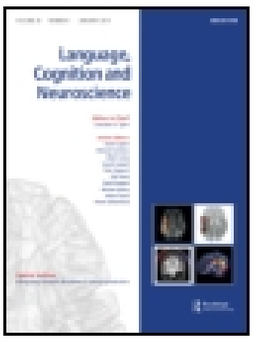

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Processing temporal presuppositions: an event-related potential study

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ABSTRACT

The ability to efficiently process presuppositions, which contain information that the speaker believes to be in the background to the conversation, is essential for effective communication. To get a deeper understanding of the nature and the time-course of temporal presupposition processing, we examined event-related potential evoked by the word *again* in two types of sentence contexts. The word *again* was presented in contexts that supported a presupposition (e.g. *Jake had tipped a maid at the hotel once before. Today he tipped a maid at the hotel again* …) or violated it (e.g. *Jake had never tipped a maid at the hotel before. Today he tipped a maid at the hotel again* …). The presupposition violation was associated with increased amplitudes of the P3b/P600 but not the N400 component. We argue for the centrality of the P3b/P600 component for presupposition processing. These findings demonstrate rapid integration of lexical presuppositions with contextual knowledge.

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Temporal presupposition; ERPs; P3b/P600; N400; presupposition violation

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1. Introduction

Natural language is highly adaptive: the very same message can be used to convey many distinct meanings depending on the communicative context. This *context-sensitivity* is one of the defining characteristics of language. One important way in which communicative contexts differ is with respect to what information is already shared among the participants in a conversation. Consider the use of the definite determiner *the* in sentence (1).

(1) Mary saw the tiger.

Which tiger Mary saw is highly context-dependent. For example, if we are at a zoo, then this sentence will likely convey that Mary saw the tiger at the zoo. In contrast, if a tiger is on the loose in town, then the sentence will likely convey that Mary saw that tiger. Critically, however, the determiner the in (1) carries the presupposition that there exists a unique tiger in the context. If there is more than one salient tiger in the context, or no tigers at all, then the sentence cannot be felicitously used, and its presupposition will have been violated. More generally, presuppositions impose requirements on the conversational context. If a sentence carries a presupposition, then it will only be felicitous if the context satisfies that presupposition (Caffi, 2006; Heim, 1983, 1992; Kamp, 2008; Katz, 1973; Simons, 2006; Van Der Sandt, 1992).

Presuppositions are "triggered" by a distinct class of words, referred to as presupposition triggers. In English, the words the, stop, and again, among others, act as presupposition triggers. These words signal the presence of shared background knowledge. For example, in (2), the trigger word stop asserts that the action of smoking was terminated at a certain time point and presupposes that the action has taken place before that point.

(2) John stopped smoking last year.

In (3), the sentence asserts that the action of tipping occurred at certain time point, and the word again presupposes that this action was also performed on a previous occasion.

(3) Jake tipped a maid at the hotel again.

As seen from the examples above, trigger words differ in the type of shared information that they signal to be present in the background of a conversation. Depending on the nature of shared background information, several types of presuppositions have been previously examined, including the temporal presupposition triggered by the word *again* (Tiemann, Kirsten, Beck, Hertrich, & Rolke, 2015), the uniqueness presupposition triggered by the definite determiner *the* (Singh, Fedorenko, Mahowald, & Gibson, 2015), change of state presupposition

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triggered by verbs *stop*, *continue*, *start* (Romoli & Schwarz, 2015), factive presupposition triggered by verbs *realise*, *discover*, *know* (Jayez, Mongelli, Reboul, & van der Henst, 2015), and additive presupposition triggered by particles *too* and *also* (Kim, 2015; Romoli, Khan, Sudo, & Snedeker, 2015).

Although theoretical discussions of presuppositions have gone on for decades, it is only recently that language researchers have begun to investigate the on-line processing of presuppositions (e.g. Chemla & Bott, 2013; Schwarz, 2007, 2015; Singh, Fedorenko, Mahowald, & Gibson, 2015; Tiemann et al., 2015). For example, some self-paced reading studies showed that presuppositions are available rapidly to the comprehenders (Schwarz, 2007; Tiemann et al., 2011, 2015). Tiemann and colleagues (2011) reported a delay in the reading of presupposition trigger words compared to non-presupposition controls. Further, presupposition triggers were processed much faster in supportive than in neutral or unsupportive contexts (Tiemann et al., 2011, 2015). These results suggest that presupposition processing starts as soon as presupposition triggers are encountered.

Participants' behaviour on sentences containing presupposition triggers has also been examined using eye-tracking (Chambers & Juan, 2008; Kim, 2015; Romoli & Schwarz, 2015; Schwarz, 2015). In these studies, participants were presented with an array of images that corresponded to alternative referents – the so-called *visual world paradigm* (Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995) – and the correct referent had to be identified based on the presence of a presupposition in an accompanying spoken utterance. The main finding of this research echoes the self-paced reading results: the processing of presuppositions started as soon as participants encountered presupposition triggers (and as early as 400–600 ms post presupposition trigger onset).

The most temporally sensitive findings on presupposition processing have been obtained using electroencephalography (EEG) or magnetoencephalography (MEG). In a few published EEG/MEG studies (Hertrich et al., 2015; Kirsten et al., 2014), researchers reported that presupposition processing began prior to and extended beyond the temporal window identified in eye-tracking studies. For example, Kirsten et al. (2014) had participants read two-sentence passages, in which a presupposition trigger either conflicted with a preceding context (4.a) or not (4. b):[1]

(4.a) Tina was in the zoo and saw some polar bears. She observed that the polar bear was aggressive.

(4.b) Tina was in the zoo and saw a polar bear. She observed that the polar bear was aggressive.

The analysis of event-related potentials (ERPs) showed modulations in the neural activity evoked by presupposition triggers in infelicitous (4.a) vs. felicitous (4.b) sentences over two periods: the 350–450 ms (the N400 ERP component) and 500–700 ms (the P600 ERP component) time-windows. The N400 component, believed to be related to the ease of lexical access and/or integration of word meanings into the preceding context (Kutas & Federmeier, 2011; Kutas & Hillyard, 1980; Kutas, Urbach, & DeLong, 2005), was interpreted by the authors as emerging in (4.a) due to the mismatch between the context (in which there were multiple polar bears) and the semantics of *the* (which presupposes a unique polar bear). The P600, which has been previously linked to syntactic integration difficulty (Hagoort, Brown, & Groothusen, 1993; Osterhout & Holcomb, 1992), discourse reanalysis (Kolk & Chwilla, 2007; Kuperberg, 2007), and error correction processes within a noisy comprehension system (Fedorenko, Stearns, Bergen, Eddy, & Gibson, submitted; Gibson, Bergen, & Piantadosi, 2013), was construed by the authors as reflecting top-down reanalysis processes and attempts to incorporate the violated presupposition of (4.a) into a mental model of the discourse.

Hertrich et al. (2015) examined spectrotemporal characteristics of the MEG signal time-locked to the onset of presupposition triggers and found a suppression of spectral power within the alpha band (from 6 to 16 Hz) for infelicitous (4.a) vs. felicitous (4.b) sentences across two time-windows: 0–500 ms and 2000 ms – 2500 ms. The reduction of alpha activity is generally associated with increased mental load and cognitive effort (Bastiaansen & Hagoort, 2006; Klimesch, 1996; Shahin, Picton, & Miller, 2009). Although the timing of presupposition processing did not closely mirror the timing reported by Kirsten et al. (2014), the authors provided a similar explanation of the biphasic pattern that they observed. In particular, the initial suppression of alpha power (0–500 ms) was taken to reflect violations of lexical expectancy, and the later one (2000–2500 ms) was linked with attempts to reinterpret presupposition triggers within the given context.

In the present study, we extend the existing work on the time-course of presupposition processing in several ways. First, this is the first study to examine ERP responses evoked by presupposition triggers in languages other than German (i.e. English). Examining ERP patterns evoked by presupposition triggers across multiple languages would shed some light on the issue of universality/language-specificity of the mechanisms of presupposition processing.

Second, we are the first to examine the ERP responses evoked during processing of temporal presuppositions, a

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type of presupposition triggered by the adverb *again*. The ERP/MEG studies of presupposition processing discussed above (Hertrich et al., 2015; Kirsten et al., 2014) examined the definite determiner (the uniqueness presupposition). Investigating ERPs evoked by other types of presupposition triggers (including the temporal presupposition trigger *again* examined here) is of theoretical importance as it will further inform the debate about the homogeneity / heterogeneity of presupposition triggers and the mechanisms used to process them.

Some researchers have argued or assumed that different types of presupposition triggers are processed by the same cognitive mechanisms and behave similarly in complex sentences (Heim, 1983; Van Der Sandt, 1992). Others, however, have suggested that presupposition is a heterogeneous phenomenon, with different triggers varying in strength (Karttunen, 1971,1973). Extensive evidence for the latter view has since been provided (Abusch, 2005, 2009; Jayez et al., 2015; Romoli, 2015). The apparent heterogeneity of presupposition stresses the importance of probing a wide range of presupposition triggers in order to form generalisations about the mechanisms of presupposition processing (Chemla & Bott, 2013; Schwarz, 2015).

Presupposition triggers vary along another dimension: whether they entail their presuppositions. It has previously been argued that certain presupposition triggers, such as *stop*, both presuppose and entail their presuppositional content. If this is true, then this has the potential to confound experimental tests of presupposition violation. Under such an account, when participants encounter a presupposition violation, they would also be encountering an entailment violation. Any signal from the experiment could therefore be measuring either the violated presupposition or the violated entailment, making it difficult to isolate the processes underlying presupposition processing.

Sudo (2012) argues for heterogeneity among presupposition triggers, providing evidence that certain triggers, such as gendered reflexives, do not entail their presuppositions. For the current study, the relevant question is whether the trigger *again* entails its presupposition. Though a detailed investigation of this question is beyond the scope of this work, there have been previous suggestions that *again* may pattern with these non-entailing triggers (see Schwarz, 2014). Assuming that *again* is a non-entailing trigger, the present study would disentangle the effects of presupposition violations from entailment violations.

Following previous research, we here compare presupposition processing contexts in which presupposition triggers are not supported (5.a) vs. contexts in which they are supported (5.b):

(5.a) Jake had never tipped a maid at the hotel before. Today he tipped a maid at the hotel again, although the hotel paid its maids good wages.

(5.b) Jake had tipped a maid at the hotel once before. Today he tipped a maid at the hotel again, although the hotel paid its maids good wages.

In (5.b), the control condition, the sentence stating that a person performed an action again follows a statement that the person has performed this action before, so the context supports the presupposition. In contrast, in the critical condition (5.a), the second sentence (containing *again*) follows a statement that the protagonist has never performed the relevant action before, leading to a conflict between the required presupposition and the stated information. Based on prior ERP studies of presupposition, we expect the processing of the presupposition trigger in an unsupportive context to lead to the modulation of the N400 and/or the P600 ERP components.

2. Methods

2.1. Participants

Thirty native English speakers (10 males; age 18–40 years) from the MIT Brain and Cognitive Sciences subject pool participated for payment. Informed consent was obtained in accordance with the MIT Committee on the Use of Humans as Experimental Subjects. Six subjects were excluded due to an excessive number of artefacts in the EEG signal (more that 25% of trials were excluded), leaving 24 participants for the final analysis.

2.2. Materials

160 experimental items were constructed with four conditions each: the control condition (6.a), the critical presupposition-violation condition (6.b), the semantic-violation condition (6.c), and the syntactic-violation condition (6.d).

(6.a) Control: Jake had tipped a maid at the hotel once before. Today he tipped a maid at the hotel again, although the hotel paid its maids good wages.

(6.b) Presupposition violation: Jake had never tipped a maid at the hotel before. Today he tipped a maid at the hotel again, although the hotel paid its maids good wages.

(6.c) Semantic violation: Jake had tipped a maid at the hotel once before. Today he tipped a horse at the hotel again, although the hotel paid its maids good wages.

(6.d) Syntactic violation: Jake had tipped a maid at the hotel once before. Today he tipped a maids at the hotel again, although the hotel paid its maids good wages.

In the control and presupposition-violation conditions, (6.a,b), the presupposition trigger *again* was the target word used in the analysis of presupposition processing. In the control, semantic violation, and syntactic-violation conditions, (6.a,c,d), the direct object of the verb in the second sentence (*maid/horse/maids* above) was the target word. The semantic violation target words were created by taking the target words from the control condition and re-ordering them so that they did not fit with the context of the sentence (e.g. the word *horse* in (6.c) was the object acted upon in the control condition of another item). The syntactic-violation target words were altered from the control condition to not agree with the determiner in number.

Semantic and syntactic-violation conditions were included for two reasons. First, these types of linguistic manipulations have a long history in the ERP research, and there is general consensus about the types of ERP patterns that they elicit (Kutas & Federmeier, 2011; Kutas & Hillyard, 1980; Osterhout & Holcomb, 1992, 1993). Detecting the expected ERP patterns for these conditions would therefore give us confidence in interpreting the results from the critical (presupposition-violation) condition. Second, by including diverse linguistic violations, the likelihood that participants would expect a particular type of violation was diminished, thus potentially boosting the magnitude of the effect for each of the examined types of violations (Hahne & Friederici, 1999).

The 640 trials were distributed across four presentation lists following a Latin Square design (for the full list of stimuli see Appendix), so that each list contained only one version of an item (and 40 trials per condition). In addition, 30 filler trials were included in each list. Filler sentences (for an example, see (7)) mimicked the structure of the experimental items, but stated that an action was performed for the first time:

(7) Percy had never received a present from his friends before. Today he received a present from his friends for the first time, although it wasn't his birthday.

Thus, each participant saw 190 total trials.

To ensure that participants read the sentences for meaning, yes/no comprehension questions appeared after a quarter of the trials, constrained such that there were no more than three consecutive trials with a question. The correct answer was "yes" half of the time. Each list was pseudo-randomly divided into 10 sets of trials, in order to give participants breaks as needed. Each set of trials contained four trials of each experimental condition, four or five questions, and three fillers. The order of trials was randomised separately for each participant.

2.3. Procedure

Participants were tested individually in a sound-attenuated and electrically-shielded booth where stimuli were presented on a computer monitor. Stimuli appeared in the centre of the screen in white on a black background, time locked to the vertical refresh rate of the monitor (75 Hz). Each trial began with a pre-trial fixation (1000 ms), followed by 500 ms of a blank screen. The first sentence in each trial was displayed all at once (for 3,000 ms + 500 ms ISI). The second sentence in each trial was displayed word-by-word. For every trial, the critical words (*again* and *maid/horse/maids* in (6) above) were displayed for 450 ms, whereas all other words were displayed for 350 ms per word. Each word was followed by a 100 ms ISI, with an additional 400 ms after the last word of the sentence. Comprehension questions were displayed all at once (for 3,500 ms + 100 ISI) in aqua on a black background, and participants responded "yes" or "no" by pressing buttons on a gamepad. At the beginning of the experiment, participants were shown a small set of 4 practice items to familiarise them with the procedure. The experiment took approximately 1 hour.

2.4. EEG recording

EEG was recorded from 32 scalp sites (10–20 system positioning), a vertical eye channel for detecting blinks, a horizontal eye channel to monitor for saccades, and two additional electrodes affixed the mastoid bone. EEG was acquired with the Active Two Biosemi system using active Ag-AgCl electrodes mounted on an elastic cap (Electro-Cap Inc.). All channels were referenced offline to an average of the mastoids. The EEG was recorded at 512 Hz sampling rate and filtered offline (bandpass 0.1–40 Hz). Trials with blinks, eye movements, muscle artefact, and skin potentials were rejected prior to averaging and analysis.

2.5. Analysis

Twelve representative electrode sites from frontal, central, parietal, and occipital regions were included in the data analysis (F3, Fz, F4, C3, Cz, C4, P3, Pz, P4, O1, Oz, O2). ERP signals were time-locked to the onset of the target word and averaged across trials from 200 ms prior to the onset of this stimulus until 800 ms after

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onset. The time window from − 200 ms to word onset was used as the pre-stimulus baseline.

3. Results

Participants were accurate in answering the comprehension questions ($M = .88$, $SE = .01$), which suggests that they were engaged in the task.

3.1. Semantic and syntactic processing

In the analysis of semantic violations, the mean amplitudes of ERPs evoked by target words in the control (8.a) and semantic-violation (8.b) conditions (repeated here from (6.a,c) above) were entered as the dependent variable in the repeated measures ANOVA:

(8.a) Today he tipped a maid at the hotel again …

(8.b) Today he tipped a horse at the hotel again …

In the analysis of syntactic violations, the mean amplitudes of ERPs evoked by words target words in the control (9.a) and syntactic-violation (9.b) conditions (repeated here from (6.a,d) above) were entered as the dependent variable in the repeated measures ANOVA:

(9.a) Today he tipped a maid at the hotel again …

(9.b) Today he tipped a maids at the hotel again …

The independent factors in both analyses were Violation (Absent vs. Present), Electrode Region (Anterior vs. Central vs. Posterior vs. Occipital), and Lateralisation (Left vs. Midline vs. Right). All repeated measures for the within factors used the Greenhouse–Geisser correction. Figure 1 shows the waveforms evoked in response to semantically expected vs. unexpected target words. Figure 2 shows the waveforms evoked in response to syntactically correct vs. incorrect target words. Based on the visual examination of the evoked brainwaves and of the modulation of the mean global field power (MGFP) of the ERP amplitudes, a negative-going component was identified in the 300–450 ms time-window (the N400), and a positive-going component in the 450–750 ms time-window (the P600).

Processing costs for words that violate semantic expectations were identified in the N400 and the P600 time-windows. In the N400 time-window, a significant two-way Violation by Electrode Region interaction was observed: $F(2, 38) = 12.35$, $p < .001$, $\eta_p^2 = .35$. In particular, the difference in the magnitude of the N400 effect for semantically expected vs. unexpected words was present over the parietal (M (violation) = −1.61, SD = 0.46 vs. M (no violation) = −0.25, SD = 0.40) and occipital areas of the scalp (M (violation) = −1.14, SD = 0.45 vs.

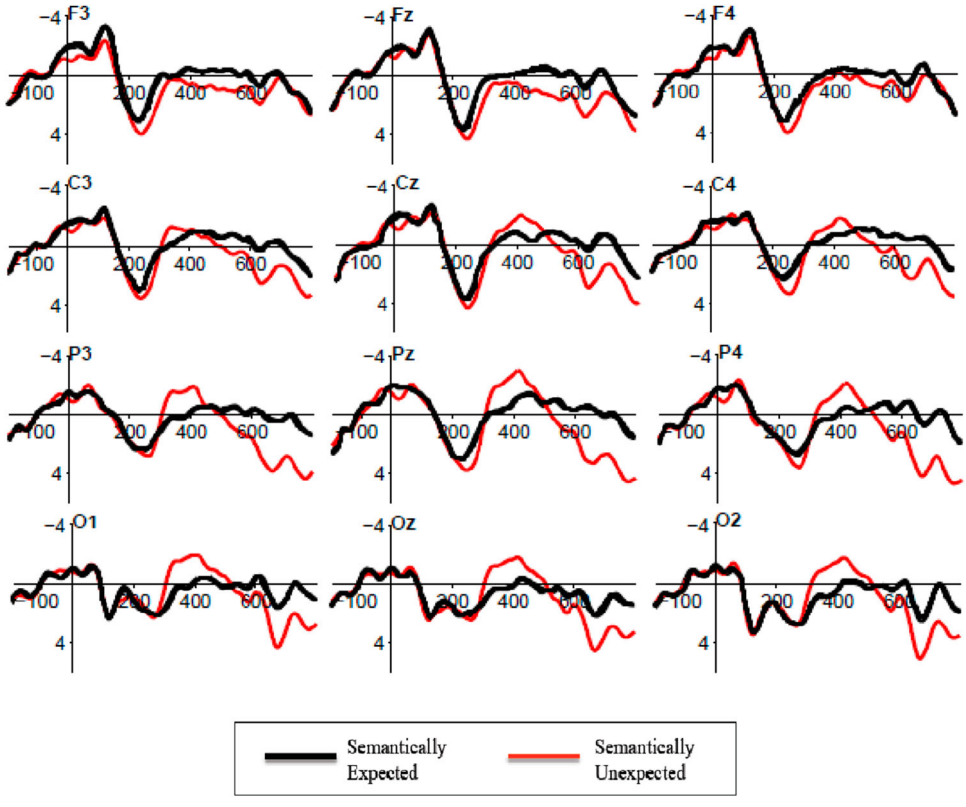

Figure 1. Grand average ERP responses to the semantically expected (black thick lines) vs. unexpected (red thin lines) target words. The *x*-axis shows time (in ms) from the onset of the presentation of the target word, and the *y*-axis shows voltages (in μV).

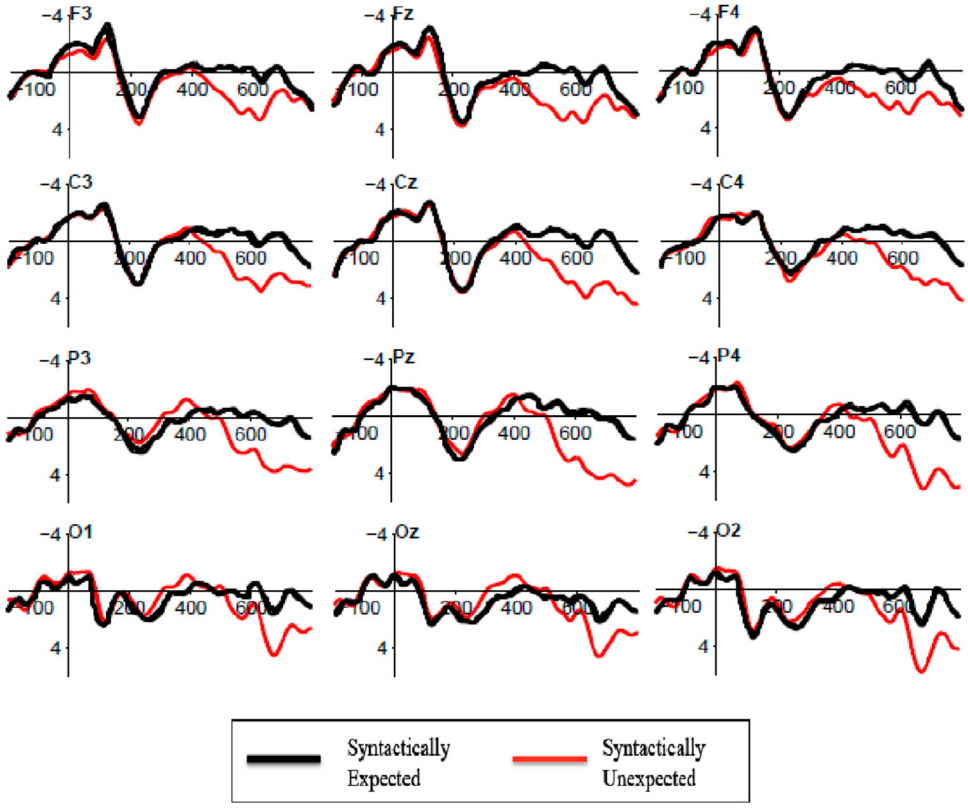

Figure 2. Grand average ERP responses to the syntactically expected (black thick lines) vs. unexpected (red thin lines) target words. The *x*-axis shows time (in ms) from the onset of the presentation of the target word, and the *y*-axis shows voltages (in μV).

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M (no violation) = 0.33, SD = 0.34). In the P600 time-window, a significant main effect of violation was observed: F (1, 23) = 5.67, p = .03, η_p^2 = .20, with the targets in the semantic-violation condition evoking more positive amplitudes (*M* = 1.32, SD = 0.50) than the targets in the control condition (*M* = −0.05, SD = 0.26).

In the analysis of syntactic violations, we found no evidence for processing costs in the N400 time-window (*M* (violation) = −0.26, SD = 0.31 vs. *M* (no violation) = 0.08, SD = 0.38), F (1, 23) = 8.82, p = .01, η_p^2 = .28. In the P600 time-window, on the other hand, we found a significant main effect of violation: F (1, 23) = 24.73, p < .001, η_p^2 = .52, with the targets in the syntactic-violation condition evoking more positive amplitudes (*M* (violation) = 2.28, SD = 0.52) than the targets in the control condition (*M* (no violation) = −0.05, SD = 0.26). There was additionally a significant violation by electrode region interaction, F (2, 42) = 3.91, p = .03, η_p^2 = .15, with the difference in the magnitude of the P600 effect being the greatest over the central (*M* (violation) = 2.52, SD = 0.60 vs. *M* (no violation) = −0.30, SD = 0.32) and parietal (*M* (violation) = 2.22, SD = 0.53 vs. *M* (no violation) = −0.49, SD = 0.32) electrode sites.

To conclude, semantic and syntactic violations produced the expected effects. Semantic violations resulted in both an N400 and a P600 effect, consistent with many prior ERP studies (e.g. Frenzel, Schlesewsky, & Bornkessel-Schlesewsky, 2011; Kuperberg, 2007; Kutas & Federmeier, 2011; van de Meerendonk, Kolk, Vissers, & Chwilla, 2010; van Petten & Luka, 2012). And syntactic violations resulted in a P600 effect, in line with prior work (Friederici, Hahne, & Saddy, 2002; Kaan, Harris, Gibson, & Holcomb, 2000; Osterhout & Holcomb, 1992, 1993). Thus our materials robustly elicit the well-established effects, and our participants show sensitivity to linguistic structure. We now proceed to examine the critical presupposition-violation condition.

3.2. Presupposition processing

In the analysis of presupposition violations, the mean amplitudes of ERPs evoked by target word (*again*) in the control and presupposition-violation conditions (see (6.a,b) above) were entered as the dependent variable in the repeated measures ANOVA. As in the analyses of semantic and syntactic violations, the independent factors were violation (absent vs. present), electrode region (anterior vs. central vs. posterior vs. occipital), and lateralisation (left vs. midline vs. right). All repeated measures for the within factors used the greenhouse –

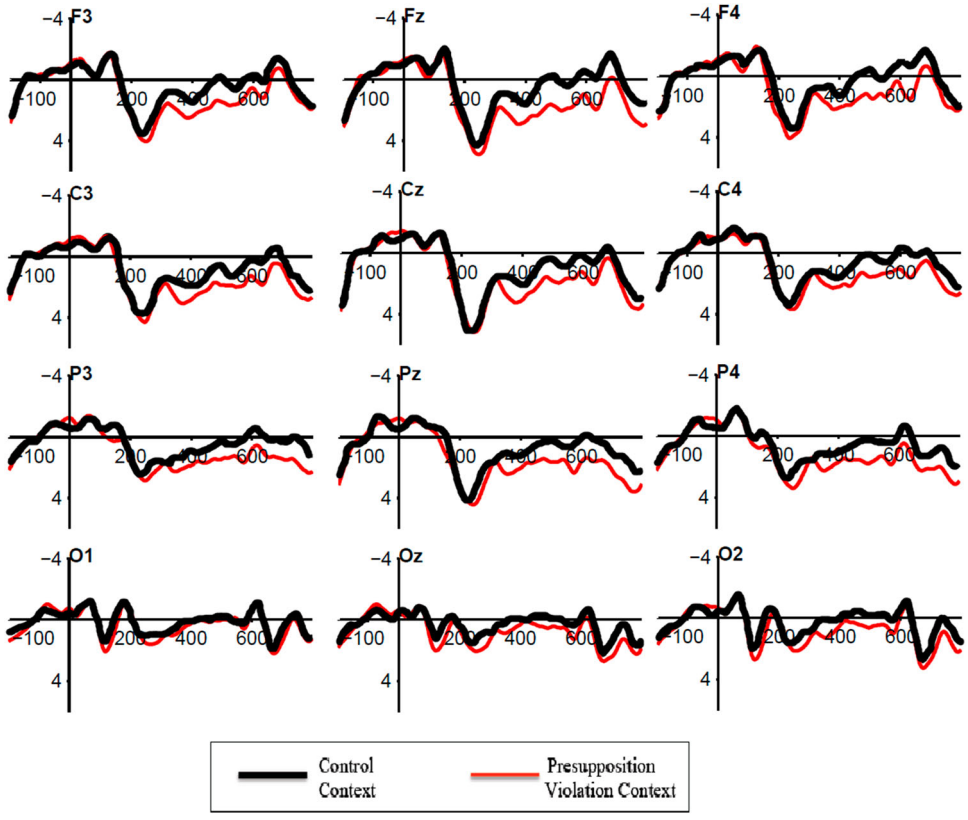

Figure 3. Grand average ERP responses to the temporal presupposition trigger *again* in the control context with no violations (black thick lines) vs. in the context with presupposition violation (red thick lines). The *x*-axis shows time (in ms) from the onset of the presentation of the word *again*, and the *y*-axis shows voltages (in μV).

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Geisser correction. Figure 3 shows the waveforms evoked in response to the target word *again* in the presupposition-violation and control conditions. Based on the visual examination of the evoked brainwaves and of the modulation of the MGFP of the ERP amplitudes, a positive-going component was identified in the 300–750 ms time-window. Magnitudes of ERP responses were examined in the 300–450 ms time-window, where an early positivity has been observed in prior ERP studies (the P3b component; Debener, Makeig, Delorme, & Engel, 2005; Dien, Spencer, & Donchin, 2004), and in the 450–750 ms time-window, a period of the late positivity in the ERP responses (the P600 component).

The amplitudes of ERP responses to the word *again* were more positive in the presupposition-violation condition than in the control condition in both the early P3b time-window ($M = 1.66$, SD = .28; $M = 0.99$, SD =.27; F (1, 23) = 4.96, $p = .04$, $\eta_p^2 = .18$), and in the late P600 time-window ($M = 1.15$, SD =.31; $M = 0.19$, SD = .32; F (1, 23) = 9.46, $p = .01$, $\eta_p^2 = .29$). None of the interactions were significant in either time-window (all $Fs < 1.45$).

Thus, the violation of temporal presupposition was associated with a positive deflection in the early P3b and the late P600 time-windows. This pattern is distinct from the earlier reported – and replicated here – patterns of ERPs elicited by semantic violations (a bi-phasic N400/P600 pattern) and syntactic violations (a P600 pattern), suggesting that neurocognitive mechanisms of presupposition processing differ from those of basic semantic or syntactic processing. The observed extended positivity in response to temporal presupposition violation also stands in contrast to the earlier reported bi-phasic N400/P600 pattern evoked by the violation of the uniqueness presupposition (Kirsten et al., 2014), implying some heterogeneity in the processing of different types of presupposition (Karttunen, 1971,1973).

4. Discussion

The goal of the present study was to examine the time-course of temporal presupposition processing triggered by the word *again*. The results revealed an extended positivity that starts as early as 300 ms post the onset of *again* and lasting through the standard P600 time-window (450–750 ms).

The positivity observed in the early time-window (300–450 ms) is reminiscent of the P3b component, which is often detected in response to novel,

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unpredictable stimuli that disconfirm participants' expectations (Debener et al., 2005; Dien et al., 2004; Donchin, 1981; Friedman, Cycowicz, & Gaeta, 2001; Goldstein, Spencer, & Donchin, 2002). The P3b has been proposed to reflect revisions to one's mental model of the conversation/environment (Donchin & Coles, 1988). The process of mental model updating/revision has been associated with an increased demand for attentional resources (Donchin & Coles, 1988; Polich, 2007).

The positivity observed in the late time-window (450–750 ms) is typically labelled as the P600 component. As discussed in the Introduction, the P600 was initially detected in response to words that did not fit with the preceding syntactic context (Hagoort et al., 1993; Osterhout & Holcomb, 1992) and was taken to reflect syntactic processing. Over the years, this interpretation of the P600 component has been challenged. For example, some studies have reported ERP patterns resembling the syntactic P600 in response to semantic violations (e.g. Kim & Osterhout, 2005; Kolk, Chwilla, Van Herten, & Oor, 2003; Kuperberg, Kreher, Sitnikova, Caplan, & Holcomb, 2007). Based on this evidence, some have suggested that the P600 reflects cognitive processes of discourse reanalysis and updating of mental discourse models (Brouwer, Fitz, & Hoeks, 2012; Kolk & Chwilla, 2007; Kuperberg, 2007; O'Rourke & Van Petten, 2011) or error correction processes within a noisy comprehension system (Fedorenko et al., submitted). Similar to the P3b, the P600 has also been proposed to reflect generic attention reorientation processes (Sassenhagen & Bornkessel-Schlesewsky, 2015).

Thus, the P3b and the P600 components – at least under some interpretations – reflect similar cognitive processes, including the updating of mental discourse models and attention reorientation (Brouwer et al., 2012; Donchin & Coles, 1988; Sassenhagen & Bornkessel-Schlesewsky, 2015). In fact, some have argued that these two components belong to the same family and should be referred to as the P3b/P600 complex (e.g. Coulson, King, & Kutas, 1998; cf. Frisch, Kotz, von Cramon, & Friederici, 2003; Gunter, Stowe, & Mulder, 1997; Osterhout, 1999; Sassenhagen, Schlesewsky, & Bornkessel-Schlesewsky, 2014). Under this interpretation, the ERP effects that we observed for presupposition violations correspond to a single extended P3b/P600 component. This component plausibly reflects integrative processes of reorganisation and updating of the mental discourse representation based on the prior context with information provided by a presupposition trigger.

Alternatively, the observed pattern can be thought of as consisting of two separate, albeit related, components, each associated with a specific function in presupposition processing. In particular, the P3b could reflect the detection of a disparity between the mental representation formed by the preceding context and the presupposition trigger, and the P600 could be associated with the potential resolution of the earlier identified incongruence. This kind of an interpretation of the P3b-P600 pattern has been previously advanced in ERP studies that examined the processing of anaphoric expressions (Li & Zhou, 2010), omitted stimuli (Nakano, Rosario, Oshima-Takane, Pierce, & Tate, 2014), and garden-path sentences (Friederici, Mecklinger, Spencer, Steinhauer, & Donchin, 2001). Interestingly, in cases of violation of pragmatic inference where resolution of incongruence is impossible or extremely effortful, a sustained negativity rather than positivity has been reported (Leuthold, Filik, Murphy, & Mackenzie, 2012; Politzer-Ahles, Fiorentino, Jiang, & Zhou, 2013; Zhao, Liu, Chen, & Chen, 2015), suggesting variability in cognitive mechanisms of pragmatic inference.

Regardless of whether the observed ERP patterns evoked during temporal presupposition processing correspond to a monophasic P3b/P600 or a biphasic P3b-P600, the positivity identified here was registered much earlier than in the study of the uniqueness presupposition processing in German by Kirsten et al. (2014). In that study, presupposition-violating trigger words elicited greater positivity (compared to triggers that did not violate presuppositions) only after 500 ms post trigger-word onset. In the earlier 300–450 ms time-window, violations of uniqueness presuppositions were associated with an increased negativity. Thus, our observation of an extended positivity associated with presupposition processing stands in contrast to the finding of a biphasic N400/P600 ERP pattern reported by Kirsten et al. (2014). The discrepancy between the two studies might reflect differences in the cognitive mechanisms of temporal vs. uniqueness presupposition processing. In the case of the uniqueness presupposition, as in (10), the word *the* presupposes that there was a single bear in the zoo, but also triggers a reference to this unique object mentioned previously in the context:

(10) Tina was in the zoo and saw a polar bear. She observed that the polar bear was aggressive.

The process of establishing references in contexts has been examined extensively in prior ERP research (e.g. Anderson & Holcomb, 2005; Barkley, Kluender, & Kutas, 2015; Heine, Tamm, Hofmann, Hutzler, & Jacobs, 2006; Van Berkum, 2004; Van Berkum, Brown, Hagoort, & Zwitserlood, 2003; van Berkum, Koornneef, Otten, & Nieuwland, 2007). In most of these studies, researchers manipulated the number of candidate referents provided in the context for a definite noun phrase. In (11.a), for example, there is a single unique referent for

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the target *the girl*, whereas in (11.b) *the girl* might refer to either of the two girls mentioned in the context:

(11.a) David had asked the boy and the girl to clean up their room … . David told the girl that had been on the phone to hang up.

(11.b) David had asked the two girls to clean up their room … . David told the girl that had been on the phone to hang up.

Resolving referential ambiguities, as in (11.b), has been shown to give rise to a widely distributed negative deflection starting at 300 ms after the onset of the definite noun phrase and labelled the "Nref" (van Berkum et al., 2007; Van Berkum, 2004; Van Berkum et al., 2003). Van Berkum and colleagues demonstrated that the Nref is elicited only in contexts where referential ambiguity needs to be resolved. In contexts like (11.c), where no candidate referents are given for the definite noun phrase and, hence, referential failure takes place, no Nref was observed:

(11.c) David had asked the two boys to clean up their room … . David told the girl that had been on the phone to hang up.

In Kirsten et al. (2014), the presupposition-violation condition (12) was characterised by referential ambiguity:

(12) Tina was in the zoo and saw some polar bears. She observed that the polar bear was aggressive.

The polar bear could refer to any of the bears in the zoo. Resolving this ambiguity could have led to the negative deflection observed in the 300–450 ms time-window, which was plausibly an Nref effect rather than a semantic N400, as it was described by Kirsten et al. (2014). In our study, we did not observe an Nref effect because our presupposition-violation contexts (13) contained no candidate referents for the trigger word *again* (i.e. there was no recently activated memory token of Jake tipping a maid). From the point of view of referential processing then, our materials were most similar to cases like (11.c) above where no Nref effect was reported.

(13) Jake had never tipped a maid at the hotel before. Today he tipped a maid at the hotel again, although the hotel paid its maids good wages.

The temporal presupposition violations that we investigated here evoked different ERP patterns from the uniqueness presupposition violations that Kirsten et al. (2014) investigated. This result suggests that different cognitive mechanisms might be at play during the processing of these two types of presuppositions, in line with some theoretical proposals (Abusch, 2005, 2009; Jayez et al., 2015; Romoli, 2015). Further empirical examination of similarities and differences in the patterns of ERPs evoked during the processing of different types of presuppositions is needed. An important consideration for this future work is that presupposition triggers vary in whether they entail their presuppositions. While it has been suggested that the trigger *again* does not entail its presupposition, many other triggers are known to do so (Sudo, 2012). As a result, the experimental tasks in future studies of presupposition will need to be carefully designed in order to isolate the processing of presupposition from the processing of entailment. Our study provides evidence that presupposition triggers are heterogeneous in nature and require different processing mechanisms.

5. Conclusions

Using ERPs, we here investigated the on-line processing of temporal presuppositions (in particular, presuppositions triggered by the word *again*). Violations of the presupposition associated with *again* in English evoked a positivity, which spanned the extended time-window of 300–750 ms, most plausibly corresponding to the P3b/600 complex (Coulson et al., 1998; Gunter et al., 1997; Sassenhagen et al., 2014). This result provides evidence for rapid, on-line integration of presupposed content triggered by the adverb *again* and contextual information. The observed pattern contrasts with previous work on the processing of presuppositions associated with definite articles in German (Kirsten et al., 2014), where a bi-phasic N400/P600 was reported. Future work will investigate whether these different patterns reflect differences in the representation and processing of different presupposition triggers.

Note

1. The studies by Kirsten et al. (2014) and Hertrich et al. (2015) were conducted in German. The cited examples are English translations of stimuli. In this example, the definite determiner "the" in the second sentence presupposes an existence of a single, unique item (one particular polar bear). This presupposition is in direct conflict with the background knowledge set up by the first sentence that describes existence of several, similar items (some polar bears).

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix

Critical stimuli

For Item 1, stimuli used in control, presupposition violation, semantic violation, and syntactic-violation conditions are given. For Items 2–160, only sentences used in the control condition are provided. The sentences for presupposition violation, semantic violation, and syntactic-violation conditions may be recreated following the template provided for Item 1.

Condition	Stimuli for Item 1
Control	Steve had changed a diaper with his girlfriend once before. Today he changed a diaper with his girlfriend again, since his girlfriend wanted him to practice and get better
Presupposition violation	Steve had never changed a diaper with his girlfriend before. Today he changed a diaper with his girlfriend again, since his girlfriend wanted him to practice and get better
Semantic violation	Steve had changed a diaper with his girlfriend once before. Today he changed a murderer with his girlfriend again, since his girlfriend wanted him to practice and get better
Syntactic violation	Steve had changed a diaper with his girlfriend once before. Today he changed a diapers with his girlfriend again, since his girlfriend wanted him to practice and get better

Other items

2. Ryan had investigated a murder for his client once before. Today he investigated a murder for his client again, although his client had not paid him for the previous investigation.
3. Evan had guarded a diplomat during the conference once before. Today he guarded a diplomat during the conference again, because the conference was taking extra security precautions.
4. Steven had led a tour at the museum once before. Today he led a tour at the museum again, since the museum had recently fired many of their guides.
5. Amelia had kissed a coworker at her job once before. Today she kissed a coworker at her job again, although her job had a strict policy against this.
6. Melissa had torn a shirt on a nail once before. Today she tore a shirt on a nail again, since a nail was sticking out of her garage's wall.
7. Mary had eaten a mango after her meal once before. Today she ate a mango after her meal again, since her meal had been too small for her.
8. Liz had fired an employee without prior warning once before. Today she fired an employee without prior warning again, although prior warning would have helped the employee find a new job.
9. Tyler had roasted a duck in the oven once before. Today he roasted a duck in the oven again, although the oven was getting to be very old.
10. Claire had lost an earring at the dance-club once before. Today she lost an earring at the dance-club again, because the dance-club was so crowded and rowdy.

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11. Lily had identified a criminal for the police once before. Today she identified a criminal for the police again, although the police did not trust her story.
12. Angela had irritated a boyfriend with her jokes once before. Today she irritated a boyfriend with her jokes again, because her jokes were inappropriate in the context.
13. Jack had poisoned a rat in his home once before. Today he poisoned a rat in his home again, because his home had become overrun with vermin.
14. Yolanda had provoked a fight with her cousin once before. Today she provoked a fight with her cousin again, although her cousin was trying to be nice to her.
15. Ashley had misinformed an investigator about her taxes once before. Today she misinformed an investigator about her taxes again, since her taxes had not been paid in several years.
16. Rachel had sewn a blanket for her granddaughter once before. Today she sewed a blanket for her granddaughter again, because her granddaughter had her birthday coming up.
17. Jillian had accused an attacker at the station once before. Today she accused an attacker at the station again, because the station was near the location of the attack.
18. Jake had tipped a maid at the hotel once before. Today he tipped a maid at the hotel again, although the hotel paid its maids good wages.
19. Bill had mowed a lawn for his neighbour once before. Today he mowed a lawn for his neighbour again, since his neighbour was too ill to do it himself.
20. Britney had offended a coworker during their meeting once before. Today she offended a coworker during their meeting again, although their meeting ended without any hurt feelings.
21. Dennis had encrypted a file for his company once before. Today he encrypted a file for his company again, since his company needed to send some confidential information to the lawyer.
22. Luke had officiated a wedding at the church once before. Today he officiated a wedding at the church again, although the church had wanted its own priest to officiate instead.
23. Joel had repaired a watch with his father once before. Today he repaired a watch with his father again, because his father wanted to teach him the family trade.
24. Tristan had flown a kite at the field once before. Today he flew a kite at the field again, because the field was where he and his friends liked to go.
25. Harry had toured a monument with his family once before. Today he toured a monument with his family again, because his family wanted him to learn about history.
26. Sally had failed an assignment after her concert once before. Today she failed an assignment after her concert again, since her concert was distracting and she did not study.
27. Avery had towed a trailer with her van once before. Today she towed a trailer with her van again, since her van was easier to drive than a large truck.
28. Audrey had swatted a mosquito near the pond once before. Today she swatted a mosquito near the pond again, since the pond had become infested with insects.
29. Gavin had nominated a candidate for the council once before. Today he nominated a candidate for the council again, since the council was corrupt and he wanted to change that.
30. Omar had misplaced a document in his files once before. Today he misplaced a document in his files again, although his files had been carefully organised by his assistant.
31. Vincent had sailed a boat across the bay once before. Today he sailed a boat across the bay again, although the bay was too small for it to be an adventure.
32. Valerie had shrunk a blouse in the dryer once before. Today she shrank a blouse in the dryer again, because the dryer had been accidentally put on the hottest setting.
33. Tess had treated a horse in her clinic once before. Today she treated a horse in her clinic again, since her clinic did not have anyone else with the required knowledge.
34. Collin had translated an article without his dictionary once before. Today he translated an article without his dictionary again, although his dictionary would have helped him translate it better.
35. Gabrielle had ordered a pizza after dress rehearsal once before. Today she ordered a pizza after dress rehearsal again, since dress rehearsal had lasted until dinner time.
36. Luis had adopted a kitten from the shelter once before. Today he adopted a kitten from the shelter again, although the shelter wanted him to adopt a puppy instead.
37. Grace had dunked a ball at the gym once before. Today she dunked a ball at the gym again, since the gym was hosting a basketball competition.
38. Shawn had poached an egg for his daughter once before. Today he poached an egg for his daughter again, because his daughter did not want a scrambled egg.
39. Joyce had painted a portrait for the businessman once before. Today she painted a portrait for the businessman again, since the businessman wanted a portrait with his new wife.
40. Hannah had performed an experiment in the lab once before. Today she performed an experiment in the lab again, since the lab had given her a research grant.
41. Chris had worn a suit to his school once before. Today he wore a suit to his school again, because his school was hosting an important fundraiser.
42. Owen had picked a lock for his neighbour once before. Today he picked a lock for his neighbour again, because his neighbour had forgotten her keys inside her house.
43. Larry had skipped a rock at the beach once before. Today he skipped a rock at the beach again, because the beach had a lot of smooth rocks for skipping.
44. Emma had stubbed a toe on her bed once before. Today she stubbed a toe on her bed again, since her bed had been moved for the renovations.
45. Abigail had won a tournament at the golf-club once before. Today she won a tournament at the golf-club again, although the golf-club alleged that she had cheated.
46. John had fed an elephant at the circus once before. Today he fed an elephant at the circus again, although the circus had strict rules prohibiting it.
47. Tom had cooked a steak on the grill once before. Today he cooked a steak on the grill again, although the grill had burned his food in the past.
48. Samantha had written a poem for her boyfriend once before. Today she wrote a poem for her boyfriend again, although her boyfriend would probably not appreciate it.
49. Kim had greeted a guest at the airport once before. Today she greeted a guest at the airport again, although the airport had a shuttle service to escort passengers.
50. Danielle had killed a spider in the bathroom once before. Today she killed a spider in the bathroom again, since the bathroom was teeming with all sorts of spiders.

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51. Gabriela had walked a dog without its leash once before. Today she walked a dog without its leash again, because its leash would not fit around its neck anymore.
52. Barry had fought a bully on the playground once before. Today he fought a bully on the playground again, since the playground was far away from the teachers.
53. Holly had dazzled an audience at the theatre once before. Today she dazzled an audience at the theatre again, although the theatre usually did not attract a large audience.
54. George had bathed a baby in the tub once before. Today he bathed a baby in the tub again, although the tub had not been cleaned in a long time.
55. Erica had deceived an investor about her finances once before. Today she deceived an investor about her finances again, because her finances were in disarray and she was bankrupt.
56. Angelica had cashed a check at the bank once before. Today she cashed a check at the bank again, because the bank provided this service for free.
57. Landon had visited a volcano without a guide once before. Today he visited a volcano without a guide again, because a guide would have prevented him from climbing near the top.
58. Alejandro had drilled a hole in the wall once before. Today he drilled a hole in the wall again, although the wall was now starting to seem weak.
59. Lucy had abandoned a friend at the club once before. Today she abandoned a friend at the club again, since the club had become too crowded for her.
60. Brendan had fouled a player behind the referee once before. Today he fouled a player behind the referee again, because the referee was less likely to notice the foul.
61. Dwight had met a celebrity on the street once before. Today he met a celebrity on the street again, because the street was the scene of a new movie.
62. Max had arrested a suspect at the airport once before. Today he arrested a suspect at the airport again, since the airport was being used to transport drugs.
63. Elijah had refereed a game during the playoffs once before. Today he refereed a game during the playoffs again, because the playoffs were very important and required extra referees.
64. Jennifer had baked a cake for her sister once before. Today she baked a cake for her sister again, although her sister was trying to stay on a diet.
65. Amy had recorded a meeting for her supervisor once before. Today she recorded a meeting for her supervisor again, since her supervisor needed to attend a different meeting instead.
66. Dylan had misquoted a source in the newspaper once before. Today he misquoted a source in the newspaper again, although the newspaper would be able to print a correction.
67. Caroline had stained a dress with red wine once before. Today she stained a dress with red wine again, although red wine was unlikely to come off her dress.
68. Alan had scored a touchdown against his rivals once before. Today he scored a touchdown against his rivals again, because his rivals did not have good defensive players.
69. Roxanne had cracked a code for the military once before. Today she cracked a code for the military again, because the military was trying to figure out its enemies' plans.
70. Marcus had addressed a crowd at the graduation once before. Today he addressed a crowd at the graduation again, although the graduation was already running over its allotted time.
71. Tanya had watched an opera on her television once before. Today she watched an opera on her television again, because her television had been left on that channel.
72. Dan had entertained a crowd on the field once before. Today he entertained a crowd on the field again, since the field was where the event was being held.
73. Crystal had smuggled a soda into the theatre once before. Today she smuggled a soda into the theatre again, because the theatre sold its drinks at outrageous prices.
74. Marianne had mocked a performer at the festival once before. Today she mocked a performer at the festival again, although the festival was trying to promote a friendly atmosphere.
75. Zachary had inspected a building for the agency once before. Today he inspected a building for the agency again, since the agency was checking for building code violations.
76. Scarlett had overcharged a customer in the store once before. Today she overcharged a customer in the store again, because the store had a broken cash register.
77. Peter had smoked a cigarette with his friends once before. Today he smoked a cigarette with his friends again, although his friends did not like the smell of the smoke.
78. Sophie had built a chair from old junk once before. Today she built a chair from old junk again, since old junk would make the chair look very distinctive.
79. Albert had opened an umbrella in the house once before. Today he opened an umbrella in the house again, since the house had a leak in its roof.
80. Jared had dressed a baby on the bed once before. Today he dressed a baby on the bed again, since the bed was bigger than the changing table.
81. Karen had chased a squirrel around the park once before. Today she chased a squirrel around the park again, because the park was filled with squirrels that ate people's food.
82. Caitlyn had consulted a therapist for her daughter once before. Today she consulted a therapist for her daughter again, because her daughter had trouble concentrating in school.
83. Joe had lit a candle in his house once before. Today he lit a candle in his house again, because his house had lost power during the rainstorm.
84. Madeline had sold an antique at the market once before. Today she sold an antique at the market again, although the market did not have many customers.
85. Katie had cursed a driver on the highway once before. Today she cursed a driver on the highway again, although the highway was usually not a stressful place to drive.
86. Mark had admitted an error at his job once before. Today he admitted an error at his job again, because his job had a very relaxed environment.
87. Harold had broken a bone in his finger once before. Today he broke a bone in his finger again, since his finger got crushed under a paperweight.
88. Mariah had replaced a tire during a storm once before. Today she replaced a tire during a storm again, since a storm had blown debris into the road.
89. Simon had hugged a teacher at his school once before. Today he hugged a teacher at his school again, since his school was a very supportive and friendly place.
90. Greg had milked a cow for the farmer once before. Today he milked a cow for the farmer again, since the farmer was away on a trip.

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91. Megan had played a violin with her instructor once before. Today she played a violin with her instructor again, since her instructor wanted to introduce her to new techniques.
92. Helen had rescued an animal from the shelter once before. Today she rescued an animal from the shelter again, since the shelter was running out of space for abandoned animals.
93. Robert had cleaned a chimney without his gloves once before. Today he cleaned a chimney without his gloves again, because his gloves were too small for him now.
94. Trevor had hunted a bear in the forest once before. Today he hunted a bear in the forest again, since the forest had become overrun with dangerous bears.
95. Kyle had trained a dolphin for the aquarium once before. Today he trained a dolphin for the aquarium again, since the aquarium had just acquired a new dolphin.
96. Nina had hired a nanny for her daughter once before. Today she hired a nanny for her daughter again, although her daughter had disliked her previous nanny.
97. Ed had discharged a soldier from the army once before. Today he discharged a soldier from the army again, although the army was facing a shortage of soldiers.
98. Josh had developed a film in the darkroom once before. Today he developed a film in the darkroom again, although the darkroom was only supposed to be used by teachers.
99. Beverly had expelled a student from the school once before. Today she expelled a student from the school again, since the school had a no smoking policy.
100. Kenny had explored a cave with his father once before. Today he explored a cave with his father again, although his father did not think they would find anything.
101. Philip had shot a pistol towards the lake once before. Today he shot a pistol towards the lake again, since the lake was empty and nobody would be hurt.
102. Ted had bitten a jalapeno at the restaurant once before. Today he bit a jalapeno at the restaurant again, although the restaurant thought it had removed the jalapenos from his food.
103. Noah had bribed an official for a contract once before. Today he bribed an official for a contract again, since a contract would save his business from bankruptcy.
104. Zoe had fooled a stranger with her story once before. Today she fooled a stranger with her story again, although her story had many inconsistencies in it.
105. Diana had drunk a martini at the bar once before. Today she drank a martini at the bar again, because the bar had a special on cocktails.
106. Brandon had filmed a protest for the police once before. Today he filmed a protest for the police again, because the police wanted a record of who attended the protest.
107. Susan had recited a poem at the contest once before. Today she recited a poem at the contest again, because the contest was an opportunity for people to get feedback.
108. Sergio had interviewed a politician for his newspaper once before. Today he interviewed a politician for his newspaper again, because his newspaper was running a story about the election.
109. Renee had crushed a bug on the window once before. Today she crushed a bug on the window again, since the window had been accidentally left open overnight.
110. Garrett had drained a pool without his pump once before. Today he drained a pool without his pump again, because his pump had broken the last time he used it.
111. Sharon had swindled a client with her scheme once before. Today she swindled a client with her scheme again, since her scheme had been very carefully planned.
112. Brian had confronted a bully at his school once before. Today he confronted a bully at his school again, because his school refused to take care of the problem.
113. Julia had run a marathon in bad weather once before. Today she ran a marathon in bad weather again, although bad weather would prevent her from improving her time.
114. Chloe had chaperoned a trip without other adults once before. Today she chaperoned a trip without other adults again, although other adults would have made the trip less stressful.
115. Andrew had evaluated a manager for his company once before. Today he evaluated a manager for his company again, since his company tracked the performance of all of its employees.
116. Charlie had bullied a girl in the daycare once before. Today he bullied a girl in the daycare again, although the daycare usually kept a close watch over the children.
117. Jacob had quoted a philosopher during the lecture once before. Today he quoted a philosopher during the lecture again, because the lecture was a historical introduction to the topic.
118. Janine had called a lawyer for her husband once before. Today she called a lawyer for her husband again, since her husband was being sued for breaking a contract.
119. Christina had scolded a toddler at the pool once before. Today she scolded a toddler at the pool again, because the pool was slippery, and dangerous to run around.
120. Adriana had delivered a speech without her notes once before. Today she delivered a speech without her notes again, because her notes had been left at home by accident.
121. Paul had harassed a waitress at the restaurant once before. Today he harassed a waitress at the restaurant again, because the restaurant was running inefficiently, and making him late for his
122. Sebastian had robbed a bank in his neighbourhood once before. Today he robbed a bank in his neighbourhood again, although his neighbourhood was small and he was likely to get caught.
123. Ivan had disarmed a bomb for his unit once before. Today he disarmed a bomb for his unit again, since his unit had been assigned a dangerous mission.
124. Linda had smacked a friend with her frisbee once before. Today she smacked a friend with her frisbee again, since her frisbee was bent and flew out of control.
125. Jeremy had stolen a candy from the store once before. Today he stole a candy from the store again, although the store was owned by a nice old man.
126. Dave had swallowed a bug on the trail once before. Today he swallowed a bug on the trail again, since the trail passed through an area swarming with bugs.
127. James had caught a moth in the kitchen once before. Today he caught a moth in the kitchen again, since the kitchen had bright lights which attracted bugs.
128. Ava had told a lie to the judge once before. Today she told a lie to the judge again, although the judge knew that she had lied before.
129. Christian had tutored a peer in social studies once before. Today he tutored a peer in social studies again, although social studies was not Christian's best subject at school.
130. Nicholas had carved a turkey for his relatives once before. Today he carved a turkey for his relatives again, although his relatives usually liked to carve it themselves.

131. Melinda had scratched a car during her commute once before. Today she scratched a car during her commute again, because her commute was hectic and another car had been careless.
132. Theresa had dropped an egg in the supermarket once before. Today she dropped an egg in the supermarket again, since the supermarket had not packaged its eggs securely.
133. Jordan had defended a murderer in the courtroom once before. Today he defended a murderer in the courtroom again, although the courtroom was packed with friends of the victim.
134. Alexa had insulted a customer at the checkout once before. Today she insulted a customer at the checkout again, since the checkout was crowded and the customer was delaying everyone else.
135. Rick had rolled a falafel at the stand once before. Today he rolled a falafel at the stand again, because the stand was run by a family friend.
136. Naomi had climbed a tree with her friend once before. Today she climbed a tree with her friend again, although her friend was afraid to climb it at first.
137. Grant had intimidated a witness for his gang once before. Today he intimidated a witness for his gang again, since his gang was being charged with various crimes.
138. Matilda had disregarded a warning at the factory once before. Today she disregarded a warning at the factory again, although the factory was a dangerous place to work.
139. Roger had slaughtered a cow on the farm once before. Today he slaughtered a cow on the farm again, because the farm was planning to sell some beef at the market.
140. Rebecca had evicted a tenant from the building once before. Today she evicted a tenant from the building again, because the building was becoming unsafe for others.
141. Mia had bought a gift for her boss once before. Today she bought a gift for her boss again, because her boss had just given her a promotion.
142. Bruce had undressed a mannequin at the store once before. Today he undressed a mannequin at the store again, since the store had asked him to help close up.
143. Elizabeth had recommended a novel at the bookclub once before. Today she recommended a novel at the bookclub again, because the bookclub was running out of ideas for books to read.
144. Sarah had thrown a baseball in the park once before. Today she threw a baseball in the park again, because the park had lots of open space.
145. Chelsea had read a book in the garden once before. Today she read a book in the garden again, since the garden was a pleasant place for thinking.
146. Derek had hit a homerun for his team once before. Today he hit a homerun for his team again, although his team did not end up winning.
147. Lauren had designed a costume for the pageant once before. Today she designed a costume for the pageant again, because the pageant wanted to display new costumes this year.
148. Kayla had hosted a guest with her partner once before. Today she hosted a guest with her partner again, although her partner was shy and usually avoided most people.
149. Sonia had sheltered a friend from a hurricane once before. Today she sheltered a friend from a hurricane again, because a hurricane could destroy her friend's tiny house.
150. Nate had reprimanded a student in the classroom once before. Today he reprimanded a student in the classroom again, because the classroom was not a place to run around in.
151. Julian had belittled a teammate at the game once before. Today he belittled a teammate at the game again, although the game had gone well for their team.
152. Kristen had attended an opera with her uncle once before. Today she attended an opera with her uncle again, because her uncle wanted her to learn about culture.
153. Alyssa had dissected a frog with her class once before. Today she dissected a frog with her class again, since her class was learning about the anatomy of amphibians.
154. Lillian had washed a car at the carwash once before. Today she washed a car at the carwash again, although the carwash had scratched her car last time.
155. Nathan had interrogated a suspect with his partner once before. Today he interrogated a suspect with his partner again, although his partner was more experienced and did most of the work.
156. Matt had diagnosed a disease for his patient once before. Today he diagnosed a disease for his patient again, although his patient had not taken medication for her previous illness.
157. Kevin had shovelled a driveway with his wife once before. Today he shovelled a driveway with his wife again, because his wife had wanted it cleared for a long time.
158. Jane had ridden a motorcycle without her helmet once before. Today she rode a motorcycle without her helmet again, although her helmet would have protected her if she crashed.
159. Harrison had photographed an exam with his phone once before. Today he photographed an exam with his phone again, since his phone was easy to conceal from his teacher.
160. Dana had fixed a computer at the lab once before. Today she fixed a computer at the lab again, since the lab never hired a dedicated technician to maintain the equipment.

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