0009	0.0028	−0.32
animacy[Animate]:task[C]:lat.[L]:sag.[post]	0.00093	0.0028	0.33
animacy[Animate]:task[C]:lat.[R]:sag.[post]	0.00064	0.0029	0.22

Table 16: Summary of effects in Auditory Subject NP late P600 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	6.120762e+00	1	0.0133603
task	2.056221e+00	1	0.1515857
lat.	3.486938e+02	2	0.0000000
sag.	1.078820e+03	2	0.0000000
scale(prestim)	1.010987e+05	1	0.0000000
animacy:task	2.271526e+01	1	0.0000019
animacy:lat.	5.109577e+00	2	0.0777087
task:lat.	1.797103e+01	2	0.0001252
animacy:sag.	1.479738e+02	2	0.0000000
task:sag.	1.717275e+01	2	0.0001866
lat.:sag.	6.040146e+01	4	0.0000000
animacy:task:lat.	9.947518e+00	2	0.0069171
animacy:task:sag.	1.369485e+00	2	0.5042200
animacy:lat.:sag.	1.093816e+00	4	0.8952521
task:lat.:sag.	4.637146e+00	4	0.3265938
animacy:task:lat.:sag.	5.433485e-01	4	0.9691461

Table 17: Summary of Linear Mixed Model for the Auditory Verb N400 time-window (300-500ms).

Linear mixed model fit by REML

REML criterion at convergence: 1542861

Scaled residuals:

Min	1Q	Median	3Q	Max
-10.46	-0.58	0	0.57	10.63

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.46568
subj	(Intercept)	0.49814
Residual		4.39600

Number of obs: 265896, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.082	0.095	−0.87
animacy[Grammatical]	0.056	0.0086	6.6
verbtype[ASV]	−0.017	0.0086	−2
task[C]	−0.0085	0.073	−0.12
lat.[L]	0.026	0.012	2.2
lat.[R]	0.078	0.012	6.4
sag.[ant]	0.44	0.012	36
sag.[post]	−0.36	0.012	−30
scale(prestim)	−0.83	0.0087	−95
animacy[Grammatical]:verbtype[ASV]	0.023	0.0086	2.7
animacy[Grammatical]:task[C]	−0.04	0.0086	−4.7
verbtype[ASV]:task[C]	0.069	0.0086	8.1
animacy[Grammatical]:lat.[L]	−0.057	0.012	−4.7
animacy[Grammatical]:lat.[R]	0.056	0.012	4.6
verbtype[ASV]:lat.[L]	−0.019	0.012	−1.6
verbtype[ASV]:lat.[R]	0.0099	0.012	0.81
task[C]:lat.[L]	−0.031	0.012	−2.6
task[C]:lat.[R]	0.048	0.012	3.9
animacy[Grammatical]:sag.[ant]	−0.052	0.012	−4.3
animacy[Grammatical]:sag.[post]	0.043	0.012	3.5
verbtype[ASV]:sag.[ant]	−0.037	0.012	−3
verbtype[ASV]:sag.[post]	0.042	0.012	3.5
task[C]:sag.[ant]	−0.074	0.012	−6.1
task[C]:sag.[post]	0.073	0.012	6
lat.[L]:sag.[ant]	0.12	0.017	7.3
lat.[R]:sag.[ant]	−0.018	0.017	−1
lat.[L]:sag.[post]	−0.1	0.017	−6
lat.[R]:sag.[post]	−0.012	0.018	−0.66
animacy[Grammatical]:verbtype[ASV]:task[C]	−0.0016	0.0086	−0.19
animacy[Grammatical]:verbtype[ASV]:lat.[L]	0.027	0.012	2.2
animacy[Grammatical]:verbtype[ASV]:lat.[R]	−0.024	0.012	−1.9
animacy[Grammatical]:task[C]:lat.[L]	0.051	0.012	4.2
animacy[Grammatical]:task[C]:lat.[R]	−0.039	0.012	−3.2
verbtype[ASV]:task[C]:lat.[L]	0.0037	0.012	0.31
verbtype[ASV]:task[C]:lat.[R]	−0.035	0.012	−2.9
animacy[Grammatical]:verbtype[ASV]:sag.[ant]	0.011	0.012	0.9
animacy[Grammatical]:verbtype[ASV]:sag.[post]	−0.011	0.012	−0.92
animacy[Grammatical]:task[C]:sag.[ant]	0.057	0.012	4.7
animacy[Grammatical]:task[C]:sag.[post]	−0.041	0.012	−3.4
verbtype[ASV]:task[C]:sag.[ant]	0.003	0.012	0.25
verbtype[ASV]:task[C]:sag.[post]	−0.014	0.012	−1.1
animacy[Grammatical]:lat.[L]:sag.[ant]	−0.039	0.017	−2.3
animacy[Grammatical]:lat.[R]:sag.[ant]	0.031	0.017	1.8
animacy[Grammatical]:lat.[L]:sag.[post]	0.044	0.017	2.6
animacy[Grammatical]:lat.[R]:sag.[post]	−0.038	0.018	−2.2
verbtype[ASV]:lat.[L]:sag.[ant]	−0.0008	0.017	−0.047
verbtype[ASV]:lat.[R]:sag.[ant]	0.01	0.017	0.59
verbtype[ASV]:lat.[L]:sag.[post]	−0.00035	0.017	−0.02
verbtype[ASV]:lat.[R]:sag.[post]	−0.0018	0.018	−0.1
task[C]:lat.[L]:sag.[ant]	−0.022	0.017	−1.3
task[C]:lat.[R]:sag.[ant]	−0.017	0.017	−0.96
task[C]:lat.[L]:sag.[post]	0.013	0.017	0.74
task[C]:lat.[R]:sag.[post]	0.0022	0.018	0.13
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]	−0.021	0.012	−1.7
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]	0.012	0.012	0.95
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[ant]	0.023	0.012	1.9
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[post]	−0.017	0.012	−1.4
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[ant]	0.0072	0.017	0.42
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[ant]	−0.0076	0.017	−0.44
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[post]	−0.004	0.017	−0.24
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[post]	−0.0019	0.018	−0.11
animacy[Grammatical]:task[C]:lat.[L]:sag.[ant]	0.023	0.017	1.3
animacy[Grammatical]:task[C]:lat.[R]:sag.[ant]	−0.029	0.017	−1.7
animacy[Grammatical]:task[C]:lat.[L]:sag.[post]	−0.032	0.017	−1.9
animacy[Grammatical]:task[C]:lat.[R]:sag.[post]	0.027	0.018	1.5
verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	−0.034	0.017	−2
verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.0049	0.017	0.28
verbtype[ASV]:task[C]:lat.[L]:sag.[post]	0.034	0.017	2
verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.003	0.018	0.17
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	0.0093	0.017	0.55
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	−0.019	0.017	−1.1
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[post]	−0.012	0.017	−0.71
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.022	0.018	1.2

Table 18: Summary of effects in Auditory Verb N400 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	43.4617849	1	0.0000000
verbtype	4.4464125	1	0.0349746
task	0.0186500	1	0.8913746
lat.	76.7501604	2	0.0000000
sag.	1472.4155977	2	0.0000000
scale(prestim)	9110.6693008	1	0.0000000
animacy:verbtype	7.6224213	1	0.0057647
animacy:task	21.9546733	1	0.0000028
verbtype:task	66.6998680	1	0.0000000
animacy:lat.	30.1459463	2	0.0000003
verbtype:lat.	2.5876633	2	0.2742181
task:lat.	15.8819041	2	0.0003559
animacy:sag.	22.1290689	2	0.0000157
verbtype:sag.	14.6927774	2	0.0006449
task:sag.	48.3857464	2	0.0000000
lat.:sag.	82.5124110	4	0.0000000
animacy:verbtype:task	0.0690395	1	0.7927404
animacy:verbtype:lat.	5.7065876	2	0.0576541
animacy:task:lat.	19.5045524	2	0.0000582
verbtype:task:lat.	9.5759974	2	0.0083291
animacy:verbtype:sag.	1.0320112	2	0.5969001
animacy:task:sag.	24.2360072	2	0.0000055
verbtype:task:sag.	1.7143075	2	0.4243682
animacy:lat.:sag.	8.9599481	4	0.0621084
verbtype:lat.:sag.	0.5024099	4	0.9732660
task:lat.:sag.	5.4663764	4	0.2427009
animacy:verbtype:task:lat.	2.7735065	2	0.2498853
animacy:verbtype:task:sag.	4.2085295	2	0.1219353
animacy:verbtype:lat.:sag.	0.4699604	4	0.9763587
animacy:task:lat.:sag.	5.0440626	4	0.2828062
verbtype:task:lat.:sag.	7.6441347	4	0.1055190
animacy:verbtype:task:lat.:sag.	1.8277564	4	0.7674004

Table 19: Summary of Linear Mixed Model for the Auditory Verb P600 time-window (700-900ms).

Linear mixed model fit by REML

REML criterion at convergence: 1533514

Scaled residuals:

Min	1Q	Median	3Q	Max
-11.18	-0.57	0.01	0.58	10.43

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.37474
subj	(Intercept)	0.38035
Residual		4.31976

Number of obs: 265896, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.41	0.074	−5.5
animacy[Grammatical]	−0.012	0.0084	−1.4
verbtype[ASV]	0.031	0.0084	3.7
task[C]	0.024	0.056	0.42
lat.[L]	0.063	0.012	5.3
lat.[R]	−0.062	0.012	−5.1
sag.[ant]	−0.23	0.012	−19
sag.[post]	0.23	0.012	19
scale(prestim)	−2.3	0.0086	−2.7e+02
animacy[Grammatical]:verbtype[ASV]	−0.077	0.0084	−9.2
animacy[Grammatical]:task[C]	0.03	0.0084	3.6
verbtype[ASV]:task[C]	−0.051	0.0084	−6
animacy[Grammatical]:lat.[L]	0.017	0.012	1.5
animacy[Grammatical]:lat.[R]	−0.042	0.012	−3.5
verbtype[ASV]:lat.[L]	−0.00093	0.012	−0.079
verbtype[ASV]:lat.[R]	0.0044	0.012	0.37
task[C]:lat.[L]	−0.014	0.012	−1.1
task[C]:lat.[R]	−0.0086	0.012	−0.72
animacy[Grammatical]:sag.[ant]	0.0076	0.012	0.64
animacy[Grammatical]:sag.[post]	−0.0085	0.012	−0.71
verbtype[ASV]:sag.[ant]	−0.0056	0.012	−0.47
verbtype[ASV]:sag.[post]	−0.0089	0.012	−0.75
task[C]:sag.[ant]	0.054	0.012	4.5
task[C]:sag.[post]	−0.067	0.012	−5.6
lat.[L]:sag.[ant]	−0.044	0.017	−2.6
lat.[R]:sag.[ant]	0.0087	0.017	0.51
lat.[L]:sag.[post]	0.028	0.017	1.7
lat.[R]:sag.[post]	−0.0088	0.017	−0.51
animacy[Grammatical]:verbtype[ASV]:task[C]	−0.044	0.0084	−5.2
animacy[Grammatical]:verbtype[ASV]:lat.[L]	0.0045	0.012	0.38
animacy[Grammatical]:verbtype[ASV]:lat.[R]	−0.0031	0.012	−0.26
animacy[Grammatical]:task[C]:lat.[L]	−0.036	0.012	−3
animacy[Grammatical]:task[C]:lat.[R]	0.026	0.012	2.2
verbtype[ASV]:task[C]:lat.[L]	−0.045	0.012	−3.8
verbtype[ASV]:task[C]:lat.[R]	0.057	0.012	4.7
animacy[Grammatical]:verbtype[ASV]:sag.[ant]	0.016	0.012	1.3
animacy[Grammatical]:verbtype[ASV]:sag.[post]	−0.015	0.012	−1.3
animacy[Grammatical]:task[C]:sag.[ant]	−0.0038	0.012	−0.32
animacy[Grammatical]:task[C]:sag.[post]	0.00018	0.012	0.015
verbtype[ASV]:task[C]:sag.[ant]	−0.024	0.012	−2
verbtype[ASV]:task[C]:sag.[post]	0.03	0.012	2.5
animacy[Grammatical]:lat.[L]:sag.[ant]	0.022	0.017	1.3
animacy[Grammatical]:lat.[R]:sag.[ant]	−0.029	0.017	−1.7
animacy[Grammatical]:lat.[L]:sag.[post]	−0.015	0.017	−0.91
animacy[Grammatical]:lat.[R]:sag.[post]	0.028	0.017	1.6
verbtype[ASV]:lat.[L]:sag.[ant]	0.022	0.017	1.3
verbtype[ASV]:lat.[R]:sag.[ant]	−0.017	0.017	−1
verbtype[ASV]:lat.[L]:sag.[post]	−0.019	0.017	−1.2
verbtype[ASV]:lat.[R]:sag.[post]	0.013	0.017	0.73
task[C]:lat.[L]:sag.[ant]	−0.013	0.017	−0.77
task[C]:lat.[R]:sag.[ant]	0.023	0.017	1.4
task[C]:lat.[L]:sag.[post]	0.027	0.017	1.6
task[C]:lat.[R]:sag.[post]	−0.021	0.017	−1.2
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]	0.031	0.012	2.6
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]	0.0026	0.012	0.21
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[ant]	−0.0019	0.012	−0.16
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[post]	0.0058	0.012	0.49
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[ant]	−0.038	0.017	−2.3
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[ant]	0.015	0.017	0.87
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[post]	0.032	0.017	1.9
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[post]	−0.014	0.017	−0.78
animacy[Grammatical]:task[C]:lat.[L]:sag.[ant]	−0.032	0.017	−1.9
animacy[Grammatical]:task[C]:lat.[R]:sag.[ant]	0.013	0.017	0.77
animacy[Grammatical]:task[C]:lat.[L]:sag.[post]	0.033	0.017	2
animacy[Grammatical]:task[C]:lat.[R]:sag.[post]	−0.015	0.017	−0.87
verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	0.0097	0.017	0.58
verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.0048	0.017	0.29
verbtype[ASV]:task[C]:lat.[L]:sag.[post]	0.0031	0.017	0.19
verbtype[ASV]:task[C]:lat.[R]:sag.[post]	−0.025	0.017	−1.5
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	−0.0024	0.017	−0.14
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.032	0.017	1.9
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[post]	−0.0038	0.017	−0.23
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[post]	−0.028	0.017	−1.6

Table 20: Summary of effects in Auditory Verb P600 time-window (Type II Wald Tests)

	Chisq	Df	Pr(¿Chisq)
animacy	1.945704e+00	1	0.1630506
verbtype	1.395801e+01	1	0.0001869
task	1.958060e-01	1	0.6581276
lat.	3.606497e+01	2	0.0000000
sag.	5.051859e+02	2	0.0000000
scale(prestim)	7.195080e+04	1	0.0000000
animacy:verbtype	8.396857e+01	1	0.0000000
animacy:task	1.274507e+01	1	0.0003569
verbtype:task	3.749827e+01	1	0.0000000
animacy:lat.	1.293878e+01	2	0.0015502
verbtype:lat.	9.033230e-02	2	0.9558387
task:lat.	3.540521e+00	2	0.1702886
animacy:sag.	8.263444e-01	2	0.6615484
verbtype:sag.	1.592221e+00	2	0.4510801
task:sag.	3.498377e+01	2	0.0000000
lat.:sag.	7.797763e+00	4	0.0992737
animacy:verbtype:task	2.669624e+01	1	0.0000002
animacy:verbtype:lat.	1.319691e-01	2	0.9361453
animacy:task:lat.	9.798402e+00	2	0.0074525
verbtype:task:lat.	2.533137e+01	2	0.0000032
animacy:verbtype:sag.	2.297371e+00	2	0.3170533
animacy:task:sag.	1.343626e-01	2	0.9350256
verbtype:task:sag.	7.828847e+00	2	0.0199520
animacy:lat.:sag.	4.016304e+00	4	0.4038038
verbtype:lat.:sag.	2.185364e+00	4	0.7017097
task:lat.:sag.	3.771881e+00	4	0.4377578
animacy:verbtype:task:lat.	9.712260e+00	2	0.0077805
animacy:verbtype:task:sag.	4.689662e-01	2	0.7909796
animacy:verbtype:lat.:sag.	6.057121e+00	4	0.1949229
animacy:task:lat.:sag.	5.020820e+00	4	0.2851679
verbtype:task:lat.:sag.	3.330704e+00	4	0.5040822
animacy:verbtype:task:lat.:sag.	6.071089e+00	4	0.1939018

Appendix A: Experimental Stimuli

ASV Correct

The parties will ratify the agreement at last.
The man will smoke the pipe at the camp.
The student will write the answer on the exam.
The teacher will explain the assessment very convincingly.
The children will hear the serenades during the night.
The civilians will barricade the shelters during the war.
The athletes will practice the workouts every day.
The medic will treat the wound for a long time.
The tourists will visit the pyramids for many years.
The gardener will plough the soil with his tools.
The ministers will tackle the difficulties in Parliament.
The enemies will sign the treaties in peace.
The hikers will use the compass in the forest.
The labourer will complete the work in the mine.
The workmen will inhale the fumes in the mine.
The customers will drink the beers in the pub.
The men will devour the meals in the restaurant.
The writers will compose the poems in the salon.
The hikers will consult the maps in the wilderness.
The campers will spend the holidays in the woods.
The villagers will flee the attacks near their homes.
The agents will record the whispers next door.
The tenants will overhear the argument next door.
The child will swallow the pill with hot tea.
The culprits will commit the crimes on the street.
The managers will incur the debts of the factory.
The nurse will bandage the scar on his back.
The committees will coordinate the tasks since the morning.
The postmen will send the letters to the border.

ASV Violation

The boys will eat the fries too quickly.
The agreement will ratify the parties at last.
The pipe will smoke the man at the camp.
The answer will write the student on the exam.
The assessment will explain the teacher very convincingly.
The serenades will hear the children during the night.
The shelters will barricade the civilians during the war.
The workouts will practice the athletes every day.
The wound will treat the medic for a long time.
The pyramids will visit the tourists for many years.
The soil will plough the gardener with his tools.
The difficulties will tackle the ministers in Parliament.
The treaties will sign the enemies in peace.
The compass will use the hikers in the forest.
The fumes will inhale the workmen in the mine.
The work will complete the labourer in the mine.
The beers will drink the customers in the pub.
The meals will devour the men in the restaurant.
The poems will compose the writers in the salon.
The maps will consult the hikers in the wilderness.
The holidays will spend the campers in the woods.
The attacks will flee the villagers near their homes.
The argument will overhear the tenants next door.
The whispers will record the agents next door.
The pill will swallow the child with hot tea.
The crimes will commit the culprits on the street.
The debts will incur the managers of the factory.
The scar will bandage the nurse on his back.
The tasks will coordinate the committees since the morning.
The letters will send the postmen to the border.
The fries will eat the boys too quickly.

ESV Correct

Her parents will appreciate my achievements a great deal.
His professors will support his efforts until the end.
The boys will relish the pastries all week long.
The citizens will hate the crimes and the politicians.
The kids will love the carousels at the fair.
The judges will despise the movies at the festival.
The jury will distrust the charges at the hearing.
Her husband will dislike her behaviour at the party.
The students will heed the reforms at the university.
The public will adore the music at those concerts.
The spectators will enjoy the jokes every evening.
The people will admire the inventions for a long time.
The patient will dread the operation for its risks.
The readers will cherish the poems for many centuries.
Her boss will value her work for many years.
The artist will resent the questions for some reason.
The girls will fear the storms for weeks.
The children will like the gifts of the orphanage.
The laureate will appreciate the prize at the ceremony
The customer will praise the service in that store.
The soldiers will mourn the losses in the army.
The students will lament the results in the competition.
The children will enjoy the holidays in the village.
The journalists will disdain the remarks of that newspaper.
The competitors will envy the successes of the company.
The managers will deplore the failures of the company.
The opponents will trust the proposals of the party.
The volunteers will regret the incidents on the ground.
Her boyfriend will grieve her death very much.
The pupils will dread the exams without reason.
My teachers will value my efforts a great deal.
The travellers will enjoy the journeys very much.
The victims will mourn the catastrophes in the area.
The boy will fear the wind at night.
The minister will dread the outbreak for long.
The detectives will suspect the clues at the investigation.
The believers will heed the sermons at the mass.
The brides will appreciate the compliments at the weddings.
My mother will dislike my comments during the meal.
The scientists will relish the challenge for its prestige.
The conductors will dread the rehearsals for many months.
The kids will enjoy the toys for many weeks.
Her neighbours will envy her achievements for no reason.
My folks will deplore my grades for the first time.
His auditors will cherish his songs for their beauty.
Her friends will disdain her handicaps for years.
The guests will praise the presents of the palace.
The tourists will like the drinks in the bar.
The students will admire the books in the class.
The doctors will regret the catastrophes in the country.
The researchers will trust the experiments in the other labs.
The fans will love the concerts in the park.
The veterans will grieve the losses of past wars.
The lawyers will resent the policies of the company.
The members will support the decisions of the party.
His supporters will hate his views once again.
Her brothers will appreciate my encouragements so much.
My children will adore my tales since birth.
The critics will despise the book very badly.
The team will lament the score very deeply.

ESV Violation

My achievements will appreciate her parents a great deal.
His efforts will support his professors until the end.
The pastries will relish the boys all week long.
The crimes will hate the citizens and the politicians.
The carousels will love the kids at the fair.
The movies will despise the judges at the festival.
The charges will distrust the jury at the hearing.
Her behaviour will dislike her husband at the party.
The reforms will heed the students at the university.
The music will adore the public at those concerts.
The jokes will enjoy the spectators every evening.
The inventions will admire the people for a long time.
The operation will dread the patient for its risks.
The poems will cherish the readers for many centuries.
Her work will value her boss for many years.
The questions will resent the artist for some reason.
The storms will fear the girls for weeks.
The gifts will like the children of the orphanage.
The prize will appreciate the laureate at the ceremony
The service will praise the customer in that store.
The losses will mourn the soldiers in the army.
The results will lament the students in the competition.
The holidays will enjoy the children in the village.
The remarks will disdain the journalists of that newspaper.

The failures will deplore the managers of the company.
The successes will envy the competitors of the company.
The proposals will trust the opponents of the party.
The incidents will regret the volunteers on the ground.
Her death will grieve her boyfriend very much.
The exams will dread the pupils without reason.
My efforts will value my teachers a great deal.
The journeys will enjoy the travellers very much.
The catastrophes will mourn the victims in the area.
The wind will fear the boy at night.
The outbreak will dread the minister for long.
The clues will suspect the detectives at the investigation.
The sermons will heed the believers at the mass.
The compliments will appreciate the brides at the weddings.
My comments will dislike my mother during the meal.
The challenge will relish the scientists for its prestige.
The rehearsals will dread the conductors for many months.
The toys will enjoy the kids for many weeks.
Her achievements will envy her neighbours for no reason.
My grades will deplore my folks for the first time.
His songs will cherish his auditors for their beauty.
Her handicaps will disdain her friends for years.
The presents will praise the guests of the palace.
The drinks will like the tourists in the bar.
The books will admire the students in the class.
The catastrophes will regret the doctors in the country.
The experiments will trust the researchers in the other labs.
The concerts will love the fans in the park.
The losses will grieve the veterans of past wars.
The policies will resent the lawyers of the company.
The decisions will support the members of the party.
His views will hate his supporters once again.
My encouragements will appreciate her brothers so much.
My tales will adore my children since birth.
The book will despise the critics very badly.
The score will lament the team very deeply.

EOV Correct

My achievements will gladden her parents a great deal.
His efforts will content his professors until the end.
The pastries will tempt the boys all week long.
The crimes will appal the citizens and the politicians.
The carousels will thrill the kids at the fair.
The movies will displease the judges at the festival.
The charges will bother the jury at the hearing.
Her behaviour will embarrass her husband at the party.
The reforms will impress the students at the university.
The music will enchant the public at those concerts.
The jokes will amuse the spectators every evening.
The inventions will fascinate the people for a long time.
The operation will disquiet the patient for its risks.
The poems will seduce the readers for many centuries.
Her work will satisfy her boss for many years.
The questions will upset the artist for some reason.
The storms will frighten the girls for weeks.
The gifts will please the children of the orphanage.
The prize will cheer the laureate at the ceremony
The service will delight the customer in that store.
The losses will afflict the soldiers in the army.
The results will demoralise the students in the competition.
The holidays will excite the children in the village.
The remarks will repulse the journalists of that newspaper.
The failures will disappoint the managers of the company.
The successes will frustrate the competitors of the company.
The proposals will convince the opponents of the party.
The incidents will depress the volunteers on the ground.
Her death will affect her boyfriend very much.
The exams will torment the pupils without reason.
My efforts will satisfy my teachers a great deal.
The journeys will excite the travellers very much.
The catastrophes will afflict the victims in the area.
The wind will frighten the boy at night.
The outbreak will disquiet the minister for long.
The clues will bother the detectives at the investigation.
The sermons will impress the believers at the mass.
The compliments will cheer the brides at the weddings.
My comments will embarrass my mother during the meal.
The challenge will tempt the scientists for its prestige.
The rehearsals will torment the conductors for many months.
The toys will amuse the kids for many weeks.
Her achievements will frustrate her neighbours for no reason.
My grades will disappoint my folks for the first time.
His songs will seduce his auditors for their beauty.
Her handicaps will repulse her friends for years.
The presents will delight the guests of the palace.
The drinks will please the tourists in the bar.
The books will fascinate the students in the class.
The catastrophes will depress the doctors in the country.
The experiments will convince the researchers in the other labs.
The concerts will thrill the fans in the park.
The losses will affect the veterans of past wars.
The policies will upset the lawyers of the company.
The decisions will content the members of the party.
His views will appal his supporters once again.
My encouragements will gladden her brothers so much.
My tales will enchant my children since birth.
The book will displease the critics very badly.
The score will demoralise the team very deeply.

EOV Violation

Her parents will gladden my achievements a great deal.
His professors will content his efforts until the end.
The boys will tempt the pastries all week long.
The citizens will appal the crimes and the politicians.
The kids will thrill the carousels at the fair.
The judges will displease the movies at the festival.
The jury will bother the charges at the hearing.
Her husband will embarrass her behaviour at the party.
The students will impress the reforms at the university.
The public will enchant the music at those concerts.
The spectators will amuse the jokes every evening.
The people will fascinate the inventions for a long time.
The patient will disquiet the operation for its risks.
The readers will seduce the poems for many centuries.
Her boss will satisfy her work for many years.
The artist will upset the questions for some reason.
The girls will frighten the storms for weeks.
The children will please the gifts of the orphanage.
The laureate will cheer the prize at the ceremony
The customer will delight the service in that store.
The soldiers will afflict the losses in the army.
The students will demoralise the results in the competition.
The children will excite the holidays in the village.
The journalists will repulse the remarks of that newspaper.
The competitors will frustrate the successes of the company.
The managers will disappoint the failures of the company.
The opponents will convince the proposals of the party.
The volunteers will depress the incidents on the ground.
Her boyfriend will affect her death very much.
The pupils will torment the exams without reason.
My teachers will satisfy my efforts a great deal.
The travellers will excite the journeys very much.
The victims will afflict the catastrophes in the area.
The wind will frighten the wind at night.
The minister will disquiet the outbreak for long.
The detectives will bother the clues at the investigation.
The believers will impress the sermons at the mass.
The brides will cheer the compliments at the weddings.
My mother will embarrass my comments during the meal.
The scientists will tempt the challenge for its prestige.
The conductors will torment the rehearsals for many months.
The kids will amuse the toys for many weeks.
Her neighbours will frustrate her achievements for no reason.
My folks will disappoint my grades for the first time.
His auditors will seduce his songs for their beauty.
Her friends will repulse her handicaps for years.
The guests will delight the presents of the palace.
The tourists will please the drinks in the bar.
The students will fascinate the books in the class.
The doctors will depress the catastrophes in the country.
The researchers will convince the experiments in the other labs.
The fans will thrill the concerts in the park.

The veterans will affect the losses of past wars.
The lawyers will upset the policies of the company.
The members will content the decisions of the party.
His supporters will appal his views once again.
Her brothers will gladden my encouragements so much.
My children will enchant my tales since birth.
The critics will displease the book very badly.
The team will demoralise the score very deeply.

PSV Correct

It will be hard to survive this August without water.
It will be hard this August to survive without water.
The university wants to publish the student this semester.
The university wants the student to publish this semester.
The general tried to hide the army from the enemy.
The general asked the army to hide from the enemy.
The actor hoped to improve the music in his scene.
The actor chose his music to improve his scene.
The priest arranged to marry the teachers at the school.
The priest wanted the teachers to marry at the school.
The people began to prepare the city for the election.
The people decorated the city to prepare for the election.
He started to thank his wife at the ceremony.
He asked his wife to thank the driver.
The man chose to adopt the rabbit for his kids.
The man chose the rabbit to adopt for his kids.
The officer tried to commit the lady for the crime.
The man forced the lady to commit the crime.
The girl wanted to collect a bird from the woods.
The girl helped the bird to collect a pile of sticks.
This letter was written to replace the letter he wrote yesterday.
He wrote this letter to replace the one from yesterday.
The teacher hated to fail the children in math.
The teacher hated for the children to fail in math.
He wanted to begin this story with a poem.
He wanted this story to begin in the morning.
The fence worked to refuse the horse entry to the field.
The farmer expected the horse to refuse to drink.
The boss tried to explain his method to the workers.
Their boss found one method to explain the huge loss.
We were asked to join the lieutenant up with a partner.
Everyone wanted the lieutenant to join their department.
The manager wants to reflect their product in the company name.
The company expects the product to reflect their values.
My father hopes to grow a tree in his yard.
My father hopes for a tree to grow in his yard.
The director works to inspect the restaurant in the mornings.
The director entered the restaurant to inspect the kitchen.
The writer expected to vary the ending of his film.
The audience expects the ending to vary every week.
She waited to open her business until after Christmas.
She waited for the business to open the new store.
The players were known to select a leader who was strong.
The players wanted their leader to select a practice time.
I would never try to threaten a friendship between two people.
I expect their friendship to threaten our time together.
I have to admit my strength in sport is weak.
I have the strength to admit when I am wrong.
I want to ignore the news while I eat.
I want the news to ignore the scandal.
She wanted to compare this trial with an earlier one.
She ran this trial to compare our performances.
She wants me to prefer her cat to mine.
She wants her cat to prefer her company to mine.
My parents want to discuss my choice of university.
I made the choice to discuss my career change.
I came to manage the department and its courses.
I came to the department to manage these courses.
We came to greet the owner of the park.
We asked the owner to greet our employees.

PSV Violation

It will be hard to August this survive without water.
It will be hard this survive to August without water.
The university wants to student the publish this semester.
The university wants the publish to student this semester.
The general tried to army the hide from the enemy.
The general asked the hide to army from the enemy.
The actor hoped to music the improve in his scene.
The actor chose his improve to music his scene.
The priest arranged to teachers the marry at the school.
The priest wanted the marry to teachers at the school.
The people began to city the prepare for the election.
The people decorated the prepare to city for the election.
He started to wife his thank at the ceremony.
He asked his thank to wife the driver.
The man chose to rabbit the adopt for his kids.
The man chose the adopt to rabbit for his kids.
The officer tried to lady the commit for the crime.
The man forced the commit to lady the crime.
The girl wanted to bird a collect from the woods.
The girl helped the collect to bird a pile of sticks.
This letter was written to letter the replace he wrote yesterday.
He wrote this replace to letter the one from yesterday.
The teacher hated to children the fail in math.
The teacher hated for the fail to children in math.
He wanted to story this begin with a poem.
He wanted this begin to story in the morning.
The fence worked the refuse to horse entry to the field.
The farmer expected the refuse to horse to drink.
The boss tried to method his explain to the workers.
Their boss found one explain to method the huge loss.
We were asked to lieutenant the join up with a partner.
Everyone wanted the join to lieutenant their department.
The manager wants to product their reflect in the company name.
The company expects the reflect to product their values.
My father hopes to tree a grow in his yard.
My father hopes for a grow to tree in his yard.
The director works to restaurant the inspect in the mornings.
The director entered the inspect to restaurant the kitchen.
The writer expected to ending the vary of his film.
The audience expects the vary to ending every week.
She waited to business her open until after Christmas.
She waited for the open to business the new store.
The players were known to leader a select who was strong.
The players wanted their select to leader a practice time.
I would never try to friendship a threaten between two people.
I expect their threaten to friendship our time together.
I have to strength my admit in sport is weak.
I have the admit to strength when I am wrong.
I want to news the ignore while I eat.
I want the ignore to news the scandal.
She wanted to trial this compare with an earlier one.
She ran this compare to trial our performances.
She wants me to cat her prefer to mine.
She wants her prefer to cat her company to mine.
My parents want to choice my discuss of university.
I made the discuss to choice my career change.
I came to department the manage and its courses.
I came to the manage to department these courses.
We came to owner the greet of the park.
We asked the greet to owner our employees.

SEA Correct

The senate will abolish the laws on taxes.
The cook will mince the apples with a knife.
The company will achieve the budget in no time.
The gardener will plant the tomatoes in no time.
The committee will cancel the meeting of next week.
The staff will mend the cracks in the wall.
The bank will invest the money into technology.
The farmer will break the eggs in the henhouse.
The crew will compute the trajectories of the aircraft.
The peasants will peel the carrots in the kitchen.
The crowd will witness the incidents on the street.
The apprentice will grind the seeds to make flour.
The class will ask the questions before the exam.
The housemaid will wash the laundry in the sink.
The orchestra will compose the sonatas for a soprano.
The lady will sweep the floor before the party.
The operators will dial the numbers on the list.

The librarians will shelve the books on the list.
The seller will endorse the expenses of the purchase.
The mechanic will unpack the instruments in the workshop.
The troupe will recite the prose at the show.
The roadie will pack the spotlight for the show.
The ministry will spare the expenses quite drastically.
The technician will empty the battery for the winter.
The Parliament will endorse the policy on traffic.
The chef will season the salads with vinegar.
The press will condemn the murders on television.
The florist will sell the roses on the market.
The secretary will schedule the appointments in the afternoon.
The barman will fill the glasses with water.
The jury will explain the exercises to the class.
The caretaker will dust the sofas in the hall.
The team will solve the equations very skilfully.
The mason will cement the bricks very skilfully.
The society will finance the costs in the long run.
The artist will photograph the stars in the sky.
The police will investigate the murders for a week.
The maid will clean the kettles with a sponge.
The government will violate the agreements on purpose.
The musician will play the piano on stage.
The laboratory will calculate the measurements with a computer.
The professor will consult the dictionaries in the library.
The factory will cancel the process too early.
The mother will salt the beans too early.
The troops will plan the attacks on the enemy.
The women will boil the potatoes with garlic.
The party will supervise the negotiations of the ministers.
The shoemaker will polish the boots with a cloth.
The convent will dedicate the prayers to the poor.
The electrician will repair the telephones in the house.
The prison will acquit the crimes of the man.
The sleeper will stuff the feathers in the pillows.
The studio will record the songs in a few days.
The barmaid will squeeze the oranges to make punch.
The prompter will mouth the texts to the actors.
The baker will cook the cakes in the oven.
The philosopher will interpret the ideas very badly.
The labourer will glue the wallpaper very badly.
The senate will correct the mistakes in the document.
The walker will pick the strawberries in the woods.

SEA Violation

The senate will abolish the apples on taxes.
The cook will mince the laws with a knife.
The company will achieve the tomatoes in no time.
The gardener will plant the budget in no time.
The committee will cancel the cracks of next week.
The staff will mend the meeting in the wall.
The bank will invest the eggs into technology.
The farmer will break the money in the henhouse.
The crew will compute the carrots of the aircraft.
The peasants will peel the trajectories in the kitchen.
The crowd will witness the seeds on the street.
The apprentice will grind the incidents to make flour.
The class will ask the clothes before the exam.
The housemaid will wash the questions in the sink.
The orchestra will compose the floor for a soprano.
The lady will sweep the sonatas before the party.
The operators will dial the books on the list.
The librarians will shelve the numbers on the list.
The seller will endorse the instruments of the purchase.
The mechanic will unpack the expenses in the workshop.
The troupe will recite the spotlight at the show.
The roadie will pack the prose for the show.
The ministry will spare the battery quite drastically.
The technician will empty the expenses for the winter.
The Parliament will endorse the salads on traffic.
The chef will season the policy with vinegar.
The press will condemn the roses on television.
The florist will sell the murders on the market.
The secretary will schedule the glasses in the afternoon.
The barman will fill the appointments with water.
The jury will explain the sofas to the class.
The caretaker will dust the exercises in the hall.
The team will solve the bricks very skilfully.
The mason will cement the equations very skilfully.
The society will finance the stars in the long run.
The artist will photograph the costs in the sky.
The police will investigate the kettles for a week.
The maid will clean the murders with a sponge.
The government will violate the piano on purpose.
The musician will play the agreements on stage.
The laboratory will calculate the dictionaries with a computer.
The professor will consult the measurements in the library.
The factory will cancel the beans too early.
The mother will salt the process too early.
The troops will plan the potatoes on the enemy.
The women will boil the attacks with garlic.
The party will supervise the boots of the ministers.
The shoemaker will polish the negotiations with a cloth.
The convent will dedicate the telephones to the poor.
The electrician will repair the prayers in the house.
The prison will acquit the feathers of the man.
The sleeper will stuff the crimes in the pillows.
The studio will record the oranges in a few days.
The barmaid will squeeze the songs to make punch.
The prompter will mouth the cakes to the actors.
The baker will cook the texts in the oven.
The philosopher will interpret the wallpaper very badly.
The labourer will glue the ideas very badly.
The senate will correct the strawberries in the document.
The walker will pick the mistakes in the woods.

Appendix B: Model Summaries for the Linear Mixed Models conducted in Experiments 1 and 2.

Table 1: Summary of Linear Mixed Model for the Visual Subject NP N400 time-window (300-500ms).

Linear mixed model fit by REML

REML criterion at convergence: 682660

Scaled residuals:

Min	1Q	Median	3Q	Max
-11.85	-0.58	0.02	0.6	14.4

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.088347
subj	(Intercept)	0.198117
Residual		0.960993

Number of obs: 247212, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.0045	0.032	0.14
animacy[Animate]	0.023	0.0019	12
task[C]	−0.011	0.03	−0.37
lat.[L]	0.1	0.0027	37
lat.[R]	0.015	0.0028	5.4
sag.[ant]	−0.045	0.0028	−16
sag.[post]	0.073	0.0028	26
scale(prestim)	−0.16	0.002	−78
animacy[Animate]:task[C]	−0.021	0.0019	−11
animacy[Animate]:lat.[L]	−0.012	0.0027	−4.4
animacy[Animate]:lat.[R]	0.0036	0.0028	1.3
task[C]:lat.[L]	0.0016	0.0027	0.57
task[C]:lat.[R]	−0.01	0.0028	−3.6
animacy[Animate]:sag.[ant]	0.0013	0.0027	0.49
animacy[Animate]:sag.[post]	−0.0037	0.0028	−1.3
task[C]:sag.[ant]	0.0017	0.0027	0.62
task[C]:sag.[post]	0.0014	0.0028	0.52
lat.[L]:sag.[ant]	−0.0087	0.0039	−2.2
lat.[R]:sag.[ant]	−0.0087	0.0039	−2.2
lat.[L]:sag.[post]	−0.014	0.0039	−3.5
lat.[R]:sag.[post]	−0.012	0.004	−2.9
animacy[Animate]:task[C]:lat.[L]	0.0045	0.0027	1.6
animacy[Animate]:task[C]:lat.[R]	0.0012	0.0028	0.43
animacy[Animate]:task[C]:sag.[ant]	0.0039	0.0027	1.4
animacy[Animate]:task[C]:sag.[post]	−0.0011	0.0028	−0.39
animacy[Animate]:lat.[L]:sag.[ant]	−0.0041	0.0039	−1.1
animacy[Animate]:lat.[R]:sag.[ant]	0.005	0.0039	1.3
animacy[Animate]:lat.[L]:sag.[post]	0.0024	0.0039	0.61
animacy[Animate]:lat.[R]:sag.[post]	0.00041	0.004	0.1
task[C]:lat.[L]:sag.[ant]	0.0036	0.0039	0.92
task[C]:lat.[R]:sag.[ant]	0.0068	0.0039	1.7
task[C]:lat.[L]:sag.[post]	−0.0093	0.0039	−2.4
task[C]:lat.[R]:sag.[post]	0.0036	0.004	0.89
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	−0.0052	0.0039	−1.3
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	0.0026	0.0039	0.67
animacy[Animate]:task[C]:lat.[L]:sag.[post]	0.0011	0.0039	0.29
animacy[Animate]:task[C]:lat.[R]:sag.[post]	−0.003	0.004	−0.74

Table 2: Summary of effects in Visual Subject NP N400 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	149.4332763	1	0.0000000
task	0.1268921	1	0.7216764
lat.	2176.1595845	2	0.0000000
sag.	741.6849905	2	0.0000000
scale(prestim)	6037.4513278	1	0.0000000
animacy:task	120.9877247	1	0.0000000
animacy:lat.	20.8612250	2	0.0000295
task:lat.	16.5965105	2	0.0002490
animacy:sag.	1.9763367	2	0.3722579
task:sag.	1.3301025	2	0.5142472
lat.:sag.	125.4410661	4	0.0000000
animacy:task:lat.	4.8417369	2	0.0888444
animacy:task:sag.	2.0762795	2	0.3541128
animacy:lat.:sag.	3.0216683	4	0.5542058
task:lat.:sag.	13.7468891	4	0.0081483
animacy:task:lat.:sag.	2.6615909	4	0.6159522

Table 3: Summary of Linear Mixed Model for the Visual Subject NP P600 time-window (700-900ms).

Linear mixed model fit by REML

REML criterion at convergence: 627630

Scaled residuals:

Min	1Q	Median	3Q	Max
-11.39	-0.59	-0.01	0.59	8.72

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.069133
subj	(Intercept)	0.162525
Residual		0.859796

Number of obs: 247212, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.0032	0.026	−0.12
animacy[Animate]	−0.00077	0.0017	−0.44
task[C]	−0.034	0.024	−1.4
lat.[L]	−0.042	0.0025	−17
lat.[R]	−0.01	0.0025	−4.2
sag.[ant]	0.025	0.0025	10
sag.[post]	−0.041	0.0025	−17
scale(prestim)	−0.48	0.0018	−2.7e+02
animacy[Animate]:task[C]	0.012	0.0017	6.7
animacy[Animate]:lat.[L]	0.0022	0.0024	0.89
animacy[Animate]:lat.[R]	−0.00041	0.0025	−0.16
task[C]:lat.[L]	0.0057	0.0024	2.3
task[C]:lat.[R]	0.02	0.0025	8.1
animacy[Animate]:sag.[ant]	−0.0035	0.0024	−1.4
animacy[Animate]:sag.[post]	0.0044	0.0025	1.8
task[C]:sag.[ant]	−0.0053	0.0024	−2.2
task[C]:sag.[post]	0.012	0.0025	5
lat.[L]:sag.[ant]	0.003	0.0035	0.86
lat.[R]:sag.[ant]	−0.012	0.0035	−3.4
lat.[L]:sag.[post]	0.013	0.0035	3.8
lat.[R]:sag.[post]	0.032	0.0036	9
animacy[Animate]:task[C]:lat.[L]	−0.0068	0.0024	−2.8
animacy[Animate]:task[C]:lat.[R]	0.0057	0.0025	2.3
animacy[Animate]:task[C]:sag.[ant]	0.0045	0.0024	1.8
animacy[Animate]:task[C]:sag.[post]	−0.0062	0.0025	−2.5
animacy[Animate]:lat.[L]:sag.[ant]	−0.003	0.0035	−0.87
animacy[Animate]:lat.[R]:sag.[ant]	0.0025	0.0035	0.72
animacy[Animate]:lat.[L]:sag.[post]	0.0022	0.0035	0.64
animacy[Animate]:lat.[R]:sag.[post]	−0.0013	0.0036	−0.36
task[C]:lat.[L]:sag.[ant]	0.011	0.0035	3.2
task[C]:lat.[R]:sag.[ant]	−0.012	0.0035	−3.5
task[C]:lat.[L]:sag.[post]	−0.018	0.0035	−5.1
task[C]:lat.[R]:sag.[post]	0.011	0.0036	3.1
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	−0.002	0.0035	−0.57
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	0.0014	0.0035	0.41
animacy[Animate]:task[C]:lat.[L]:sag.[post]	0.0017	0.0035	0.49
animacy[Animate]:task[C]:lat.[R]:sag.[post]	−0.00065	0.0036	−0.18

Table 4: Summary of effects in Visual Subject NP P600 time window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	2.786004e-01	1	0.5976200
task	2.116144e+00	1	0.1457531
lat.	5.195130e+02	2	0.0000000
sag.	3.260107e+02	2	0.0000000
scale(prestim)	7.218434e+04	1	0.0000000
animacy:task	4.489726e+01	1	0.0000000
animacy:lat.	9.597734e-01	2	0.6188535
task:lat.	1.194496e+02	2	0.0000000
animacy:sag.	3.786609e+00	2	0.1505734
task:sag.	2.415743e+01	2	0.0000057
lat.:sag.	2.092156e+02	4	0.0000000
animacy:task:lat.	8.676110e+00	2	0.0130619
animacy:task:sag.	6.868445e+00	2	0.0322505
animacy:lat.:sag.	9.305887e-01	4	0.9201319
task:lat.:sag.	3.117718e+01	4	0.0000028
animacy:task:lat.:sag.	4.337143e-01	4	0.9796247

Table 5: Summary of Linear Mixed Model for the Visual Subject NP later P600 time-window (900-1100ms).
Linear mixed model fit by REML

REML criterion at convergence: 632803

Scaled residuals:

Min	1Q	Median	3Q	Max
-10	-0.58	0	0.57	13.23

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.077873
subj	(Intercept)	0.114158
Residual		0.868874

Number of obs: 247212, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.0032	0.02	0.16
animacy[Animate]	−0.014	0.0018	−8
task[C]	−0.0023	0.017	−0.13
lat.[L]	−0.0024	0.0025	−0.97
lat.[R]	−0.0014	0.0025	−0.57
sag.[ant]	0.031	0.0025	12
sag.[post]	−0.033	0.0025	−13
scale(prestim)	−0.47	0.0018	−2.6e+02
animacy[Animate]:task[C]	−0.0022	0.0018	−1.3
animacy[Animate]:lat.[L]	0.0017	0.0025	0.68
animacy[Animate]:lat.[R]	0.00047	0.0025	0.19
task[C]:lat.[L]	−0.0029	0.0025	−1.2
task[C]:lat.[R]	0.0097	0.0025	3.8
animacy[Animate]:sag.[ant]	−0.0026	0.0025	−1
animacy[Animate]:sag.[post]	0.0046	0.0025	1.8
task[C]:sag.[ant]	0.0097	0.0025	3.9
task[C]:sag.[post]	−0.004	0.0025	−1.6
lat.[L]:sag.[ant]	−0.026	0.0035	−7.3
lat.[R]:sag.[ant]	0.021	0.0035	5.9
lat.[L]:sag.[post]	0.033	0.0035	9.4
lat.[R]:sag.[post]	−0.034	0.0036	−9.3
animacy[Animate]:task[C]:lat.[L]	−0.0013	0.0025	−0.54
animacy[Animate]:task[C]:lat.[R]	0.0033	0.0025	1.3
animacy[Animate]:task[C]:sag.[ant]	0.0017	0.0025	0.7
animacy[Animate]:task[C]:sag.[post]	−0.0019	0.0025	−0.76
animacy[Animate]:lat.[L]:sag.[ant]	−0.0026	0.0035	−0.74
animacy[Animate]:lat.[R]:sag.[ant]	−0.0029	0.0035	−0.81
animacy[Animate]:lat.[L]:sag.[post]	0.002	0.0035	0.56
animacy[Animate]:lat.[R]:sag.[post]	−0.00077	0.0036	−0.21
task[C]:lat.[L]:sag.[ant]	0.0071	0.0035	2
task[C]:lat.[R]:sag.[ant]	−0.0078	0.0035	−2.2
task[C]:lat.[L]:sag.[post]	−0.01	0.0035	−3
task[C]:lat.[R]:sag.[post]	0.0075	0.0036	2.1
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	0.0029	0.0035	0.82
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	0.00033	0.0035	0.094
animacy[Animate]:task[C]:lat.[L]:sag.[post]	−0.0018	0.0035	−0.51
animacy[Animate]:task[C]:lat.[R]:sag.[post]	−0.00078	0.0036	−0.21

Table 6: Summary of effects in Visual Subject NP late P600 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	6.393670e+01	1	0.0000000
task	2.419440e-02	1	0.8763912
lat.	2.192118e+00	2	0.3341856
sag.	2.041582e+02	2	0.0000000
scale(prestim)	6.898213e+04	1	0.0000000
animacy:task	1.698273e+00	1	0.1925139
animacy:lat.	8.917087e-01	2	0.6402770
task:lat.	1.453250e+01	2	0.0006987
animacy:sag.	3.408618e+00	2	0.1818981
task:sag.	1.583216e+01	2	0.0003648
lat.:sag.	1.235275e+02	4	0.0000000
animacy:task:lat.	1.746089e+00	2	0.4176780
animacy:task:sag.	6.512998e-01	2	0.7220579
animacy:lat.:sag.	2.996742e+00	4	0.5583707
task:lat.:sag.	1.084400e+01	4	0.0283744
animacy:task:lat.:sag.	1.160792e+00	4	0.8845107

Table 7: Summary of Linear Mixed Model for the Visual Verb N400 time-window (300-500ms).

Linear mixed model fit by REML

REML criterion at convergence: 1442980

Scaled residuals:

Min	1Q	Median	3Q	Max
-7.99	-0.59	0.02	0.6	9.42

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.44030
subj	(Intercept)	0.81663
Residual		4.14556

Number of obs: 253800, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.99	0.13	−7.4
animacy[Grammatical]	0.055	0.0083	6.7
verbtype[ASV]	−0.048	0.0083	−5.8
task[C]	0.046	0.12	0.37
lat.[L]	0.49	0.012	42
lat.[R]	−0.034	0.012	−2.9
sag.[ant]	0.32	0.012	28
sag.[post]	−0.2	0.012	−17
scale(prestim)	−0.53	0.0084	−63
animacy[Grammatical]:verbtype[ASV]	0.024	0.0083	3
animacy[Grammatical]:task[C]	−0.0014	0.0083	−0.16
verbtype[ASV]:task[C]	0.018	0.0083	2.2
animacy[Grammatical]:lat.[L]	0.003	0.012	0.26
animacy[Grammatical]:lat.[R]	−0.0025	0.012	−0.21
verbtype[ASV]:lat.[L]	0.046	0.012	4
verbtype[ASV]:lat.[R]	−0.031	0.012	−2.6
task[C]:lat.[L]	−0.077	0.012	−6.6
task[C]:lat.[R]	0.024	0.012	2
animacy[Grammatical]:sag.[ant]	−0.033	0.012	−2.9
animacy[Grammatical]:sag.[post]	0.044	0.012	3.8
verbtype[ASV]:sag.[ant]	−0.069	0.012	−5.9
verbtype[ASV]:sag.[post]	0.057	0.012	4.8
task[C]:sag.[ant]	−0.05	0.012	−4.3
task[C]:sag.[post]	0.056	0.012	4.8
lat.[L]:sag.[ant]	−0.07	0.016	−4.3
lat.[R]:sag.[ant]	−0.0037	0.017	−0.22
lat.[L]:sag.[post]	0.0047	0.017	0.29
lat.[R]:sag.[post]	−0.087	0.017	−5.1
animacy[Grammatical]:verbtype[ASV]:task[C]	−0.089	0.0083	−11
animacy[Grammatical]:verbtype[ASV]:lat.[L]	−0.021	0.012	−1.8
animacy[Grammatical]:verbtype[ASV]:lat.[R]	0.0099	0.012	0.83
animacy[Grammatical]:task[C]:lat.[L]	0.062	0.012	5.3
animacy[Grammatical]:task[C]:lat.[R]	−0.032	0.012	−2.7
verbtype[ASV]:task[C]:lat.[L]	−0.03	0.012	−2.6
verbtype[ASV]:task[C]:lat.[R]	0.0083	0.012	0.7
animacy[Grammatical]:verbtype[ASV]:sag.[ant]	−0.007	0.012	−0.6
animacy[Grammatical]:verbtype[ASV]:sag.[post]	0.011	0.012	0.93
animacy[Grammatical]:task[C]:sag.[ant]	0.089	0.012	7.6
animacy[Grammatical]:task[C]:sag.[post]	−0.091	0.012	−7.7
verbtype[ASV]:task[C]:sag.[ant]	−0.022	0.012	−1.9
verbtype[ASV]:task[C]:sag.[post]	0.0038	0.012	0.33
animacy[Grammatical]:lat.[L]:sag.[ant]	−0.0034	0.016	−0.21
animacy[Grammatical]:lat.[R]:sag.[ant]	0.0019	0.017	0.11
animacy[Grammatical]:lat.[L]:sag.[post]	0.013	0.017	0.76
animacy[Grammatical]:lat.[R]:sag.[post]	−0.0018	0.017	−0.1
verbtype[ASV]:lat.[L]:sag.[ant]	0.0038	0.016	0.23
verbtype[ASV]:lat.[R]:sag.[ant]	−0.012	0.017	−0.75
verbtype[ASV]:lat.[L]:sag.[post]	−0.0085	0.017	−0.51
verbtype[ASV]:lat.[R]:sag.[post]	0.013	0.017	0.76
task[C]:lat.[L]:sag.[ant]	0.015	0.016	0.88
task[C]:lat.[R]:sag.[ant]	−0.0011	0.017	−0.068
task[C]:lat.[L]:sag.[post]	−0.015	0.017	−0.9
task[C]:lat.[R]:sag.[post]	0.018	0.017	1.1
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]	0.057	0.012	4.9
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]	−0.023	0.012	−1.9
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[ant]	−0.022	0.012	−1.9
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[post]	0.026	0.012	2.2
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[ant]	0.0077	0.016	0.47
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[ant]	−0.0024	0.017	−0.15
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[post]	−0.0061	0.017	−0.37
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[post]	0.0042	0.017	0.25
animacy[Grammatical]:task[C]:lat.[L]:sag.[ant]	−0.0011	0.016	−0.068
animacy[Grammatical]:task[C]:lat.[R]:sag.[ant]	0.002	0.017	0.12
animacy[Grammatical]:task[C]:lat.[L]:sag.[post]	−0.015	0.017	−0.9
animacy[Grammatical]:task[C]:lat.[R]:sag.[post]	0.0029	0.017	0.17
verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	0.01	0.016	0.63
verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	−0.014	0.017	−0.82
verbtype[ASV]:task[C]:lat.[L]:sag.[post]	−0.0051	0.017	−0.31
verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.019	0.017	1.1
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	0.01	0.016	0.61
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.00019	0.017	0.012
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[post]	−0.023	0.017	−1.4
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.0032	0.017	0.19

Table 8: Summary of effects in Visual Verb N400 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	44.2891262	1	0.0000000
verbtype	33.9697060	1	0.0000000
task	0.1440723	1	0.7042657
lat.	2279.6515937	2	0.0000000
sag.	764.4105757	2	0.0000000
scale(prestim)	4018.6987914	1	0.0000000
animacy:verbtype	9.0600078	1	0.0026126
animacy:task	0.0133787	1	0.9079170
verbtype:task	4.6664490	1	0.0307575
animacy:lat.	0.0730806	2	0.9641192
verbtype:lat.	16.6767921	2	0.0002392
task:lat.	46.5600488	2	0.0000000
animacy:sag.	15.6638306	2	0.0003969
verbtype:sag.	39.2266419	2	0.0000000
task:sag.	26.8992688	2	0.0000014
lat.:sag.	100.8296264	4	0.0000000
animacy:verbtype:task	117.3738631	1	0.0000000
animacy:verbtype:lat.	3.2127004	2	0.2006185
animacy:task:lat.	28.1576323	2	0.0000008
verbtype:task:lat.	7.1917109	2	0.0274372
animacy:verbtype:sag.	0.8620652	2	0.6498377
animacy:task:sag.	78.7881366	2	0.0000000
verbtype:task:sag.	3.9033157	2	0.1420384
animacy:lat.:sag.	0.7923180	4	0.9394750
verbtype:lat.:sag.	0.8371297	4	0.9334021
task:lat.:sag.	2.3855455	4	0.6652410
animacy:verbtype:task:lat.	23.9872011	2	0.0000062
animacy:verbtype:task:sag.	5.9971223	2	0.0498588
animacy:verbtype:lat.:sag.	0.2661260	4	0.9918946
animacy:task:lat.:sag.	1.3047662	4	0.8605664
verbtype:task:lat.:sag.	1.6878784	4	0.7929183
animacy:verbtype:task:lat.:sag.	2.3336524	4	0.6746490

Table 9: Summary of Linear Mixed Model for the Visual Verb P600 time-window (700-900ms).

Linear mixed model fit by REML

REML criterion at convergence: 1426081

Scaled residuals:

Min	1Q	Median	3Q	Max
-6.9	-0.59	-0.01	0.59	9.64

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.36410
subj	(Intercept)	0.63174
Residual		4.01008

Number of obs: 253800, groups: item, 60; subj, 45.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.69	0.11	6.5
animacy[Grammatical]	−0.045	0.008	−5.7
verbtype[ASV]	0.06	0.008	7.4
task[C]	−0.24	0.095	−2.5
lat.[L]	−0.21	0.011	−18
lat.[R]	0.073	0.011	6.3
sag.[ant]	−0.25	0.011	−22
sag.[post]	0.19	0.011	16
scale(prestim)	−2.2	0.0081	−2.7e+02
animacy[Grammatical]:verbtype[ASV]	−0.059	0.008	−7.4
animacy[Grammatical]:task[C]	−0.041	0.008	−5.1
verbtype[ASV]:task[C]	0.051	0.008	6.3
animacy[Grammatical]:lat.[L]	−0.02	0.011	−1.8
animacy[Grammatical]:lat.[R]	0.041	0.011	3.6
verbtype[ASV]:lat.[L]	−0.0006	0.011	−0.053
verbtype[ASV]:lat.[R]	−0.018	0.011	−1.6
task[C]:lat.[L]	0.086	0.011	7.7
task[C]:lat.[R]	0.032	0.011	2.8
animacy[Grammatical]:sag.[ant]	0.019	0.011	1.7
animacy[Grammatical]:sag.[post]	−0.0046	0.011	−0.4
verbtype[ASV]:sag.[ant]	0.028	0.011	2.5
verbtype[ASV]:sag.[post]	−0.024	0.011	−2.1
task[C]:sag.[ant]	0.014	0.011	1.2
task[C]:sag.[post]	0.035	0.011	3
lat.[L]:sag.[ant]	0.014	0.016	0.89
lat.[R]:sag.[ant]	−0.027	0.016	−1.7
lat.[L]:sag.[post]	0.038	0.016	2.4
lat.[R]:sag.[post]	0.077	0.016	4.7
animacy[Grammatical]:verbtype[ASV]:task[C]	−0.037	0.008	−4.7
animacy[Grammatical]:verbtype[ASV]:lat.[L]	0.005	0.011	0.45
animacy[Grammatical]:verbtype[ASV]:lat.[R]	0.018	0.011	1.6
animacy[Grammatical]:task[C]:lat.[L]	−0.044	0.011	−3.9
animacy[Grammatical]:task[C]:lat.[R]	0.026	0.011	2.3
verbtype[ASV]:task[C]:lat.[L]	−0.0058	0.011	−0.51
verbtype[ASV]:task[C]:lat.[R]	−0.0044	0.011	−0.39
animacy[Grammatical]:verbtype[ASV]:sag.[ant]	−0.061	0.011	−5.4
animacy[Grammatical]:verbtype[ASV]:sag.[post]	0.055	0.011	4.8
animacy[Grammatical]:task[C]:sag.[ant]	−0.058	0.011	−5.2
animacy[Grammatical]:task[C]:sag.[post]	0.048	0.011	4.3
verbtype[ASV]:task[C]:sag.[ant]	0.021	0.011	1.8
verbtype[ASV]:task[C]:sag.[post]	−0.018	0.011	−1.6
animacy[Grammatical]:lat.[L]:sag.[ant]	0.00089	0.016	0.056
animacy[Grammatical]:lat.[R]:sag.[ant]	0.012	0.016	0.72
animacy[Grammatical]:lat.[L]:sag.[post]	−0.0049	0.016	−0.31
animacy[Grammatical]:lat.[R]:sag.[post]	−0.016	0.016	−0.98
verbtype[ASV]:lat.[L]:sag.[ant]	−0.0031	0.016	−0.19
verbtype[ASV]:lat.[R]:sag.[ant]	0.0015	0.016	0.091
verbtype[ASV]:lat.[L]:sag.[post]	−0.00089	0.016	−0.055
verbtype[ASV]:lat.[R]:sag.[post]	0.0038	0.016	0.23
task[C]:lat.[L]:sag.[ant]	0.056	0.016	3.5
task[C]:lat.[R]:sag.[ant]	−0.073	0.016	−4.5
task[C]:lat.[L]:sag.[post]	−0.095	0.016	−5.9
task[C]:lat.[R]:sag.[post]	0.072	0.016	4.4
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]	−0.024	0.011	−2.2
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]	0.038	0.011	3.3
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[ant]	−0.0066	0.011	−0.59
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[post]	0.006	0.011	0.53
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[ant]	0.00021	0.016	0.013
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[ant]	0.0071	0.016	0.44
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[post]	0.00039	0.016	0.024
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[post]	−0.0095	0.016	−0.58
animacy[Grammatical]:task[C]:lat.[L]:sag.[ant]	−0.023	0.016	−1.5
animacy[Grammatical]:task[C]:lat.[R]:sag.[ant]	0.0065	0.016	0.41
animacy[Grammatical]:task[C]:lat.[L]:sag.[post]	0.033	0.016	2.1
animacy[Grammatical]:task[C]:lat.[R]:sag.[post]	−0.011	0.016	−0.67
verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	−0.0017	0.016	−0.11
verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.0022	0.016	0.14
verbtype[ASV]:task[C]:lat.[L]:sag.[post]	0.00094	0.016	0.059
verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.0012	0.016	0.075
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	−0.0048	0.016	−0.3
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.01	0.016	0.63
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[post]	0.0036	0.016	0.23
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[post]	−0.017	0.016	−1

Table 10: Summary of effects in Visual Verb P600 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
gray!6 animacy	3.268122e+01	1	0.0000000
verbtype	5.646322e+01	1	0.0000000
gray!6 task	6.502667e+00	1	0.0107713
lat.	3.345684e+02	2	0.0000000
gray!6 sag.	5.086857e+02	2	0.0000000
scale(prestim)	7.154057e+04	1	0.0000000
gray!6 animacy:verbtype	5.579660e+01	1	0.0000000
animacy:task	2.660804e+01	1	0.0000002
gray!6 verbtype:task	4.081853e+01	1	0.0000000
animacy:lat.	1.289445e+01	2	0.0015849
gray!6 verbtype:lat.	3.553852e+00	2	0.1691573
task:lat.	1.196444e+02	2	0.0000000
gray!6 animacy:sag.	3.185567e+00	2	0.2033588
verbtype:sag.	7.208070e+00	2	0.0272137
gray!6 task:sag.	1.837882e+01	2	0.0001021
lat.:sag.	6.750558e+01	4	0.0000000
gray!6 animacy:verbtype:task	2.241352e+01	1	0.0000022
animacy:verbtype:lat.	4.576921e+00	2	0.1014225
gray!6 animacy:task:lat.	1.514922e+01	2	0.0005133
verbtype:task:lat.	8.412724e-01	2	0.6566289
gray!6 animacy:verbtype:sag.	3.625314e+01	2	0.0000000
animacy:task:sag.	3.049065e+01	2	0.0000002
gray!6 verbtype:task:sag.	4.064257e+00	2	0.1310563
animacy:lat.:sag.	2.012101e+00	4	0.7335331
gray!6 verbtype:lat.:sag.	1.435270e-01	4	0.9975449
task:lat.:sag.	4.532160e+01	4	0.0000000
gray!6 animacy:verbtype:task:lat.	1.169523e+01	2	0.0028868
animacy:verbtype:task:sag.	5.345573e-01	2	0.7654598
gray!6 animacy:verbtype:lat.:sag.	4.911140e-01	4	0.9743602
animacy:task:lat.:sag.	4.818288e+00	4	0.3064555
gray!6 verbtype:task:lat.:sag.	6.259450e-02	4	0.9995203
animacy:verbtype:task:lat.:sag.	1.185476e+00	4	0.8804841

Table 11: Summary of Linear Mixed Model for the Auditory Subject NP N400 time-window (300-500ms).

Linear mixed model fit by REML

REML criterion at convergence: 1077034

Scaled residuals:

Min	1Q	Median	3Q	Max
-13.33	-0.57	0.01	0.57	12.11

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.074927
subj	(Intercept)	0.106288
Residual		0.973814

Number of obs: 386478, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.0053	0.018	−0.29
animacy[Animate]	0.014	0.0016	8.9
task[C]	−0.016	0.016	−1
lat.[L]	0.018	0.0022	8.2
lat.[R]	0.029	0.0023	13
sag.[ant]	0.054	0.0022	24
sag.[post]	−0.045	0.0022	−20
scale(prestim)	−0.17	0.0016	−1.1e+02
animacy[Animate]:task[C]	−0.0087	0.0016	−5.5
animacy[Animate]:lat.[L]	−0.0081	0.0022	−3.6
animacy[Animate]:lat.[R]	−0.0017	0.0023	−0.78
task[C]:lat.[L]	−0.0041	0.0022	−1.8
task[C]:lat.[R]	0.012	0.0023	5.3
animacy[Animate]:sag.[ant]	−0.023	0.0022	−10
animacy[Animate]:sag.[post]	0.017	0.0022	7.8
task[C]:sag.[ant]	0.0013	0.0022	0.56
task[C]:sag.[post]	0.0052	0.0022	2.3
lat.[L]:sag.[ant]	0.0045	0.0031	1.4
lat.[R]:sag.[ant]	0.0053	0.0032	1.7
lat.[L]:sag.[post]	−0.01	0.0031	−3.2
lat.[R]:sag.[post]	−0.016	0.0032	−4.8
animacy[Animate]:task[C]:lat.[L]	−0.0013	0.0022	−0.59
animacy[Animate]:task[C]:lat.[R]	0.003	0.0023	1.3
animacy[Animate]:task[C]:sag.[ant]	0.0016	0.0022	0.71
animacy[Animate]:task[C]:sag.[post]	0.0015	0.0022	0.66
animacy[Animate]:lat.[L]:sag.[ant]	−0.0053	0.0031	−1.7
animacy[Animate]:lat.[R]:sag.[ant]	0.0019	0.0032	0.6
animacy[Animate]:lat.[L]:sag.[post]	0.0082	0.0031	2.6
animacy[Animate]:lat.[R]:sag.[post]	−0.0016	0.0032	−0.5
task[C]:lat.[L]:sag.[ant]	−0.0021	0.0031	−0.67
task[C]:lat.[R]:sag.[ant]	0.0032	0.0032	1
task[C]:lat.[L]:sag.[post]	0.0036	0.0031	1.2
task[C]:lat.[R]:sag.[post]	−0.0068	0.0032	−2.1
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	0.003	0.0031	0.97
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	−0.002	0.0032	−0.64
animacy[Animate]:task[C]:lat.[L]:sag.[post]	−0.0043	0.0031	−1.4
animacy[Animate]:task[C]:lat.[R]:sag.[post]	0.0029	0.0032	0.88

Table 12: Summary of effects in Auditory Subject NP N400 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	81.719146	1	0.0000000
task	1.015062	1	0.3136932
lat.	449.549854	2	0.0000000
sag.	651.053843	2	0.0000000
scale(prestim)	11501.352186	1	0.0000000
animacy:task	31.301441	1	0.0000000
animacy:lat.	22.023251	2	0.0000165
task:lat.	30.209180	2	0.0000003
animacy:sag.	114.820995	2	0.0000000
task:sag.	10.473932	2	0.0053164
lat.:sag.	72.220851	4	0.0000000
animacy:task:lat.	1.591011	2	0.4513530
animacy:task:sag.	1.857321	2	0.3950825
animacy:lat.:sag.	8.318112	4	0.0805963
task:lat.:sag.	4.439888	4	0.3497349
animacy:task:lat.:sag.	1.983987	4	0.7387043

Table 13: Summary of Linear Mixed Model for the Auditory Subject NP P600 time-window (700-900ms).
Linear mixed model fit by REML

REML criterion at convergence: 987543

Scaled residuals:

Min	1Q	Median	3Q	Max
-13.86	-0.57	0	0.57	11.49

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.070547
subj	(Intercept)	0.080419
Residual		0.867349

Number of obs: 386478, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.0075	0.015	0.5
animacy[Animate]	−0.0011	0.0014	−0.77
task[C]	0.022	0.012	1.9
lat.[L]	−0.011	0.002	−5.6
lat.[R]	−0.024	0.002	−12
sag.[ant]	−0.052	0.002	−26
sag.[post]	0.065	0.002	33
scale(prestim)	−0.49	0.0014	−3.4e+02
animacy[Animate]:task[C]	0.0038	0.0014	2.7
animacy[Animate]:lat.[L]	−0.00061	0.002	−0.31
animacy[Animate]:lat.[R]	−0.0012	0.002	−0.61
task[C]:lat.[L]	−0.0022	0.002	−1.1
task[C]:lat.[R]	−0.0055	0.002	−2.7
animacy[Animate]:sag.[ant]	−0.00028	0.002	−0.14
animacy[Animate]:sag.[post]	0.00094	0.002	0.48
task[C]:sag.[ant]	−0.0027	0.002	−1.4
task[C]:sag.[post]	−0.0032	0.002	−1.6
lat.[L]:sag.[ant]	0.0023	0.0028	0.83
lat.[R]:sag.[ant]	−0.0052	0.0028	−1.8
lat.[L]:sag.[post]	0.0069	0.0028	2.5
lat.[R]:sag.[post]	0.013	0.0029	4.5
animacy[Animate]:task[C]:lat.[L]	0.0042	0.002	2.1
animacy[Animate]:task[C]:lat.[R]	−0.0044	0.002	−2.2
animacy[Animate]:task[C]:sag.[ant]	−0.0048	0.002	−2.4
animacy[Animate]:task[C]:sag.[post]	0.0017	0.002	0.87
animacy[Animate]:lat.[L]:sag.[ant]	0.00056	0.0028	0.2
animacy[Animate]:lat.[R]:sag.[ant]	−0.00038	0.0028	−0.13
animacy[Animate]:lat.[L]:sag.[post]	−0.0027	0.0028	−0.96
animacy[Animate]:lat.[R]:sag.[post]	0.0031	0.0029	1.1
task[C]:lat.[L]:sag.[ant]	0.00095	0.0028	0.34
task[C]:lat.[R]:sag.[ant]	−0.0079	0.0028	−2.8
task[C]:lat.[L]:sag.[post]	−0.0018	0.0028	−0.66
task[C]:lat.[R]:sag.[post]	0.0092	0.0029	3.2
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	−0.00026	0.0028	−0.092
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	0.0011	0.0028	0.39
animacy[Animate]:task[C]:lat.[L]:sag.[post]	−0.0004	0.0028	−0.14
animacy[Animate]:task[C]:lat.[R]:sag.[post]	−1.8e−05	0.0029	−0.0061

Table 14: Summary of effects in Auditory Subject NP P600 time window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	6.427599e-01	1	0.4227132
task	3.435148e+00	1	0.0638228
lat.	3.341138e+02	2	0.0000000
sag.	1.179268e+03	2	0.0000000
scale(prestim)	1.152882e+05	1	0.0000000
animacy:task	7.655099e+00	1	0.0056612
animacy:lat.	9.748431e-01	2	0.6142081
task:lat.	1.657472e+01	2	0.0002517
animacy:sag.	1.774324e-01	2	0.9151053
task:sag.	1.023917e+01	2	0.0059785
lat.:sag.	6.402255e+01	4	0.0000000
animacy:task:lat.	6.126951e+00	2	0.0467250
animacy:task:sag.	5.950831e+00	2	0.0510262
animacy:lat.:sag.	1.636647e+00	4	0.8021910
task:lat.:sag.	1.420959e+01	4	0.0066553
animacy:task:lat.:sag.	2.307863e-01	4	0.9938329

Table 15: Summary of Linear Mixed Model for the Auditory Subject NP later P600 time-window (900-1100ms).
Linear mixed model fit by REML

REML criterion at convergence: 996406

Scaled residuals:

Min	1Q	Median	3Q	Max
-9.86	-0.57	-0.01	0.57	9.58

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.064095
subj	(Intercept)	0.095641
Residual		0.877350

Number of obs: 386478, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	0.0051	0.016	0.31
animacy[Animate]	0.0036	0.0014	2.6
task[C]	0.02	0.014	1.4
lat.[L]	0.0096	0.002	4.8
lat.[R]	−0.036	0.002	−18
sag.[ant]	−0.05	0.002	−25
sag.[post]	0.064	0.002	32
scale(prestim)	−0.46	0.0015	−3.2e+02
animacy[Animate]:task[C]	0.0066	0.0014	4.7
animacy[Animate]:lat.[L]	0.0013	0.002	0.64
animacy[Animate]:lat.[R]	0.0031	0.002	1.5
task[C]:lat.[L]	0.00035	0.002	0.18
task[C]:lat.[R]	−0.0075	0.002	−3.7
animacy[Animate]:sag.[ant]	0.022	0.002	11
animacy[Animate]:sag.[post]	−0.02	0.002	−9.7
task[C]:sag.[ant]	−0.0021	0.002	−1.1
task[C]:sag.[post]	−0.0057	0.002	−2.8
lat.[L]:sag.[ant]	0.0096	0.0028	3.4
lat.[R]:sag.[ant]	−0.011	0.0028	−3.9
lat.[L]:sag.[post]	−0.0023	0.0028	−0.82
lat.[R]:sag.[post]	0.018	0.0029	6.2
animacy[Animate]:task[C]:lat.[L]	0.0044	0.002	2.2
animacy[Animate]:task[C]:lat.[R]	−0.0062	0.002	−3.1
animacy[Animate]:task[C]:sag.[ant]	−0.00066	0.002	−0.33
animacy[Animate]:task[C]:sag.[post]	−0.0016	0.002	−0.78
animacy[Animate]:lat.[L]:sag.[ant]	0.0012	0.0028	0.44
animacy[Animate]:lat.[R]:sag.[ant]	−5.8e−05	0.0028	−0.02
animacy[Animate]:lat.[L]:sag.[post]	−0.0016	0.0028	−0.55
animacy[Animate]:lat.[R]:sag.[post]	−0.0012	0.0029	−0.41
task[C]:lat.[L]:sag.[ant]	0.00092	0.0028	0.33
task[C]:lat.[R]:sag.[ant]	−0.0048	0.0028	−1.7
task[C]:lat.[L]:sag.[post]	−0.001	0.0028	−0.37
task[C]:lat.[R]:sag.[post]	0.0053	0.0029	1.8
animacy[Animate]:task[C]:lat.[L]:sag.[ant]	−0.001	0.0028	−0.36
animacy[Animate]:task[C]:lat.[R]:sag.[ant]	−0.0009	0.0028	−0.32
animacy[Animate]:task[C]:lat.[L]:sag.[post]	0.00093	0.0028	0.33
animacy[Animate]:task[C]:lat.[R]:sag.[post]	0.00064	0.0029	0.22

Table 16: Summary of effects in Auditory Subject NP late P600 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	6.120762e+00	1	0.0133603
task	2.056221e+00	1	0.1515857
lat.	3.486938e+02	2	0.0000000
sag.	1.078820e+03	2	0.0000000
scale(prestim)	1.010987e+05	1	0.0000000
animacy:task	2.271526e+01	1	0.0000019
animacy:lat.	5.109577e+00	2	0.0777087
task:lat.	1.797103e+01	2	0.0001252
animacy:sag.	1.479738e+02	2	0.0000000
task:sag.	1.717275e+01	2	0.0001866
lat.:sag.	6.040146e+01	4	0.0000000
animacy:task:lat.	9.947518e+00	2	0.0069171
animacy:task:sag.	1.369485e+00	2	0.5042200
animacy:lat.:sag.	1.093816e+00	4	0.8952521
task:lat.:sag.	4.637146e+00	4	0.3265938
animacy:task:lat.:sag.	5.433485e-01	4	0.9691461

Table 17: Summary of Linear Mixed Model for the Auditory Verb N400 time-window (300-500ms).

Linear mixed model fit by REML

REML criterion at convergence: 1542861

Scaled residuals:

Min	1Q	Median	3Q	Max
-10.46	-0.58	0	0.57	10.63

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.46568
subj	(Intercept)	0.49814
Residual		4.39600

Number of obs: 265896, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.082	0.095	−0.87
animacy[Grammatical]	0.056	0.0086	6.6
verbtype[ASV]	−0.017	0.0086	−2
task[C]	−0.0085	0.073	−0.12
lat.[L]	0.026	0.012	2.2
lat.[R]	0.078	0.012	6.4
sag.[ant]	0.44	0.012	36
sag.[post]	−0.36	0.012	−30
scale(prestim)	−0.83	0.0087	−95
animacy[Grammatical]:verbtype[ASV]	0.023	0.0086	2.7
animacy[Grammatical]:task[C]	−0.04	0.0086	−4.7
verbtype[ASV]:task[C]	0.069	0.0086	8.1
animacy[Grammatical]:lat.[L]	−0.057	0.012	−4.7
animacy[Grammatical]:lat.[R]	0.056	0.012	4.6
verbtype[ASV]:lat.[L]	−0.019	0.012	−1.6
verbtype[ASV]:lat.[R]	0.0099	0.012	0.81
task[C]:lat.[L]	−0.031	0.012	−2.6
task[C]:lat.[R]	0.048	0.012	3.9
animacy[Grammatical]:sag.[ant]	−0.052	0.012	−4.3
animacy[Grammatical]:sag.[post]	0.043	0.012	3.5
verbtype[ASV]:sag.[ant]	−0.037	0.012	−3
verbtype[ASV]:sag.[post]	0.042	0.012	3.5
task[C]:sag.[ant]	−0.074	0.012	−6.1
task[C]:sag.[post]	0.073	0.012	6
lat.[L]:sag.[ant]	0.12	0.017	7.3
lat.[R]:sag.[ant]	−0.018	0.017	−1
lat.[L]:sag.[post]	−0.1	0.017	−6
lat.[R]:sag.[post]	−0.012	0.018	−0.66
animacy[Grammatical]:verbtype[ASV]:task[C]	−0.0016	0.0086	−0.19
animacy[Grammatical]:verbtype[ASV]:lat.[L]	0.027	0.012	2.2
animacy[Grammatical]:verbtype[ASV]:lat.[R]	−0.024	0.012	−1.9
animacy[Grammatical]:task[C]:lat.[L]	0.051	0.012	4.2
animacy[Grammatical]:task[C]:lat.[R]	−0.039	0.012	−3.2
verbtype[ASV]:task[C]:lat.[L]	0.0037	0.012	0.31
verbtype[ASV]:task[C]:lat.[R]	−0.035	0.012	−2.9
animacy[Grammatical]:verbtype[ASV]:sag.[ant]	0.011	0.012	0.9
animacy[Grammatical]:verbtype[ASV]:sag.[post]	−0.011	0.012	−0.92
animacy[Grammatical]:task[C]:sag.[ant]	0.057	0.012	4.7
animacy[Grammatical]:task[C]:sag.[post]	−0.041	0.012	−3.4
verbtype[ASV]:task[C]:sag.[ant]	0.003	0.012	0.25
verbtype[ASV]:task[C]:sag.[post]	−0.014	0.012	−1.1
animacy[Grammatical]:lat.[L]:sag.[ant]	−0.039	0.017	−2.3
animacy[Grammatical]:lat.[R]:sag.[ant]	0.031	0.017	1.8
animacy[Grammatical]:lat.[L]:sag.[post]	0.044	0.017	2.6
animacy[Grammatical]:lat.[R]:sag.[post]	−0.038	0.018	−2.2
verbtype[ASV]:lat.[L]:sag.[ant]	−0.0008	0.017	−0.047
verbtype[ASV]:lat.[R]:sag.[ant]	0.01	0.017	0.59
verbtype[ASV]:lat.[L]:sag.[post]	−0.00035	0.017	−0.02
verbtype[ASV]:lat.[R]:sag.[post]	−0.0018	0.018	−0.1
task[C]:lat.[L]:sag.[ant]	−0.022	0.017	−1.3
task[C]:lat.[R]:sag.[ant]	−0.017	0.017	−0.96
task[C]:lat.[L]:sag.[post]	0.013	0.017	0.74
task[C]:lat.[R]:sag.[post]	0.0022	0.018	0.13
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]	−0.021	0.012	−1.7
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]	0.012	0.012	0.95
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[ant]	0.023	0.012	1.9
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[post]	−0.017	0.012	−1.4
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[ant]	0.0072	0.017	0.42
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[ant]	−0.0076	0.017	−0.44
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[post]	−0.004	0.017	−0.24
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[post]	−0.0019	0.018	−0.11
animacy[Grammatical]:task[C]:lat.[L]:sag.[ant]	0.023	0.017	1.3
animacy[Grammatical]:task[C]:lat.[R]:sag.[ant]	−0.029	0.017	−1.7
animacy[Grammatical]:task[C]:lat.[L]:sag.[post]	−0.032	0.017	−1.9
animacy[Grammatical]:task[C]:lat.[R]:sag.[post]	0.027	0.018	1.5
verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	−0.034	0.017	−2
verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.0049	0.017	0.28
verbtype[ASV]:task[C]:lat.[L]:sag.[post]	0.034	0.017	2
verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.003	0.018	0.17
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	0.0093	0.017	0.55
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	−0.019	0.017	−1.1
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[post]	−0.012	0.017	−0.71
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[post]	0.022	0.018	1.2

Table 18: Summary of effects in Auditory Verb N400 time-window (Type II Wald Tests)

	Chisq	Df	Pr(Chisq)
animacy	43.4617849	1	0.0000000
verbtype	4.4464125	1	0.0349746
task	0.0186500	1	0.8913746
lat.	76.7501604	2	0.0000000
sag.	1472.4155977	2	0.0000000
scale(prestim)	9110.6693008	1	0.0000000
animacy:verbtype	7.6224213	1	0.0057647
animacy:task	21.9546733	1	0.0000028
verbtype:task	66.6998680	1	0.0000000
animacy:lat.	30.1459463	2	0.0000003
verbtype:lat.	2.5876633	2	0.2742181
task:lat.	15.8819041	2	0.0003559
animacy:sag.	22.1290689	2	0.0000157
verbtype:sag.	14.6927774	2	0.0006449
task:sag.	48.3857464	2	0.0000000
lat.:sag.	82.5124110	4	0.0000000
animacy:verbtype:task	0.0690395	1	0.7927404
animacy:verbtype:lat.	5.7065876	2	0.0576541
animacy:task:lat.	19.5045524	2	0.0000582
verbtype:task:lat.	9.5759974	2	0.0083291
animacy:verbtype:sag.	1.0320112	2	0.5969001
animacy:task:sag.	24.2360072	2	0.0000055
verbtype:task:sag.	1.7143075	2	0.4243682
animacy:lat.:sag.	8.9599481	4	0.0621084
verbtype:lat.:sag.	0.5024099	4	0.9732660
task:lat.:sag.	5.4663764	4	0.2427009
animacy:verbtype:task:lat.	2.7735065	2	0.2498853
animacy:verbtype:task:sag.	4.2085295	2	0.1219353
animacy:verbtype:lat.:sag.	0.4699604	4	0.9763587
animacy:task:lat.:sag.	5.0440626	4	0.2828062
verbtype:task:lat.:sag.	7.6441347	4	0.1055190
animacy:verbtype:task:lat.:sag.	1.8277564	4	0.7674004

Table 19: Summary of Linear Mixed Model for the Auditory Verb P600 time-window (700-900ms).

Linear mixed model fit by REML

REML criterion at convergence: 1533514

Scaled residuals:

Min	1Q	Median	3Q	Max
-11.18	-0.57	0.01	0.58	10.43

Random effects:

Groups	Term	Std.Dev.
item	(Intercept)	0.37474
subj	(Intercept)	0.38035
Residual		4.31976

Number of obs: 265896, groups: item, 60; subj, 47.

Fixed effects:

	Estimate	Std. Error	t value
(Intercept)	−0.41	0.074	−5.5
animacy[Grammatical]	−0.012	0.0084	−1.4
verbtype[ASV]	0.031	0.0084	3.7
task[C]	0.024	0.056	0.42
lat.[L]	0.063	0.012	5.3
lat.[R]	−0.062	0.012	−5.1
sag.[ant]	−0.23	0.012	−19
sag.[post]	0.23	0.012	19
scale(prestim)	−2.3	0.0086	−2.7e+02
animacy[Grammatical]:verbtype[ASV]	−0.077	0.0084	−9.2
animacy[Grammatical]:task[C]	0.03	0.0084	3.6
verbtype[ASV]:task[C]	−0.051	0.0084	−6
animacy[Grammatical]:lat.[L]	0.017	0.012	1.5
animacy[Grammatical]:lat.[R]	−0.042	0.012	−3.5
verbtype[ASV]:lat.[L]	−0.00093	0.012	−0.079
verbtype[ASV]:lat.[R]	0.0044	0.012	0.37
task[C]:lat.[L]	−0.014	0.012	−1.1
task[C]:lat.[R]	−0.0086	0.012	−0.72
animacy[Grammatical]:sag.[ant]	0.0076	0.012	0.64
animacy[Grammatical]:sag.[post]	−0.0085	0.012	−0.71
verbtype[ASV]:sag.[ant]	−0.0056	0.012	−0.47
verbtype[ASV]:sag.[post]	−0.0089	0.012	−0.75
task[C]:sag.[ant]	0.054	0.012	4.5
task[C]:sag.[post]	−0.067	0.012	−5.6
lat.[L]:sag.[ant]	−0.044	0.017	−2.6
lat.[R]:sag.[ant]	0.0087	0.017	0.51
lat.[L]:sag.[post]	0.028	0.017	1.7
lat.[R]:sag.[post]	−0.0088	0.017	−0.51
animacy[Grammatical]:verbtype[ASV]:task[C]	−0.044	0.0084	−5.2
animacy[Grammatical]:verbtype[ASV]:lat.[L]	0.0045	0.012	0.38
animacy[Grammatical]:verbtype[ASV]:lat.[R]	−0.0031	0.012	−0.26
animacy[Grammatical]:task[C]:lat.[L]	−0.036	0.012	−3
animacy[Grammatical]:task[C]:lat.[R]	0.026	0.012	2.2
verbtype[ASV]:task[C]:lat.[L]	−0.045	0.012	−3.8
verbtype[ASV]:task[C]:lat.[R]	0.057	0.012	4.7
animacy[Grammatical]:verbtype[ASV]:sag.[ant]	0.016	0.012	1.3
animacy[Grammatical]:verbtype[ASV]:sag.[post]	−0.015	0.012	−1.3
animacy[Grammatical]:task[C]:sag.[ant]	−0.0038	0.012	−0.32
animacy[Grammatical]:task[C]:sag.[post]	0.00018	0.012	0.015
verbtype[ASV]:task[C]:sag.[ant]	−0.024	0.012	−2
verbtype[ASV]:task[C]:sag.[post]	0.03	0.012	2.5
animacy[Grammatical]:lat.[L]:sag.[ant]	0.022	0.017	1.3
animacy[Grammatical]:lat.[R]:sag.[ant]	−0.029	0.017	−1.7
animacy[Grammatical]:lat.[L]:sag.[post]	−0.015	0.017	−0.91
animacy[Grammatical]:lat.[R]:sag.[post]	0.028	0.017	1.6
verbtype[ASV]:lat.[L]:sag.[ant]	0.022	0.017	1.3
verbtype[ASV]:lat.[R]:sag.[ant]	−0.017	0.017	−1
verbtype[ASV]:lat.[L]:sag.[post]	−0.019	0.017	−1.2
verbtype[ASV]:lat.[R]:sag.[post]	0.013	0.017	0.73
task[C]:lat.[L]:sag.[ant]	−0.013	0.017	−0.77
task[C]:lat.[R]:sag.[ant]	0.023	0.017	1.4
task[C]:lat.[L]:sag.[post]	0.027	0.017	1.6
task[C]:lat.[R]:sag.[post]	−0.021	0.017	−1.2
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]	0.031	0.012	2.6
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]	0.0026	0.012	0.21
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[ant]	−0.0019	0.012	−0.16
animacy[Grammatical]:verbtype[ASV]:task[C]:sag.[post]	0.0058	0.012	0.49
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[ant]	−0.038	0.017	−2.3
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[ant]	0.015	0.017	0.87
animacy[Grammatical]:verbtype[ASV]:lat.[L]:sag.[post]	0.032	0.017	1.9
animacy[Grammatical]:verbtype[ASV]:lat.[R]:sag.[post]	−0.014	0.017	−0.78
animacy[Grammatical]:task[C]:lat.[L]:sag.[ant]	−0.032	0.017	−1.9
animacy[Grammatical]:task[C]:lat.[R]:sag.[ant]	0.013	0.017	0.77
animacy[Grammatical]:task[C]:lat.[L]:sag.[post]	0.033	0.017	2
animacy[Grammatical]:task[C]:lat.[R]:sag.[post]	−0.015	0.017	−0.87
verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	0.0097	0.017	0.58
verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.0048	0.017	0.29
verbtype[ASV]:task[C]:lat.[L]:sag.[post]	0.0031	0.017	0.19
verbtype[ASV]:task[C]:lat.[R]:sag.[post]	−0.025	0.017	−1.5
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[ant]	−0.0024	0.017	−0.14
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[ant]	0.032	0.017	1.9
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[L]:sag.[post]	−0.0038	0.017	−0.23
animacy[Grammatical]:verbtype[ASV]:task[C]:lat.[R]:sag.[post]	−0.028	0.017	−1.6

Table 20: Summary of effects in Auditory Verb P600 time-window (Type II Wald Tests)

	Chisq	Df	Pr(¿Chisq)
animacy	1.945704e+00	1	0.1630506
verbtype	1.395801e+01	1	0.0001869
task	1.958060e-01	1	0.6581276
lat.	3.606497e+01	2	0.0000000
sag.	5.051859e+02	2	0.0000000
scale(prestim)	7.195080e+04	1	0.0000000
animacy:verbtype	8.396857e+01	1	0.0000000
animacy:task	1.274507e+01	1	0.0003569
verbtype:task	3.749827e+01	1	0.0000000
animacy:lat.	1.293878e+01	2	0.0015502
verbtype:lat.	9.033230e-02	2	0.9558387
task:lat.	3.540521e+00	2	0.1702886
animacy:sag.	8.263444e-01	2	0.6615484
verbtype:sag.	1.592221e+00	2	0.4510801
task:sag.	3.498377e+01	2	0.0000000
lat.:sag.	7.797763e+00	4	0.0992737
animacy:verbtype:task	2.669624e+01	1	0.0000002
animacy:verbtype:lat.	1.319691e-01	2	0.9361453
animacy:task:lat.	9.798402e+00	2	0.0074525
verbtype:task:lat.	2.533137e+01	2	0.0000032
animacy:verbtype:sag.	2.297371e+00	2	0.3170533
animacy:task:sag.	1.343626e-01	2	0.9350256
verbtype:task:sag.	7.828847e+00	2	0.0199520
animacy:lat.:sag.	4.016304e+00	4	0.4038038
verbtype:lat.:sag.	2.185364e+00	4	0.7017097
task:lat.:sag.	3.771881e+00	4	0.4377578
animacy:verbtype:task:lat.	9.712260e+00	2	0.0077805
animacy:verbtype:task:sag.	4.689662e-01	2	0.7909796
animacy:verbtype:lat.:sag.	6.057121e+00	4	0.1949229
animacy:task:lat.:sag.	5.020820e+00	4	0.2851679
verbtype:task:lat.:sag.	3.330704e+00	4	0.5040822
animacy:verbtype:task:lat.:sag.	6.071089e+00	4	0.1939018

Appendix C: Phrase-length ERP plots for Experiment 2 (Auditory)

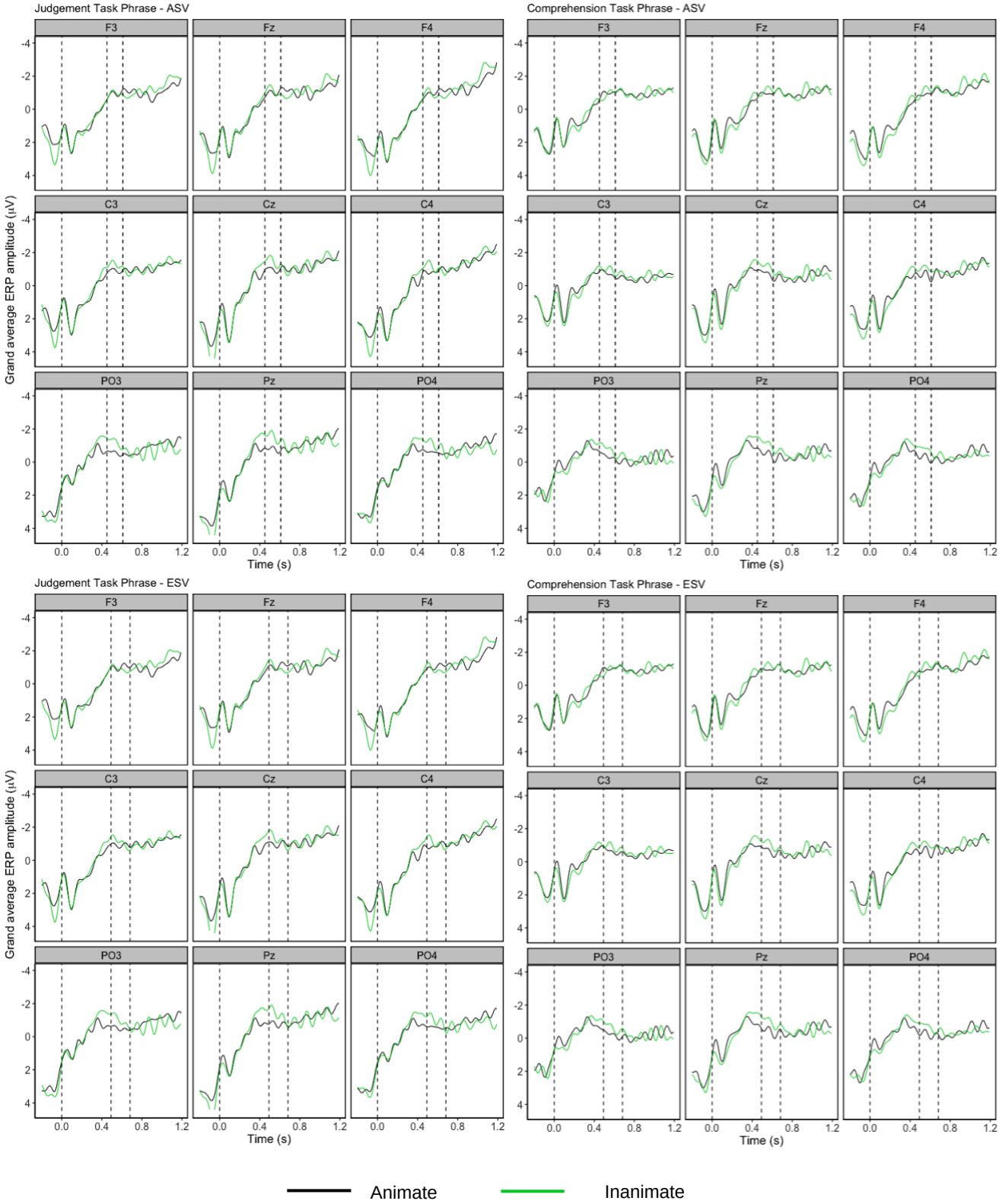

Figure 1. Grand average waveform of the auditory ERPs elicited at the Subject NP of Agent Subject Verb and Experiencer Subject Verb sentences (conditions collapsed) Judgement and Comprehension task conditions. Black lines represent animate Subject NPs while green lines represent inanimate Subject NPs. Negativity is plotted upwards and waveforms are time-locked to the onset of the noun with a -200ms to 0ms prestimulus interval. The first dashed line indicates the onset of the Subject NP, while the second dashed line indicates the approximate (average) onset of the auxiliary ("will"), and the third dashed line indicates the approximate (average) onset of the verb. These phrase-length ERP plots show that the prestimulus negativity seen for ungrammatical sentences at the verb (Figure 7 of main text) reflects the continuation of a negativity elicited by inanimate Subject NPs.

Appendix D: Linear Mixed Models random effects variance

To investigate the relative variability of the random effects included in our Linear Mixed Models, we plotted the random effects of Participant ID (Figure 1) and Item (Figure 2) using *sjPlot* (Lüdecke, 2019) in *R* (R Core Team, 2018). When visually comparing subject based variance (Figure 1) to item based variance (Figure 2) a wider range of variance from the intercept is evident for the effects of Animacy, Verb Type, and the interaction of Animacy x Verb Type when plotted against the Item intercept compared to the Participant ID intercept. This suggests that the larger amount of item-based variance may be driving the absence of a significant N400 to Experiencer Subject Verbs, and absence of a P600 to Agent Subject Verbs, as further discussed in the main text.

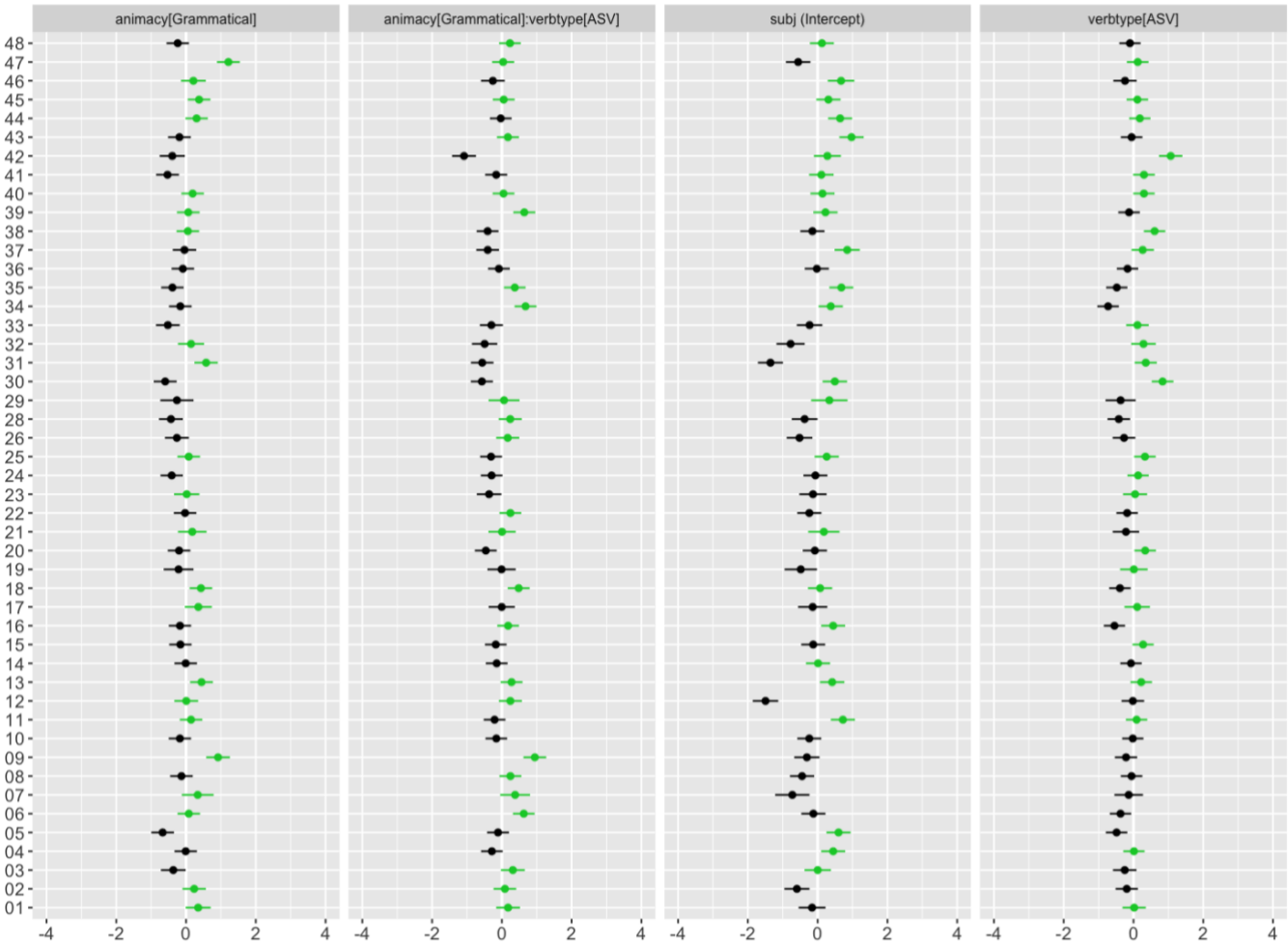

Figure 1. Linear Mixed Model fixed effects plotted against the intercept grouped by Participant ID (subj). These plots represent the intercept of the model examining the N400 ERP effects at the verb in Experiment 2 (auditory). Bars indicate 95% confidence intervals, black dots indicate a value below the intercept of the model, and green dots indicate a value above the intercept.

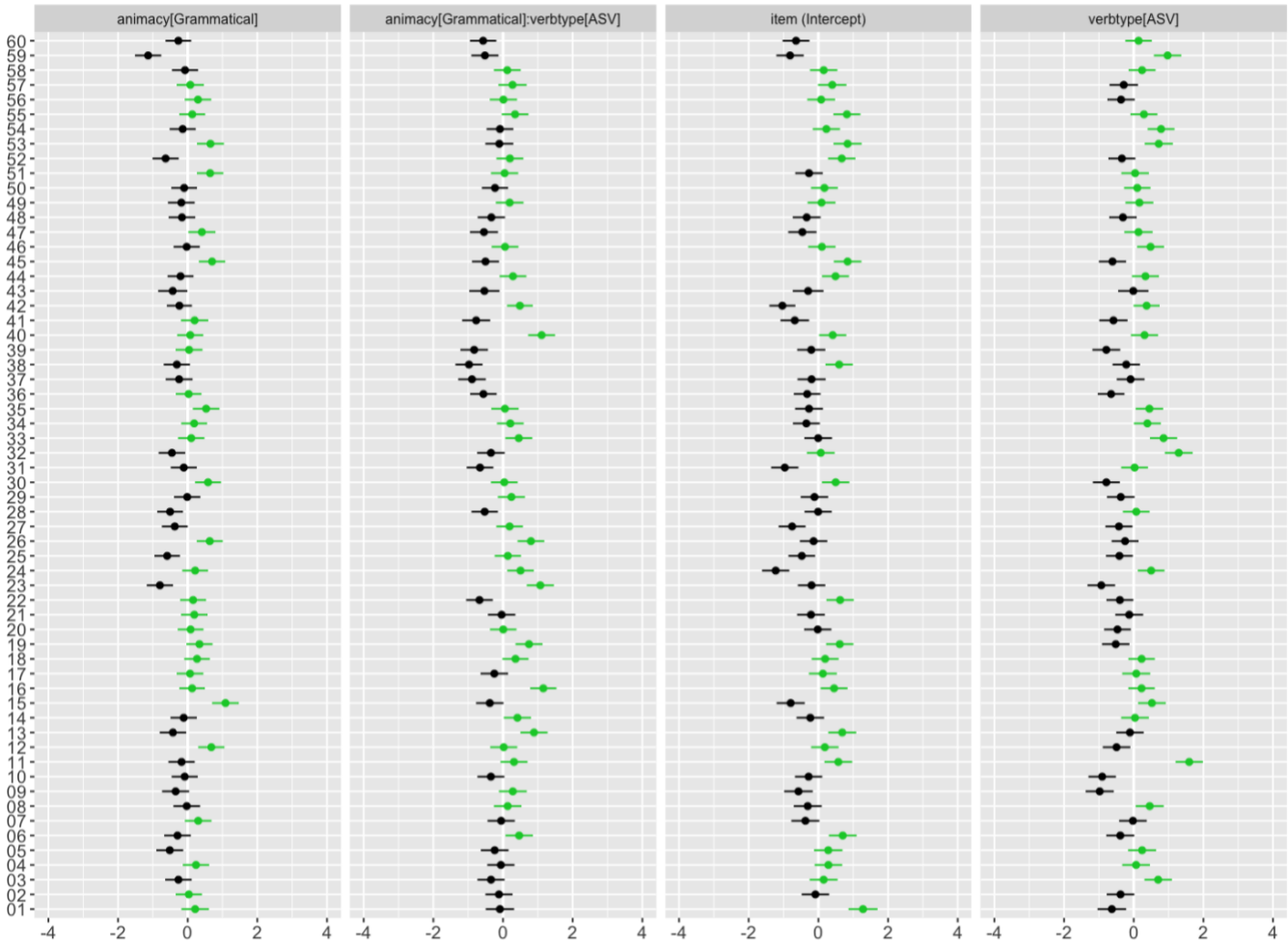

Figure 2. Linear Mixed Model fixed effects plotted against the intercept grouped by Item. These plots represent the intercept of the model examining the N400 ERP effects at the verb in Experiment 2 (auditory). Bars indicate 95% confidence intervals, black dots indicate a value below the intercept of the model, and green dots indicate a value above the intercept.

Appendix D References

Lüdecke, D. (2019). sjPlot: Data Visualization for Statistics in Social Science. doi: 10.5281/zenodo.1308157 (URL: http://doi.org/10.5281/zenodo.1308157), R package version 2.6.3, <URL: https://CRAN.R-project.org/package=sjPlot>

R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/