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Time, Perspectives, Verbs, and Imagining Events

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TIME, PERSPECTIVES, VERBS, AND IMAGINING EVENTS

By

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Abstract

During the processing of verbs, readers form internal representations of the events described by those verbs. Two key elements in the construction of event representations are temporal information, given by the verbs that describe the represented events, and the visual perspective from which the events are represented. The current study is composed of two experiments aimed at examining the roles these two factors play in event representation. Specifically, the study aimed to determine how temporal information and visual perspective are represented during event imagination.

Experiment 1 investigated the role of temporal information associated with verbs, given by grammatical aspect (GA) and lexical aspect (LA). GA refers to morphosyntactic structures that variably focus on events as being ongoing or as having ended. Experiment 1 was concerned with two past-tense forms of GA: the imperfective (e.g., I was acting), which places focus on the ongoing portion of an event; and the perfective (e.g., I acted), which places focus on the completion of an event. Lexical aspect refers to the property of a verb as possessing or lacking a natural endpoint. Experiment 1 was concerned with accomplishment verbs (e.g., build), which possess natural endpoints, and activity verbs (e.g., act), which lack natural endpoints. Participants read short verb phrases and imagined themselves participating in the described events. During imagination, slow-cortical potential amplitudes (SCPs) were recorded using electroencephalography (EEG), as an index of cognitive effort associated with imagining. Participants also completed behavioural measures on the temporal and sensory properties of their imagined events. SCP results indicated that imagining events based on activity cues was more effortful when cues were given in the perfective than when they were given in the imperfective aspect. In contrast, accomplishments were associated with more effortful imagining when given

in the imperfective than when given in the perfective aspect. Differences in GA/LA were also found to lead to changes in the tendency to view events from either the first-person or the third-person perspective, as indicated by self-report measures.

Experiment 2 used cue phrases containing imperfective activity verbs and participants were prompted to either take a first or third person perspective when imagining events. SCP results indicated that greater cognitive effort was associated with imagining activities from the third-person perspective as compared to the first-person perspective.

Results for both experiments are discussed further in terms of topographical differences in SCP negativity and differences in behavioural ratings. This research represents a novel examination of how the imagination process is constrained by the different types of temporal information present in verb cues and the perspective from which imagined events are represented.

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Time, Perspectives, Verbs, and Imagining Events

When a person imagines an event, they combine the disparate elements of that event to form a coherent mental representation. These elements include one's sensory experience, the entities and objects in the event, and the location in which the event takes place. Further, all of these elements can vary in the level of vividness with which they are imagined and the level of personal importance associated with the event. Event representations also vary as a result of temporal information. For example, varying representations of duration are associated with specific events, and particular event segments (beginning, middle, end) may be more salient than others (Madden & Ferretti, 2009). In the process of representing an event, these elements are combined to form a situation model (Zwaan & Radavansky, 1998).

Various linguistic properties guide the temporal layout of a situation model. For example, tense is responsible for defining an event's relative date of occurrence as taking place in the past, present, or future. Moving the narrative time line causes the updating of situation models and this creates cognitive difficulty (Anderson, 1983; Ditman & Kuperberg, 2008; Dwivedi, Phillips, Laguë-Beauvais, & Baum, 2006; Zwaan, 1996). Furthermore, real-world knowledge plays a role in defining an event's duration and whether or not they include a natural temporal endpoint (i.e., telicity). For example, writing a cheque might take a few minutes while writing a book might take a few years. However, such durations can only be estimated with knowledge of performing these actions.

The current project is comprised of two experiments. Experiment 1 investigated two properties associated with verbs that guide temporal organization in situation models of individual events: Grammatical aspect (GA) and lexical aspect (LA; Vendler, 1957). These factors play a role in shaping event representations as being ongoing or completed, as having

natural temporal endpoints or no endpoints, and variably place focus on specific segments of an event (see Madden & Ferretti, 2009, for a review). The main goal of this experiment was to elucidate the manner in which these temporal variables interact to constrain people's ability to imagine events.

While Experiment 1 was primarily concerned with the cognitive effort associated with imagining events, results from this experiment revealed that differences in grammatical and lexical aspect may also lead to differences in peoplepleened with the imagine events from the first-person or the third-person perspective. Experiment 2 was conducted to investigate how these differences in perspective affect the cognitive effort associated with imagining events without natural endpoints (i.e., activities). The framework for Experiment 2 is therefore based on the outcome of Experiment 1. As such, Experiment 1 is described first and is preceded by an overview of various investigations on GA, studies which pertain to the SCP methodology used in the current study, and examinations of the neurophysiology of event imagination. Experiment 2 is described thereafter.

GA and the mental representation of events

GA is morphosyntactic information that references the temporal development of events as either ongoing or completed (Comrie, 1976; Dowty, 1979). Three forms of GA exist in the English language: the imperfective, the perfective, and the perfect. The imperfective (e.g., I was dancing) references events as ongoing, whereas the perfective (e.g., I danced) and perfect (e.g., I had danced) forms references events as completed.

Previous psycholinguistic research on GA has shown that it plays a key role in the construction of event representations during language comprehension, as well as affecting the availability of information in situation models (Becker, Ferretti, & Madden-Lombardi, 2013;

Carreiras, Carriedo, Alonso, & Fernández, 1997; Ferretti, Rohde, Kehler, & Crutchley, 2009; Ferretti, Kutas, & McRae, 2007; Magliano & Schleich, 2000).

Carreiras et al. (1997) investigated the manner in which GA and temporal associations between characters impact mental representations. In this experiment, participants read short stories about two characters. Each story began with two sentences, each describing one of the characters. These descriptions were followed by the critical sentence, which provided temporal information on the main character and was phrased in the imperfective or the perfect aspect. Critical sentences were structured such that they did or did not describe both characters as concurrently being in the same location. Critical sentences were followed by 0, 1, or 2 filler sentences before the presentation of a test word. As shown in the example below, the test word for experimental trials was the name of the main character.

1. John works as a waiter in a restaurant.

2. Mary eats there every day.

3. John was finishing / had finished his shift

4. when Mary arrived at the restaurant.

5. She asked for the dish of the day.

6. She read the newspaper while waiting for the food.

Test word: John

The results showed that reaction times were faster when the critical sentence was phrased in the imperfective as compared to the perfect (i.e., when both characters were concurrently in the same location, as compared to when they were not). It was also found that greater sentence distance led to slower reaction times to the test word. These results were taken to indicate that

differences in syntax-based temporal information led to associations and disassociations in mental models.

GA has also been found to interact with both knowledge of real-world event durations and working memory capacity. These factors have been shown to influence representations of multiple events co-occurring or occurring in sequence in narratives (Magliano & Schleich, 2000; Mozuraitis, Chambers, & Daneman, 2013). For example, Magliano and Schleich (2000) conducted a series of experiments in which participants read short narratives that varied by aspect (perfective/imperfective) in the critical sentence. A question, intended to determine if the event in the critical sentence was perceived as ongoing or completed, appeared after 1 to 4 subsequent sentences. Individual experiments examined the manner in which aspect interacts with knowledge of real-world event durations and participants' working memory spans. In general, the results indicated that participants were more likely to perceive events initially given in the imperfective, as opposed to the perfective, as being ongoing at the time of the questions. Furthermore, the likelihood of perceiving an imperfective event as ongoing decreased as the number of sentences separating the critical sentence and the response prompt increased. This decrease was more exaggerated when short-duration, as opposed to long-duration events, were described in the imperfective aspect. This interaction was not found for perfective critical sentences.

Response times to the probe questions that followed the critical sentence did not vary as a direct function of either grammatical aspect or working-memory span. However, an interaction between these factors was observed. For questions following the critical sentence by 4 sentences, individuals with high working-memory spans responded more quickly when the critical sentence was in the imperfective than when it was in the perfective. This GA-based difference in response

time was not observed for the low-working-memory participants. This result was taken to indicate that high-span individuals are more capable of maintaining discourse information in a high state of activation when imperfective aspect references events as ongoing in the narrative.

Madden and Zwaan (2003) have also shown that participants associate imperfective and perfective stimuli with visual depictions of ongoing and completed events, respectively. In one experiment, participants were given a sentence written in the imperfective or the perfective aspect and were asked to select from two pictures the one that best represented the sentences. One of these pictures depicted the described event as ongoing, while the other picture depicted it as having been completed. Participants were more likely to associate the imperfective and perfective stimuli with the ongoing and completed event depictions, respectively. Another experiment aimed to determine whether or not verb aspect is implicitly associated with ongoing and completed states, in the previously determined manner. Participants in this experiment were again exposed to imperfective and perfective stimuli but were shown only a single picture afterwards and were required to quickly as possible to indicate if the picture accurately captured the preceding sentences. The results showed that for perfective sentences participants were faster to respond to pictures depicting completed events as compared to those depicting ongoing events. Alternatively, this difference was not seen following the two different pictures for imperfective sentences.

The influence of GA has also recently been shown to influence event representations in domains of cognitive processing other than language comprehension (Ferretti & Katz, 2010; Matlock, Sparks, Mathews, Hunter, & Huette, 2012; Salomon, Magliano, & Radvansky, 2013). For example, Salomon et al. (2013) demonstrated that GA can influence the ease of solving insight problems. Participants in their research were posed with two sets of insight problems,

each of which required participants to focus on a certain aspect of the problems to realize the solution. One set of problems required participants to focus on the action taking place in each problem, while the other set required participants to focus on the gender of a character in each problem.

In this study, imperfective phrasing, rather than perfective phrasing, was found to lead to correct responses to problems requiring focus on actions. In contrast, a perfective advantage was found for problems where finding the solution required a focus on gender information. For those solutions that required a focus on gender, imperfective phrasing was concluded to have detracted from problem solvability by drawing attention to irrelevant action information. Thus, action information distracted participants from focussing the gender information required to develop correct solutions. This result was interpreted as indicating that the imperfective aspect leads to events being represented with a focus on the actions taking place in those events.

Matlock et al. (2012) has also shown that GA can bias the way events are communicated and conceptualized. This research investigated how recordings of vehicle accidents are perceived according to the form of GA with which questions regarding the event are posed. Participants in this study were shown recordings of vehicle accidents and asked "What was happening?" (imperfective) or "What happened?" (perfective). Responses were analyzed in terms of word and gesture frequencies. It was found that motion verbs were more often used to respond to imperfective questions than to perfective questions. Conversely, non-motion verbs were more often used to respond to questions phrased in the perfective, as compared to the imperfective. It was also found that participants made a greater number of references to reckless driving behaviours when the question was posed in the imperfective as compared to when it was posed in the perfective.

Gesture frequencies were analyzed in terms of iconic gestures and beat gestures. Iconic gestures are those that provide information on motion, size, and spatial information. In contrast, beat gestures are shorter movements that convey no semantic information. Questions in the imperfective, as compared to the perfective, were found to evoke more iconic gestures. In contrast, questions in the perfective, as compared to the imperfective, were found to evoke more beat gestures. Thus, it was concluded that information on actions seems to become more vivid and accessible, when questions are phrased in the imperfective rather than the perfective. This research represents a situation in which GA plays a clear role in modifying representations of key real-world events and highlights the benefit of further research into the constraints placed upon event representation by variations in GA and other linguistic factors.

Research on GA has also investigated how GA influences event representations during autobiographical memory (AM) retrieval. Ferretti and Katz (2010) presented participants with cues consisting of imperfective, perfective, and perfect sentence cues describing personal events (e.g., I had written an exam in high school). Participants then read these cues, recalled AMs based on the cues, and answered a questionnaire on the details of their recalled AMs. Results indicated that imperfective cues more often led to memories being recalled from the first-person perspective, as if reliving the memory, as compared to the other two forms of aspect. Other findings demonstrated that the temporal segments of recalled events were constrained such that imperfective cues more likely led to a memory featuring the middle of an event, whereas perfect cues more likely led to a memory featuring the end of an event.

Ferretti et al. (2009) has also examined the role played by GA in the formation of situation models during reading tasks that require coreferential processing. Their first study had participants read sentences that each describe the transfer of an object between two people who

differed in gender (e.g., "Mary handed a book to Tom"). This gender difference was included to ensure that any pronouns in subsequent sentences would be unambiguous. These sentences were phrased in either the imperfective or the perfective aspect. Using these stimuli, the researchers aimed to determine how GA influences the relative salience of the source referent (the person transferring the object) and the goal referent (the person to whom the object is transferred). Participants read the sentences describing the object transfer and then wrote another sentence that could plausibly follow each of the first sentences. Their results showed that continuations most often made reference to the goal of stimulus sentences. Additionally, it was found that references to the goal were more often made following perfective than imperfective sentences. These results were taken to indicate that perfective phrasing places focus on the end portion of an event. Thus, salience for the goal referent was increased by perfective phrasing relative to imperfective phrasing.

The second experiment conducted by Ferretti et al. (2009) used ERP methodology to examine how changes in GA influence coreferential processing. Participants in this experiment were shown sentence stimuli, each consisting of two sentences: A sentence that was similar to those used in the first experiment and a subsequent sentence that used an unambiguous pronoun that had a gender consistent with either the preceding source or goal entity. For each sentence, it was predicted that participants would develop expectations from the first sentence about who is likely to be mentioned next in the subsequent sentence. Further, it was predicted that the pronoun would more often be expected to refer to the goal than the source. It was also predicted that pronouns would refer to the goal more often following perfective sentences, as compared to imperfective sentences. In order to examine participants' expectations, the researchers analyzed two ERP components: Left anterior negativity (LAN) and the P600 component. LAN amplitudes

have previously been established as reflecting the processing of morphosyntactic violations, including pronouns mismatching referents according to gender (Coulson, King, & Kutas, 1998; Osterhout & Holcomb, 1992). The P600 component has been established as reflecting syntactic violations, complexity, and reanalysis (Coulson, King, & Kutas, 1998; Osterhout & Holcomb, 1992). ERP amplitudes indicated that greater cognitive effort was required to process pronouns that referred to the source than was required to process those that referred to the goal. Following perfective, but not imperfective sentences, P600 results indicated that participants recognized a gender mismatch when pronouns referred to the source, as compared the goal. Analysis of the LAN revealed a similar pattern of results to that of the P600. This result, in combination with the aforementioned P600 result, was taken to indicate that perceived gender mismatches between pronouns and their referents are perceived as morphosyntactic violations.

    Ferretti et al. (2007) conducted a series of experiments in which they looked at the role of GA in activating event knowledge. Their first experiment focussed on how event representation is altered by the actions described by verbs and the locations in which those actions take place. In this semantic priming experiment, participants were presented with action-location pairs, with actions given in either the imperfective (e.g., was skating) or the perfect (e.g., had skated). Each action-location pair consisted either of a verb and a location commonly associated with that verb (e.g., was skating–arena) or a verb and a location that is not associated with that verb (e.g., was praying–arena). Participants silently read verb phrases to themselves and then named the target locations aloud. It was found that naming latencies were shorter for related pairs than for unrelated pairs, but only for imperfective verb phrases.

    Ferretti et al.'s second experiment investigated the influence of GA on the content of sentences. In this experiment, participants wrote continuations to sentences phrased in the

imperfective (e.g., The cow was grazing...) or the perfect aspect (The cow had grazed…). Sentences were analyzed in terms of phrase type with which they were completed: locative prepositional, other prepositional, noun, adverb, and conjunctive. It was found that locative prepositional phrases were more often used to complete imperfective sentence fragments than they were to complete perfect sentence fragments. This difference indicates that imperfective phrasing, relative to perfect phrasing, places a greater amount of emphasis on location information. In contrast, noun phrases and adverbial information were more often used to complete perfective than imperfective sentence fragments. It was concluded that perfect aspect places a greater amount of emphasis on direct objects than does imperfective aspect. Conjunctive phrases were equally likely to be used to complete either imperfective or perfect sentence fragments.

In their third experiment, the sentences were designed to describe actions occurring in locations where they would be commonly expected to occur (high-expectancy condition, e.g., "The diver was snorkelling in the ocean") or would not be commonly expected to occur (low-expectancy condition, e.g., "The diver was snorkelling in the pond"). Sentences in this experiment were phrased either in the imperfective or in the perfect aspect. EEG was recorded as participants read sentences. Differences in two ERP components were expected and analyzed: The N400 and slow cortical Potentials (SCPs). The N400 is a negative amplitude that peaks 300-500 ms following stimulus onset. In language processing, the N400 is often used as an index of semantic expectancy (Kutas & Hillyard, 1980). As such, Ferretti et al. (2007) analyzed N400 amplitudes as an index of locations expectancy in sentence processing. The researchers also analyzed SCP amplitudes as an index of cognitive load associated with the processing and integration of locative prepositional phrases in sentences.

Following the reading of sentences in the imperfective, but not in the perfect aspect, participants were found to exhibit more negative N400 amplitudes in response to low-expectancy versus high-expectancy locations. This result was consistent with those of the previous experiments. The researchers concluded that imperfective stimuli are more likely to cause participants to develop expectations for common event locations, whereas locative information in perfect sentences is less expected, regardless of location commonality. As is indicated by the difference in SCP amplitudes, these violations of expectation also lead to greater difficulty of information integration into sentence representations. Collectively, these experiments indicate that location information is more accessible based on imperfective stimuli than based on perfect stimuli.

The findings discussed above make it clear that GA plays a key role in influencing event representations during a range of tasks that involve different cognitive processes. The present research extends this body of research by examining how GA influences the ease of imagining different categories of events. Next we describe the type of events examined in the current study.

LA and the mental representation of events

While GA can place focus on the ongoing portion or the endpoint of an event, some events denoted by verbs inherently do or do not possess natural endpoints (Comrie, 1976; Dowty, 1979, Lyons, 1977). This property of LA refers to the nature of a verb as being telic (possessing a natural endpoint) or atelic (lacking a natural endpoint). Accomplishment verbs such as "build" are classified as telic because they have a natural endpoint (i.e., something gets built). In contrast, an activity verb such as "act" is atelic because it is not necessarily associated with a natural endpoint in the absence of a temporally constraining context (e.g., I acted in a Broadway musical; Vendler, 1957).

Recent research by Yap et al. (2009) has shown that people have more difficulty constructing mental representations of events when GA forces completion status to events without natural endpoints (activities), or when GA forces ongoing status to events with natural endpoints (accomplishments). Participants in this research heard sentences describing events that contained an accomplishment or activity verb and were phrased in imperfective or perfective aspect. Following each auditory stimulus, participants were presented with a pair of pictures, which depicted two variations of the previously heard event: the ongoing event or the event's completion state. Participants were, as quickly as possible, to select the picture most closely described by the preceding sentence. Response times for activity sentences were faster when stimuli were phrased in the imperfective as compared to the perfective aspect. Conversely, accomplishment sentences led to faster selection times when phrased in the perfective as compared to the imperfective aspect.

The interaction between GA and LA has also recently been examined in an ERP study in the context of information availability in situation models (Becker et al., 2013). Participants in this research read a set of short stories that contained a critical sentence describing an activity or accomplishment given in the imperfective or the perfective aspect. The critical sentence was followed by a sentence describing either a temporally long or a short intervening event. The subsequent probe sentence contained the target word that referred to the event in the critical sentences. As the N400 component is known to be more negative for words that are semantically more difficult to integrate with the context (Kutas & Hillyard, 1980; Brown, Hagoort, & Kutas, 2000), this component was examined to determine the availability of preceding information at the time of the onset of the target words. The results of this study showed that information was more available if it had previously been given in the imperfective as compared to the perfective

aspect. However, this was only the case when the critical sentence described an accomplishment and was followed by a buffer sentence that described a short intervening event. This result provides empirical evidence of the electrophysiological differences in temporal representation, based on the matching/mismatching temporal information given by GA and LA.

These results highlight the importance of GA and LA in influencing mental representations of events. While a large body of previous research has examined the role of GA in event representations, only a few studies have examined the interaction between GA and LA. Thus there is a need for further investigation into the GA/LA interaction in the mental representation of events. The current research examines how GA and LA interact to influence the ease of imagining events. The findings will provide insight into the processing of temporal information in sentences and to further elucidate the manner in which time is represented during event imagination.

Slow cortical potentials in language processing

Slow Cortical Potentials (SCPs) are EEG-recorded amplitudes recorded from the scalp. These amplitudes have a relatively long duration, lasting from a few hundred milliseconds to a number of minutes. A number of studies have found SCP amplitudes to indicate levels of cognitive effort associated with language processing (e.g., Ferretti et al., 2007; King & Kutas, 1998).

Münte, Schiltz, and Kutas (1998) investigated the processing of sentences that describe sequentially occurring events. Specifically, this experiment was concerned with two types of sentences that contain temporal modifiers; examples of which are below:

(1) After the scientist submitted the paper, the journal changed its policy.

(2) Before the scientist submitted the paper, the journal changed its policy.

Each of these two example sentences describes two sequential events. The first example contains the modifier "after" which retains the natural temporal order of the two described events, whereas the second example uses the modifier "before" which disrupts the natural temporal order of the two events.

Münte et al. (1998) used EEG to investigate how disrupting the natural temporal order of events affects sentence processing. Amplitudes were recorded during the reading of sentences, similar in structure to those in the given examples (1, 2), which similarly began with the word 'After' or 'Before'. Participants were also given a sentence span task, to test their working memory capacities. Results indicated that EEG-recorded SCP negativity was greater for 'Before' sentences than for 'After' sentences. It was also found that the difference in negativity, according to sentences type, was positively correlated with working memory capacity. These results show that people use real world information combined with sentence descriptions of temporal structures to process event information. It is expected that people make use of the real-world, temporal knowledge given by LA, in a similar manner.

King and Kutas (1995) used ERP methodology to investigate how the processing of subject- (1) and object-relative (2) sentences is influenced by readers' working memory capacities.

(1) The reporter who harshly attacked the senator admitted the error.

(2) The reporter who the senator harshly attacked admitted the error.

SCP amplitudes were recorded while participants read sentences. Additionally, participants were tested on their comprehension of the sentences previously read. Based on comprehension test results, participants were classified either as 'Poor Comprehenders' or 'Good Comprehenders'. Across all participants, it was found that SCP amplitudes were more negative

for object-relative sentences than for subject-relative sentences. This negativity and sentence-type-based difference in amplitude was found to be greater for Good Comprehenders than for Poor Comprehenders. Based on these results, the researchers concluded that the observed SCP amplitudes could be seen as indexing the difficulty of sentence processing, with greater negativity in SCP amplitudes indicating greater processing difficulty.

SCP methodology has also been used by Conway, Pleydell-Pearce, and Whitecross (2001) to investigate the electrophysiological correlates of autobiographical memory retrieval. Participants in this study retrieved autobiographical memories in response to noun cues from three categories: common objects (e.g., chair), common locations (e.g., restaurant), and emotions (e.g., happy). Upon viewing a cue, each participant retrieved a related, autobiographical memory, and indicated by a lever pull that they had successfully done so. After memory retrieval, participants held their memories in mind for 5 seconds and then actively released the memory from mind over the following 5 seconds. Participants also recorded ratings on their retrieved memories regarding memory vividness, importance, emotionality, and how frequently the memory had been rehearsed.

Based on the SCP results, Conway et al. (2001) concluded that autobiographical memory retrieval is associated with a pattern of activation beginning in left-frontal networks and moving to right-posterior networks. This left-frontal activation was interpreted as being associated with memory retrieval, while the later, right-posterior activation was associated with holding a memory in mind. It was also noted, based on behavioural results, that memories were predominantly visual in nature. Lastly, it was found that, during early retrieval, memories based on emotion cues were associated with the most SCP negativity while those based on object cues were associated with the least. In the later "hold-in-mind" phase, however, memories based on

emotion cues were found to elicit the greatest negativity of all cue types. This increased negativity was concluded to be associated with greater recruitment of cognitive resources.

Neurophysiology of imagined events

Further ERP research by Conway and colleagues has investigated the similarities and differences in the electrophysiological correlates of imagining events and retrieving events from AM (Conway et al., 2001; Conway, Pleydell-Pearce, Whitecross, & Sharpe, 2003). This research, and the fMRI research discussed below, converge to show that in general the same brain regions are recruited for AM retrieval and imagining events, although to different degrees.

Using methodology similar to that of Conway et al. (2001), Conway et al. (2003) examined the neurophysiological similarities between the processes of autobiographical memory recall and event imagining. Participants generated and held in mind AMs and imagined events that were elicited to noun cues that described common objects and generic locations. The researchers examined how SCPs changed while people generated and held these event representations in mind. Conway et al.'s (2003) findings showed that in the event generation phase, SCPs were more negative over left frontal regions for both AM and imagined event representations (Dwivedi et al., 2006). This negativity over the left frontal regions is thought to capture cognitive mechanisms that are necessary for constructing event representations. Another key finding was that during the generation phase, SCPs became more negative over posterior occipital regions, and that this negativity was greater for AM representations. The authors suggest that these differences at posterior occipital regions reflect differences in the content of the forms of event representation, with AMs more likely to invoke the activation of sensory/perceptual knowledge than imagined events. Note that the methodology employed in the current study is based on that of Conway et al. (2001; 2003), in that it also involves participants

generating events in response to textual stimuli. This methodological similarity allows for the discussion, later in this document, of interpretations of the current study's results, based on Conway et al.'s (2003) interpretations of differences in SCP topography associated with event representation.

Addis, Wong, and Schacter (2007) employed a functional magnetic resonance imaging (fMRI) paradigm in order to identify and contrast the neural substrates of recalling past events with those of imagining plausible future events. Participants were cued with various nouns as well as instructions either to recall or to imagine a noun-related event. In response to each cue, participants were to construct the event in their minds (construction phase), indicate via button press that they had done so, and then continue to elaborate on the event in mind (elaboration phase). Participants were also cued with descriptions of the timeframes for events (e.g., last week, last year, next year, etc.) and told to imagine events from the first-person perspective. A semantic retrieval task and a visual imagery task were interspersed between trials to act as control tasks.

The researchers concluded that the right frontopolar cortex has a role in prospective thinking and that the left ventrolateral prefrontal cortex is involved in the process of event generation. The right hippocampus was determined to be associated with the process of future event imagination, as it was uniquely activated during this process. Both processes were also found to activate areas that constitute the autobiographical memory retrieval network.

Another fMRI study conducted by Hassabis, Kumaran, and Maguire (2007) similarly investigated the neural correlates of event recall and event imagination. This research attempted to more finely identify the neural correlates of complex episodic recollection and imagination by contrasting activation for retrieval/generation of complex scenes with that for simple objects. In

order to accomplish this, the researchers had participants form memories and imagine scenes and objects prior to the actual scanning procedure. During pre-scan interviews, participants completed four tasks:

1. Remember a set of common objects, based on pictures of those objects.

2. Visualize and remember a set of common objects, based on verbal descriptions of those objects.

3. Imagine scenes, based on verbal descriptions of locations.

4. Recall recent, episodic memories.

During the scanning sessions to follow, participants formed mental representations, based on cues, while undergoing fMRI scanning. Specifically, participants retrieved representations of the objects, locations, and episodic memories that had been recalled or created during the pre-scan interview. Additionally, participants were to imagine new fictitious scenes and objects. These tasks allowed for the comparison of object representation and scene representation in order to isolate those neural components distinctly recruited by the process of scene representation. Representations for imagined scenes could then be contrasted with those of episodic memories. The results showed that both episodic memory retrieval and the construction of new fictitious scenes recruited the hippocampus, parahippocampal gyrus, retrosplenial cortices, posterior parietal cortices, and ventromedial prefrontal cortex. Additionally, activation occurred in the anterior medial prefrontal cortex, the posterior cingulate cortex, and the precuneus, only during the process of episodic memory retrieval. It was concluded that these regions may be involved in the representation of self-related processes and in mental time travel.

Experiment 1

The current study employed an imagination task similar to that used by Conway et al. (2003) to investigate the electrophysiological differences associated with processing GA and LA in verb phrases while people imagine events. Relatively little is known about how GA and LA influence event representations and, therefore, the main goal was to contribute to this limited, but important, literature by examining the influence of GA and LA in terms of both the ease of imagining events and qualitative differences in event representation. This research aimed to determine how temporal information is represented in the brain during the process of event imagination. The investigation of how these factors influence invent imagination is crucial to the understanding of sentence processing, discourse processing, the representation of time during event imagination, and the development of experimental paradigms that use verbal cues.

In the present study, participants read short sentences (e.g., I was building) that always begin with the pronoun "I" and contain an imperfective or perfective verb that is either an activity or an accomplishment. EEG amplitudes were recorded for later SCP analysis while participants imagined themselves participating in the described events for 8 seconds. Behavioural measures were also employed to investigate the influence of GA and LA on ratings of sensory vividness as well as vividness of people, objects, and locations. Other crucial event properties investigated include the perspective of the imagined events (first versus third person), the temporal component of the events imagined (beginning, middle, end), the rated importance and duration of the events in the real world, and the number of people and objects present in the events. Based on the previous GA research discussed above, we expect that in general the behavioural measures should show evidence that the imperfective aspect highlights properties of events that are consistent with the ongoing nature of those events, whereas the perfective phrases should highlight properties consistent with the completion of those events.

Our predictions about SCP amplitudes and the ease of imagining the events are based on the previous GA and LA findings with a sentence-picture matching paradigm (Yap et al., 2009). If Yap et al.'s findings extend to when people simply imagine events, then forcing people to imagine Activities (which do not have natural endpoints) as *completed* (perfective) should cause greater negative SCP amplitudes than when the same events are ongoing (imperfective). Conversely, forcing people to imagine Accomplishments (which do have natural endpoints) as *ongoing*, should cause SCP amplitudes to be more negative than when those same events are imagined as completed (see Table 4 for a tabular representation of predicted results).

Method

Participants

Participants were 50 (29 female) students from Wilfrid Laurier University, ranging in age from 18-21 years. All participants were right-handed native English speakers. Participants were granted course credit for their participation.

Materials

The experimental stimuli consisted of 46 activity verbs and 46 accomplishment verbs (see Appendix A, Tables 1 & 2). A Google frequency search was conducted to ensure that the activity and accomplishment verbs used did not differ in commonality across their aspectual forms. A GA (imperfective vs. perfective) X LA ANOVA was conducted on the collected frequencies. Verb stimuli were not found to differ based on GA, $F(1,180) = 1.271$, $p = .261$, LA, $F(1,180) = 1.061$, $p = .304$, and there was no GA X LA interaction, $F(1,180) = .390$, $p = .533$. These verbs were presented in short phrases that always began with the pronoun "I". Half of the phrases were presented in the imperfective form (e.g., I was skating) and the other half presented

in the perfective form (e.g., I skated). Thus, there were 4 conditions presented in the form of the following examples:

Imperfective Accomplishment: I was building

Perfective Accomplishment: I built

Imperfective Activity: I was acting

Perfective Activity: I acted

Two experimental lists were created such that each participant saw each verb only once and received 23 trials in each of the 4 conditions. Across the 2 lists, each verb appeared in both its imperfective and perfective form. Each list also contained 2 additional trials at the beginning that served as practice trials.

A booklet (see Appendix A, Figure 1) was also provided to each participant that consisted of a set of questions that were to be answered following each trial. These questions included 1) the perspective of the imagined event; from my eyes (first person) / looking at self (third person), 2) sensory vividness (sight, touch, taste, smell, sound) on a 1-7 scale (1 = not at all, 7 = very), 3) vividness of people, objects, and locations on a 1-7 scale (1 = not at all, 7 = very), 4) the temporal component of the events imagined (beginning, middle, end), 5) the number of people and objects present in the imagined event, 6) the estimation of the duration of the imagined events in the real world, and 7) the importance of the imagined events in the real world (1 = not at all, 7 = very).

Procedure

Participants were seated in an electrically shielded room facing a monitor and a push-button switch. Participants were then outfitted with an EEG cap. Following capping, participants were instructed to imagine themselves participating in the described action that appears on the screen. It was emphasized that the imagined action should not simply be a memory. On each trial the stimulus presentation began with a "Ready?" prompt, to which participants responded by pressing a button to begin the trial. Following this prompt, a fixation, "XXXX", was presented in the centre of the screen for 5000 ms. Participants were instructed to focus on this fixation. The fixation was followed by a stimulus phrase with either the first (perfective condition) or first two words (imperfective condition) presented one at a time in the centre of the screen. These words were always presented for 300 ms and then followed by 200 ms of blank screen). The last word in the phrase (i.e., verbing/verbed) remained on the screen for 8 seconds. After the verb was on the screen for 8 seconds, it was replaced by the instruction, "Record answers now" (see Figure 2 for a sample trial). Participants then completed the behavioural questionnaire regarding the properties of the preceding imagined event.

EEG Recording

The electroencephalograph (EEG) was recorded via a cap that contained 64 Ag/AgCl electrodes distributed evenly across the scalp (10-20 layout). Electrodes were placed on the left infra and supra orbital ridge of each participant as well as the outer canthii. EEG was processed through a Neuroscan Synamps2 amplifier, set at a bandpass of 0.05-100 Hz and digitized at 250 Hz. Electrical impedance was kept below 5 KΩ.

<div align="center">Results</div>

EEG Results

The raw data was re-referenced off-line to the average of the left and right mastoids. A low-pass filter set at 30 Hz was applied to remove high frequency noise. Trials contaminated by artifacts (blinks, excessive muscle artifact, etc.) were removed before averaging. ERP averages were then created for each participant that spanned 200 ms before the onset of the verbs in each phrase to 6 seconds following the verbs.[1] For analysis purposes, the averages for all participants were separated into 500 ms time segments for the first 3 seconds following the onset of the verbs in the phrases, and then separated into 1000 ms segments for the remaining 3 seconds of the imagining period. The shorter time measurements for the first half of the imagination periods allowed examination of changes in amplitudes that reflect the transition from comprehending the phrases to actively trying to imagine the events over the six second period.

The mean amplitudes for each temporal region were then subjected to a GA (imperfective vs. perfective) X LA (activities vs. accomplishments) X Anteriority (prefrontal vs. frontal vs. central vs. parietal vs. occipital) X Hemisphere (left vs. right) X List (1 vs. 2) ANOVA. The electrodes that comprised the topographical variables included FP1, FP2, F3, F4, C3, C4, P3, P4, CB1, CB2. All variables except for List were within-participant variables. Note that topographical effects are only reported below if they interacted with GA and/or LA because those are the topographical interactions of main theoretical interest. All p-values are reported after Epsilon correction (Huynh-Felt) for repeated measures with greater than one degree of freedom. See Appendix C, Tables 5-7 and Figures 6-14, for ANOVA results and graphical representations of SCP amplitudes.

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[1] Note that participants were required to imagine the events for 8 seconds, which is a long time to not move or blink relative to other ERP studies. As a result, we only analyzed up to 6 seconds because of the increase in artifacts toward the end of the trials. Only trials that were completely free of artifacts for 6 seconds following the onset of the verbs were included in the analysis (74% of all trials).

0-500 ms time region. The two-way interaction between GA and LA was significant, $F(1,48) = 5.13$, $p < .03$. This interaction occurred because, for accomplishment phrases, mean amplitudes were more negative when they were in imperfective ($M = -.31$ μV) than perfective form ($M = .60$), $F(1,48) = 4.36$, $p < .05$. Alternatively, for activity phrases, mean amplitudes were more negative when they were in perfective ($M = .07$ μV) than imperfective form ($M = .55$ μV). However this latter comparison did not reach statistical significance ($p > .26$).

There also was a robust GA by Anteriority interaction, $F(4,192) = 15.26$, $p < .001$. In frontal and prefrontal regions, respectively, amplitudes were more negative for imperfective than for perfective phrases, $F(1,192) = 34.91$, $p < .001$, $F(1,192) = 34.79$, $p < .001$. Alternatively, in the central, parietal, and occipital regions, amplitudes were more negative for perfective than for imperfective phrases, although this difference in GA only reached significance in the occipital region (occipital: $F(1,192) = 5.22$, $p < .05$; parietal: $F(1,192) = 4.60$, $p = .06$; central: $F(1,192) = 1.63$, $p > .17$. No other effects of interest were marginal or significant.

500-1000 ms time region. The interaction between GA and LA was significant, $F(1,48) = 4.90$, $p < .04$. Amplitudes were more negative for imperfective ($M = 1.65$ μV) than perfective accomplishment phrases ($M = 2.62$ μV), $F(1,48) = 2.19$, $p > .14$. Alternatively, amplitudes were more negative for perfective ($M = 2.41$ μV) than imperfective activity phrases ($M = 3.51$ μV), $F(1,48) = 2.72$, $p < .11$.

The GA by Anteriority interaction was also significant, $F(4,192) = 8.12$, $p < .001$. Amplitudes were more negative for imperfective than for perfective phrases at prefrontal, $F(1,192) = 11.51$, $p < .01$, and frontal scalp locations, $F(1,192) = 3.45$, $p < .09$. Alternatively, in the central, parietal, and occipital regions, amplitudes were more negative for perfective than for

imperfective phrases (occipital: $F(1,192) = 8.76$, $p < .02$; parietal: $F(1,192) = 7.50$, $p = .03$; central: $F(1,192) = 1.90$, $p > .16$).

Finally, there was a main effect of LA, which occurred because mean amplitudes were more positive for activity ($M = 2.96$ μV) than accomplishment phrases ($M = 2.14$ μV), $F(1,48) = 4.07$, $p < .05$. No other effects of interest were marginal or significant.

1000-1500 ms time region. The LA and GA interaction was significant, $F(1,48) = 6.76$, $p < .02$. Similar to the preceding time regions, this interaction occurred because mean amplitudes were more negative for perfective ($M = 2.44$ μV) than imperfective activity phrases ($M = 4.50$ μV), $F(1,48) = 5.49$, $p < .03$. Alternatively, amplitudes were more negative for imperfective ($M = 2.31$ μV) than perfective accomplishment phrases ($M = 3.49$ μV), although this effect did not reach significance, $F(1,48) = 1.78$, $p > .18$.

GA and Anteriority also interacted, $F(4,192) = 10.23$, $p < .001$. At prefrontal locations, amplitudes were more negative for imperfective than perfective phrases, $F(1,192) = 5.35$, $p < .05$. Alternatively, amplitudes were more negative for perfective than imperfective phrases at all other head locations, and these differences reached significance at all regions except frontal (occipital: $F(1,192) = 20.69$, $p < .001$; parietal: $F(1,192) = 23.82$, $p < .001$; central: $F(1,192) = 20.73$, $p < .001$; frontal: $F<1$). No other effects of interest were marginal or significant.

1500-2000 ms time region. The interaction between LA and GA was significant, $F(1,48) = 6.14$, $p < .02$. Mean amplitudes were more negative for perfective ($M = 2.10$ μV) than imperfective activity phrases ($M = 4.31$ μV), $F(1,48) = 5.15$, $p < .03$. In contrast, amplitudes were more negative for imperfective ($M = 2.21$ μV) than perfective accomplishment phrases ($M = 3.41$ μV), although this difference did not reach significance, $F(1,48) = 1.53$, $p > .22$.

The interaction between GA and Anteriority continued to be significant in this temporal region, $F(4,192) = 4.85$, $p < .02$. At prefrontal locations, amplitudes were now nonsignificantly more negative for imperfective than perfective phrases, $F < 1.05$. Amplitudes at all other head locations were more negative for perfective than imperfective phrases, and once again these differences reached significance at all regions except the frontal region (occipital: $F(1,192) = 11.80$, $p < .01$; parietal: $F(1,192) = 16.24$, $p < .01$; central: $F(1,192) = 14.92$, $p < .01$; frontal: $F < 1.06$). No other effects of interest were marginal or significant.

2000-2500 ms time region. GA and LA continued to interact in this region, $F(1,48) = 7.41$, $p < .01$. Mean amplitudes were more negative for perfective ($M = 1.69$ μV) than imperfective activity phrases ($M = 4.26$ μV), $F(1,48) = 6.00$, $p < .02$. For accomplishment phrases, amplitudes were more negative for imperfective ($M = 1.87$ μV) than perfective phrases ($M = 3.34$ μV), $F(1,48) = 1.96$, $p > .16$.

The GA by Anteriority interaction was marginally significant, $F(4,192) = 2.52$, $p < .09$. The form of this interaction was identical to the previous temporal region; at prefrontal locations, amplitudes were nonsignificantly more negative for imperfective than perfective phrases, $F < 1$, whereas amplitudes at all other head locations were more negative for perfective than imperfective phrases, and these differences reached significance at all regions except the frontal region (occipital: $F(1,192) = 8.09$, $p < .02$; parietal: $F(1,192) = 12.54$, $p < .01$; central: $F(1,192) = 10.95$, $p < .01$; frontal: $F(1,192) = 1.91$, $p > .16$). No other effects of interest were marginal or significant.

2500-3000 ms time region. The GA by LA interaction was marginally significant, $F(1,48) = 3.90$, $p < .06$. Amplitudes were more negative for perfective ($M = 1.82$ μV) than imperfective activity phrases ($M = 2.94$ μV), $F(1,48) = 6.00$, $p < .02$. For accomplishment

phrases, amplitudes were more negative for imperfective ($M = 1.29\ \mu$V) than perfective phrases ($M = 2.77\ \mu$V), $F(1,48) = 2.5$, $p > .12$.

The GA by Anteriority interaction was also marginally significant, $F(4,192) = 2.69$, $p < .07$. Amplitudes were more negative for imperfective than perfective phrases at prefrontal, frontal, and central regions, although these differences only reached significance at prefrontal regions (prefrontal: $F(1,192) = 7.97$, $p < .02$, frontal: $F < 1.53$, central; $F < 1$). Amplitudes at parietal and occipital regions were more negative for perfective than imperfective phrases, although these differences were not significant for either region (occipital: $F < 1$; parietal: $F < 1.61$). No other effects of interest were marginal or significant.

3000-4000 ms time region. GA and LA marginally interacted in this temporal region, $F(1,48) = 2.90$, $p < .10$. Amplitudes were more negative for perfective ($M = .71\ \mu$V) than imperfective activities ($M = 2.14\ \mu$V), and were more negative for imperfective ($M = .38\ \mu$V) than perfective ($M = 1.88\ \mu$V) accomplishments, although neither of these comparisons reached significance (activities: $F < 1.38$, accomplishments: $F < 1.52$).

GA and Anteriority also marginally interacted, $F(4,192) = 2.49$, $p < .09$. Amplitudes were more negative for imperfective than perfective phrases at prefrontal and frontal regions, although this difference only reached significance at prefrontal regions (prefrontal: $F(1,192) = 6.24$, $p < .04$, frontal: $F < 1$). Amplitudes at central, parietal and occipital regions were more negative for perfective than imperfective phrases, although these differences were not significant at any of these regions (occipital: $F < 1$; parietal: $F(1,192) = 2.44$, $p > .12$; central: $F < 1$). No other effects of interest were marginal or significant.

4000-5000 ms time region. The GA by Anteriority interaction was the only effect of interest in this region that approached significance, $F(4, 192) = 2.34$, $p < .10$. Amplitudes were

more negative for imperfective than perfective phrases at prefrontal and frontal regions (prefrontal: $F(1,192) = 15.96$, $p < .01$, frontal: $F(1,192) = 6.69$, $p < .03$). Alternatively, amplitudes at central, parietal and occipital regions were slightly more negative for perfective than imperfective phrases (occipital: $F < 1$; parietal: $F < 1$; central: $F(1,192) = 1.88$, $p > .16$).

5000-6000 ms time region. The GA by Anteriority interaction was significant, $F(4, 192) = 3.04$, $p < .05$. Amplitudes were more negative for imperfective than perfective phrases at all topographical regions, although the difference was largest at prefrontal, frontal, and central regions (prefrontal: $F(1,192) = 39.06$, $p < .001$, frontal: $F(1,192) = 29.42$, $p < .001$; central: $F(1,192) = 17.43$, $p < .001$; parietal: $F(1,192) = 3.82$, $p < .08$; occipital: $F(1,192) = 9.03$, $p < .02$). No other effects of interest were marginal or significant.

Behavioural Results

The means per condition for each participant on the behavioural measures were subjected to a 2 Grammatical Aspect (GA: imperfective vs. perfective) X 2 Lexical Aspect (LA: activities vs. accomplishments) X 2 Participant List (list 1 vs. list 2) ANOVA. GA and LA were within-participants variables, whereas List was between participants. See Appendix C, Tables 8 and 9, for a list of the overall means for the different conditions for each of the questions answered and the associated F-values.

Perspective. The GA by LA interaction was not significant ($F<1$). However, activity phrases were found more often than accomplishment phrases to evoke the first-person perspective, $F(1,48) = 27.33$, $p < .001$. The main effect of GA was also marginally significant, and this occurred because people imagined events slightly more often in first person perspective with perfective than imperfective aspect, $F(1,48) = 3.21$, $p < .08$. This effect was largely driven from the larger difference in first person perspective for perfective than imperfective

accomplishment phrases, $F(1,48) = 6.20$, $p < .02$. The percentage of events imagined in first person perspective did not vary as a function of GA for activity phrases, $F(1,48) = 1.34$, $p > .25$.

Event Vividness. Accomplishment phrases evoked greater sensory vividness than activity phrases, for sight, $F(1,48) = 15.20$, $p < .001$, sound, $F(1,48) = 50.89$, $p < .001$, and taste, $F(1,48) = 4.56$, $p < .04$. Alternatively, activity phrases evoked greater sensory vividness than accomplishment phrases for touch, $F(1,48) = 28.88$, $p < .001$. LA had no influence on smell vividness, $F < 1$. All GA main effects and GA by LA interactions were not significant for sensory vividness.

Accomplishment phrases led to more vivid imagining of the people featured in an event than did activity phrases, $F(1,48) = 66.50$, $p < .001$. Although the GA by LA interaction did not reach significance, $F(1,48) = 2.19$, $p > .14$, planned comparisons revealed that imagined people were more vivid for imperfective than perfective activities, $F(1,48) = 5.48$, $p < .03$. Alternatively, GA had no influence on people vividness for accomplishment phrases, $F < 1$. The main effect of GA was marginally significant, and this occurred because imagined people were more vivid in general for imperfective than perfective phrases, $F(1,48) = 3.18$, $p = .08$.

Accomplishment phrases also led to more vivid imagining of the event locations than did activity phrases, $F(1,48) = 40.03$, $p < .001$. The main effect of GA was not significant, $F < 1$. However, the GA by LA interaction was marginally significant, $F(1,48) = 3.26$, $p < .08$. This effect occurred because imagined event locations were marginally more vivid for imperfective than perfective activities, $F(1,48) = 2.83$, $p < .10$, whereas the difference in imagined event vividness did not approach significance for accomplishments, $F < 1$.

Activity phrases led to more vivid imagining of event objects than did accomplishment phrases, $F(1,48) = 44.10$, $p < .001$. All other effects for object vividness did not approach significance (all Fs < 1.34).

Imagined Temporal Components of Events (*beginning, middle, end*). The ANOVA conducted for this behavioural measure was identical to the ANOVAs described above with the exception that the present ANOVA included the variable Temporal Component (beginning versus middle versus end), which was a within participant variable. This analysis demonstrated that when participants imagined events they tended to imagine the middle temporal component of those events with the most frequency (82%), followed by the beginning (38%) and then the end component (25%), $F(2,48) = 100.94$, $p < .001$. Participants also tended to imagine more of the different temporal components in general for perfective (49%) than imperfective aspect (47%), $F(1,48) = 6.17$, $p < .02$. The main effect of LA was not significant, F < 1.

The interaction between Temporal Component and GA was significant, $F(2,48) = 8.25$, $p < .001$. This interaction occurred because people imagined the end component of events more frequently for perfective (29%) than for imperfective phrases (21%), $F(1,48) = 17.65$, $p < .001$, whereas no differences were found for GA for the middle component (imperfective = 83%, perfective 80%), $F < 1.41$, or beginning component (imperfective = 38%, perfective 37%), $F < 1$.

The interaction between Temporal Component and LA was also significant, $F(2,48) = 4.69$, $p < .02$. This interaction occurred because people imagined the end component of events more frequently for activities (27%) than for accomplishments (23%), $F(1,48) = 5.70$, $p < .02$, whereas no differences were found for LA for the middle component (activities = 80%, accomplishments = 83%), $F(1,48) = 2.46$, $p > .12$, or beginning component (activities = 37%, accomplishments = 38%), $F < 1.25$.

Although the interaction between Temporal Component, GA, and LA was not significant ($F < 1.24$), planned comparisons demonstrated that people imagined the middle component more often for imperfective activity phrases than for the same phrases in perfective form, $F(1,96) = 4.20$, $p < .05$. Alternatively, for accomplishment phrases there were no differences in GA for the middle component. For both activities and accomplishments, people imagined the end component more often when phrases were in perfective than imperfective form (activities: $F(1,96) = 22.47$, $p < .001$; accomplishments: $F(1,96) = 11.56$, $p < .01$). There were no significant differences between GA and LA for the beginning component (all Fs < 1).

Number of people and objects in imagined events. The ANOVA for the number of people imagined demonstrated a robust main effect of LA, $F(1,48) = 23.83$, $p < .001$. This effect occurred because people imagined more people for accomplishment (9.8) than activity (4.3) phrases. No other effects approached significance for the number of people imagined (all Fs < 1).

The ANOVA for the number of objects imagined demonstrated a marginal main effect of GA, $F(1,48) = 2.97$, $p = .09$. This marginal effect occurred because people imagined more objects for perfective (9.0) than imperfective (7.0) phrases. Planned comparisons revealed that this difference approached significance for Activity phrases, $F(1,48) = 3.70$, $p = .06$, but not for Accomplishment phrases, $F < 1$. No other effects approached significance (all F's < 1).

Estimation of event duration and importance in real world. Activities ($M = 33.77$ minutes) were estimated to have a longer duration in the real world than accomplishments ($M = 14.52$ minutes), $F(1,48) = 4.46$, $p < .04$. GA did not have a significant influence on estimated event durations, $F < 1.46$, and the GA x LA interaction was also not significant, $F < 1$. Planned comparisons showed that GA had no influence for accomplishments, $F < 1$. Alternatively,

perfective activities tended to be estimated as longer in duration than imperfective activities, although this difference did not reach significance, $F(1,48) = 2.67$, $p < .11$.

Participants rated accomplishments ($M = 3.52$) as more important events in the real world than activities ($M = 2.89$), $F(1,48) = 80.99$, $p < .001$. No other effects were significant or marginally significant for importance estimations (All Fs < 1.17).

Discussion

GA/LA SCP Results

The results of the SCP analyses revealed that LA and GA interacted. Amplitudes were more negative when phrases contained perfective activities relative to imperfective activities throughout the first 6 seconds of the imagination period. Alternatively, over the same period amplitudes were more negative for imperfective accomplishments than perfective accomplishments. This crossover interaction reached significance or was marginally significant up to 4 seconds into the imagination period. These results show that imagining events without natural endpoints (activities) as completed, or imagining events with natural endpoints (accomplishments) as ongoing, is more difficult than when the same events are reference as ongoing or completed, respectively.

It is important to note that the GA by LA interaction began within 500 ms of the onset of the verbs, which is likely to be a period that still captures comprehension of the phrases in general. Later time frames are less likely to capture comprehension per se and more likely to reflect the participants actively trying to imagine the described events. In this regard, our findings show that GA and LA had a similar influence on the electrophysiological correlates associated with comprehending and imagining the events described in the phrases. It is possible,

however, that the task demand of actively imagining the events is leading to the similarities in the results between the early and later time frames.

The results of the current research extend recent research that manipulated GA and LA and demonstrated a similar interaction to that shown by Yap et al. (2009). Recall that this study employed a picture-matching task and used matching latencies as a measure of cognitive effort. As in the current study, Yap et al. (2009) investigated the interaction between GA and LA. In both this study and the current study, GA and LA were found to interact in a similar manner. The results of both studies point to the conclusion that activities require more effort to represent in the perfective than in the imperfective form and that accomplishments require more effort to represent in the imperfective than in the perfective form.

Behavioural Results

For both vividness of location and vividness of people, participants gave higher ratings based on activity stimuli than based on accomplishment stimuli. Further, vividness ratings on these event features were higher based on imperfective-activity stimuli, as compared to perfective activity stimuli. These results indicate that participants represent these factors with a greater degree of vividness when they represent events as being ongoing. Further, this indicates that both people and locations are more accessible in event representations based on activity verbs, as opposed to those based on accomplishment verbs.

As expected, the middle component of events was imagined with greater frequency based on activities than based on accomplishments. This component was also imagined more frequently based on imperfective-activity verbs than based on perfective-activity verbs. This result is consistent with previous literature that has found the imperfective and activity verbs to

be associated with a focus on the ongoing stage of events (Madden & Zwaan, 2003; Yap et al., 2009).

Perfective stimuli were found more often than imperfective stimuli to lead to representations of an event's end. This result is consistent with the idea that perfective stimuli place focus on the endpoints of events (Madden & Zwaan, 2003). Unexpectedly, participants represented the end of events more often following activity stimuli than following accomplishment stimuli.

Imagined Events and Visual Perspective

Regardless of event cue, participants were most likely to represent events from the first-person perspective than from the third-person perspective. However, the frequency of first-person perspective usage was unexpectedly influenced by the GA/LA interaction. This pattern of perspective usage seems to be distinct or partially distinct from the observed pattern of GA/LA-based differences in SCP negativity. Thus, there does not appear to exist a simple relationship between the tendency to represent an event from a certain perspective and the cognitive effort associated with event representation. Rather, representation from the first-person perspective seems to occur more for activities than it does for accomplishments. It was also found that use of the first-person perspective occurred more spontaneously for accomplishments when they were in perfective than imperfective form.

Experiment 2

Based on the finding that perspective recruitment differs markedly based on the GA and LA of imagined-event cues, Experiment 2 was conducted to determine how imagined events are constrained by explicit instructions to adopt either a first or third person perspective. This

experiment is introduced by an overview of previous literature on differences between forms of visual perspective. This overview is followed by a description of Experiment 2.

Nigro and Neisser (1983) conducted a number of the first studies aimed at investigating differences in people's tendencies to represent recalled events from the first-person or the third-person perspective. Participants were cued with sentence-long descriptions of familiar events and asked to recall specific events from the past in response. Participants then rated events on various dimensions: emotionality, self-awareness, recency, vividness, and ability to recall each memory. Crucially, they also indicated whether they perceived events from the first-person perspective, the third-person perspective, both perspectives, or neither perspective. Results from these ratings indicate that participants were more likely to adopt the third-person perspective than the first-person perspective for memories associated with high ratings of emotionality and self-awareness. First-person memories were also found to have taken place more recently and to be more vivid than third-person memories.

In a separate manipulation, Nigro and Neisser (1983) had participants complete a similar task, but were asked to focus on the feelings associated with an event or the event's concrete/objective features. A third group of participants, told simply to describe the event, acted as a control. Their results showed that participants were more likely to adopt the first-person than third-person perspective when asked to focus on their feelings during recall. When asked to focus on the concrete/objective features during recall, participants more often used the third-person than in the group asked to focus on their feelings during recall. Overall, the first-person perspective was used more often than the third-person perspective. Collectively, Nigro and Neisser's (1983) findings represent a key investigation into the multitude of factors that

influence visual perspective recruitment. It is clear from this research that subtle changes in stimulus content can be greatly influential on the perspective used in event representation.

Previous research has investigated the neural correlates of first-person and third-person perspective event representation. For example, Eich, Nelson, Leghari, and Handy (2009) conducted an fMRI investigation into the differences in neural activation associated with the usage of different perspectives in event recall. Participants in the study engaged in a series of complex physical tasks one week prior to an fMRI scanning session. During fMRI scanning, participants recalled each event two times: Once from the first-person or the third-person perspective and again from either that same perspective or the previously unused perspective. During the scanning procedure, participants also engaged in a visual search task, which served as a control task. Following the recollection of each event, participants gave verbal reports of the event they recalled and rated that event on emotionality, as well as indicating how successful they were at using and maintaining the perspective they were instructed to use.

Event recall from both the first-person and third-person perspectives was associated with activation in the prefrontal cortex, medial temporal cortex, inferior parietal lobule, precuneus, bilateral insula, left somatosensory areas, right posterior, and dorsal amygdala. Relative to the control task, recall from the first-person perspective was associated with increased activation in the right posterior amygdala. In contrast, third-person perspective recall was associated with diminished activation in the bilateral insula. In the left hemisphere, activation in the somatosensory area, motor strip, sensory strip, and lateral occipital complex was diminished for first-person recall, relative to the control task, and further diminished for third-person recall.

Research on perspective has also examined the manner in which the adoption of different perspectives affects appraisals of physical sensation and social perceptions. For example,

Macrae, Raj, Best, Christian, and Miles (2012) investigated the role played by differences in perspective on appraisals of social warmth. In order to investigate this relationship, the researchers developed a paradigm in which participants imagined an interaction with a friend, in which that friend has them hold his/her coffee, which is described as either hot or iced. Crucially, participants imagined this interaction as occurring from either the first-person or the third-person perspective. Following the imagining of an interaction, participants completed a questionnaire in which they rated their appraisals of the imagined friend on a cold-warm scale (psychological warmth). As a control, additional trials were conducted in which no temperature was associated with the coffee cup.

For the interactions imagined from the third-person perspective, it was found that coffee cup temperature had no influence on participants' evaluations of psychological warmth. However, when participants imagined interactions from the first-person perspective their evaluations of the friend's psychological warmth were influenced by the temperature of the coffee such that the friend was rated as colder while participants imagined holding an iced coffee as compared to a hot coffee and the control task. It is clear from these findings that participants were impaired at detecting changes in temperature when imagining themselves coming into contact with a cold/warm object from an external perspective. From the first-person perspective, however, participants were able to make such judgments. This result indicates that he first-person perspective enhances sensitivity to sensory information, which can impact the process of making social judgments.

Experiment 2 was designed to extend previous research on perspective taking by determining the roles of visual perspective in constraining the representation of imagined activities. Recall that one of the key findings of people's perspective taking in Experiment 1 was

that people employed the first person perspective significantly more often than third person perspective for activities, and that this result was found for both imperfective and perfective aspect. This suggests that when people imagine dynamic events that do not have natural endpoints they tend to imagine them as if they are experiencing them directly (i.e., an embodied perspective). If people naturally use the first person perspective more frequently for activities, then presumably it should be more difficult to imagine activities when forced to adopt the less frequent third person perspective. To test this possibility, participants in the present experiment were given explicit instructions to imagine imperfective activities from either the first-person or the third-person perspective. If our assumptions about perspective taking for activities are confirmed, then SCP amplitudes should be more negative when participants imagine activities from the third versus first person perspective.

The current study also employed behavioural measures to investigate the influence of perspective taking on ratings of sensory vividness as well as vividness of people, objects, and locations. Other crucial event properties investigated included the difficulty associated with imagining events, the temporal component of the events imagined (beginning, middle, end), the rated importance and duration of the events in the real world, and the number of people and objects present in the events.

<div align="center">Method</div>

Participants

Participants were 42 (34 female) students from Wilfrid Laurier University and other persons from the surrounding area, ranging in age from 18-51 years. All participants were right-

handed native English speakers. Participants were granted course credit or paid $22 for their participation.

Materials

The experimental stimuli consisted of 46 activity verb statements phrased in the imperfective (see Appendix B, Table 4). These phrases began with the pronoun "I". Each of these phrases was preceded by an instruction to imagine the described event from a given perspective and then a fixation ("XXXX"). Half of these phrases were preceded by instructions to imagine the described event, "From my eyes", while the other half were preceded by instructions to imagine the described event from the perspective, "Looking at self".

Two experimental lists were created for counterbalancing purposes. Verb phrases were presented in the same order in both lists but with each phrase being preceded by the opposite perspective instruction from the other list. Each list also contained 2 additional trials at the beginning that served as practice trials.

A booklet containing a short questionnaire to be answered after every trial (see Appendix B, Figure 4) was also provided to each participant. The questions gathered information on participants perceptions of 1) vividness (sight, touch, taste, smell, sound) on a 1-7 scale (1 = not at all, 7 = very), 2) vividness of people, objects, and locations on a 1-7 scale (1 = not at all, 7 = very), 3) the amount of difficulty associated with imagining an event on a 1-7 scale, 4) the temporal component of the events imagined (beginning, middle, end), 5) the number of people and objects present in the imagined event, 6) the estimation of the duration of the imagined events in the real world, and 7) the importance of the imagined events in the real world (1 = not at all, 7 = very).

Procedure

The procedure for Experiment 2 was identical to that of Experiment 1, save for two differences: Each "Ready?" prompt was followed by an instruction to imagine the event described by the coming verb phrase from a given perspective (see Materials); and final word of the phrase only remained on the screen for 5 seconds (see Figure 5 for a sample trial with timings). The presentation time was reduced form the 8 seconds used in Experiment 1 due to the number of blink/movement artifacts that occurred beyond the 5-second mark. Participants were also instructed to complete the questionnaires based only on the 5 seconds in which they were imagining the events in question.

EEG Recording

The electroencephalograph (EEG) was recorded via a cap that contained 64 Ag/AgCl electrodes distributed evenly across the scalp (10-20 layout). Electrodes were placed on the left infra and supra orbital ridge of each participant as well as the outer canthii. EEG was processed through a Neuroscan Synamps2 amplifier, set at a bandpass of 0.05-100 Hz and digitized at 250 Hz. Electrical impedance was kept below 5 KΩ.

<center>Results</center>

EEG Results

The raw data was re-referenced off-line to the average of the left and right mastoids. A low-pass filter set at 30 Hz was applied to remove high frequency noise. Trials contaminated by artifacts (blinks, excessive muscle artifact, etc.) were removed before averaging. ERP averages were then created for each participant that spanned 200 ms before the onset of the verbs in each phrase to 5 seconds following the verbs. For analysis purposes, the averages for all participants were separated into 500 ms time segments for the first 2 seconds following the onset of the verbs

in the phrases, and then separated into 1000 ms segments for the remaining 3 seconds of the imagining period.

The mean amplitudes for each temporal region were then subjected to a Perspective (first-person vs. third-person) X Anteriority (prefrontal vs. frontal vs. central vs. parietal vs. occipital) X Hemisphere (left vs. right) X List (1 vs. 2) ANOVA. The electrodes that comprised the topographical variables included FP1, FP2, F3, F4, C3, C4, P3, P4, CB1, CB2. All variables except for List were within-participant variables. Note that topographical effects are only reported below if they interacted with perspective because those are the topographical interactions of main theoretical interest. All p-values are reported after Epsilon correction (Huynh-Felt) for repeated measures with greater than one degree of freedom. See Appendix D, Tables 10-13 and Figures 15-19, for ANOVA results and graphical representations of SCP amplitudes.

0-500 ms time region. The interaction between Perspective and Anteriority was marginally significant, $F(4,160) = 2.59$, $p < .07$. In prefrontal regions, the third-person perspective ($M = 3.53 \, \mu V$) was associated with greater negativity than the first-person perspective ($M = 3.17 \, \mu V$), $F(1,160) = 6.72$, $p < .03$. A marginal effect was also found in frontal regions, in which the third-person perspective ($M = 2.39 \, \mu V$) was again associated with greater negativity than the first-person perspective ($M = 2.64 \, \mu V$), $F(1,160) = 3.30$, $p < .09$. No other effects involving perspective approached significance.

500-1000 ms time region. A main effect of Perspective was found such that the third-person perspective was associated with greater negativity than the first-person perspective, $F(1,40) = 4.90$, $p < .04$. The interaction between Perspective and Anteriority was again significant, $F(4,160) = 3.62$, $p < .02$. The third-person perspective was associated with greater

negativity than the first-person perspective in prefrontal (M = 5.89 μV, M = 7.08 μV; $F(1,160)$ = 31.12, p < .001), frontal (M = 5.21 μV, M = 6.55 μV; $F(1,160)$ = 39.04, p < .001), central (M = 4.86 μV), M = 5.56 μV; $F(1,160)$ = 10.73, p < .01), and occipital (M = 2.69 μV, M = 3.63 μV; $F(1,160)$ = 19.21, p < .001) regions. No other effects involving perspective were significant.

1000-1500 ms time region. A main effect of Perspective was found such that the third-person perspective was associated with greater negativity than the first-person perspective, $F(1,40)$ = 4.37, p < .05. The interaction between Perspective and Anteriority was significant, $F(4,160)$ = 4.35, p < .01. The third-person perspective was associated with greater negativity than the first-person perspective in prefrontal (M = 7.90 μV, M = 9.43 μV; $F(1,160)$ = 28.90, p < .001), frontal (M = 6.82 μV, M = 8.49 μV; $F(1,160)$ = 35.36, p < .001), central (M = 5.84 μV), M = 6.74 μV; $F(1,160)$ = 10.22, p < .01), and occipital (M = 3.00 μV, M = 4.02 μV; $F(1,160)$ = 12.95, p < .01) regions.

1500-2000 ms time region. A main effect of Perspective was found such that the third-person perspective was associated with greater negativity than the first-person perspective, $F(1,40)$ = 4.65, p < .04. The interaction between Perspective and Anteriority was significant, $F(4,160)$ = 4.46, p < .01. The third-person perspective was associated with greater negativity than the first-person perspective in prefrontal (M = 7.67 μV, M = 9.68 μV; $F(1,160)$ = 38.88, p < .001), frontal (M = 6.686 μV, M = 8.532 μV; $F(1,160)$ = 32.88, p < .001), central (M = 5.95 μV), M = 6.95 μV; $F(1,160)$ = 9.57, p < .01), and occipital (M = 2.65 μV, M = 6.95 μV; $F(1,160)$ = 16.95, p < .001) regions. A marginal interaction was found between Perspective and Hemisphere, $F(1,40)$ = 3.52, p < .07. This interaction occurred because although the third person perspective lead to significantly greater SCP negativity than first person perspective over both

the left, $F(1,40) = 126.11$, $p < .001$, and right hemisphere, $F(1,40) = 73.58$, $p < .001$, this difference was larger over the left hemisphere.

2000-3000 ms time region. The third-person perspective was associated with greater negativity than the first-person perspective, $F(1,40) = 2.86$, $p < .10$. The interaction between Perspective and Anteriority was significant, $F(4,160) = 3.98$, $p < .01$. The third-person perspective was associated with greater negativity than the first-person perspective in prefrontal ($M = 7.74$ μV, $M = 9.84$ μV; $F(1,160) = 30.33$, $p < .001$), frontal ($M = 6.97$ μV, $M = 8.84$ μV; $F(1,160) = 24.14$, $p < .001$), central ($M = 6.76$ μV), $M = 7.61$ μV; $F(1,160) = 5.00$, $p < .04$), and occipital ($M = 2.89$ μV, $M = 4.43$ μV; $F(1,160) = 16.36$, $p < .001$) regions. No other effects involving perspective were significant.

3000-4000 ms time region. The interaction between Perspective and Anteriority was marginally significant, $F(4,160) = 2.36$, $p = .07$. The third-person perspective was associated with greater negativity than the first-person perspective in prefrontal ($M = 7.25$ μV, $M = 9.18$ μV; $F(1,160) = 18.98$, $p < .001$), frontal ($M = 6.41$ μV, $M = 8.22$ μV; $F(1,160) = 16.68$, $p < .001$), central ($M = 6.78$ μV, $M = 7.63$ μV; $F(1,160) = 3.71$, $p < .07$), and occipital ($M = 2.59$ μV, $M = 4.28$ μV; $F(1,160) = 14.55$, $p < .001$) regions. No other effects involving perspective were significant.

4000-5000 ms time region. The interaction between Perspective and Anteriority was not significant. However, the third-person perspective was associated with greater negativity than the first-person perspective in prefrontal ($M = 6.74$ μV, $M = 8.14$ μV; $F(1,160) = 7.08$, $p < .02$), frontal ($M = 5.48$ μV, $M = 6.92$ μV; $F(1,160) = 7.52$, $p < .02$), and occipital ($M = 1.59$ μV, $M = 3.12$ μV; $F(1,160) = 8.56$, $p < .01$) regions. No other effects involving perspective were significant.

Behavioural Results

The means per condition for each participant on the behavioural measures were subjected to a 2 Perspective (first-person vs. third-person) X 2 Participant List (list 1 vs. list 2) ANOVA. Perspective was a within-participants variable, whereas List was between participants. Perspective-based contrasts were analyzed with paired *t*-tests and an additional 2 Perspective (first-person vs. third-person) X 2 Temporal component (beginning vs. middle vs. end) ANOVA. See Appendix D, Tables 14 and 15, for a list of the overall means for the different conditions for each of the questions answered and the associated F-values.

Sensory Vividness. Vividness of touch was found to be more vivid from the first-person than from the third-person perspective, $t(47) = 2.60$, $p < .02$. A marginally significant effect was found in which the first-person perspective was associated with greater vividness than the third-person perspective for taste, $t(47) = 1.8302$, $p < .08$. Marginally significant effects were found in which the third-person perspective was associated with higher ratings than the first-person perspective for vividness of people ($t(47) = 1.77$, $p < .09$) and locations ($t(47) = 1.92$, $p = .06$).

Temporal Components. The main effect of temporal component was significant, $F(2,92) = 113.87$, $p < .001$. The middle temporal component was more often found to be represented than the beginning ($t(47) = 7.21$, $p < .001$) and the end temporal component ($t(47) = 17.18$, $p < .001$). The beginning temporal component was more often represented than the end temporal component, $t(47) = 7.80$, $p < .001$.

Behavioural measures yielded no other significant or marginally significant results.

Discussion

The present SCP results indicate that imagining activities requires greater cognitive effort when imagined from the third-person as compared to the first-person perspective. This effect was

evident from 500 ms after the onset of the final word of the phrase ("verbing") and lasted at least another 3500 ms while people continued to imagine the activity. Topographical analysis further revealed that event imagination was more difficult from the third-person perspective than from the first-person perspective in prefrontal, frontal, central, and occipital regions. Notably, this effect was consistently not found for electrode sites located over parietal regions. It is also interesting to note, from topographical contrasts, that this effect was observed for prefrontal, frontal, and occipital regions in the 3000-4000 ms timeframe but that, in this same timeframe, this effect becomes only marginally significant in central regions. In the subsequent 4000-5000 ms timeframe this effect remains significant in the prefrontal, frontal, and occipital regions, while becoming non-significant in central regions.

Collectively, the observed pattern of SCP negativity indicates that imagining from the third-person perspective is associated with greater cognitive effort than imagining from the first-person perspective across various timeframes and topographical regions. This effect begins in prefrontal/frontal regions, becomes more widely distributed across the scalp (with the exception parietal regions), and is observed only in prefrontal/frontal and occipital regions in the later period of analysis.

As in Experiment 1, differences in perspective-taking behaviour were associated with differences in the cognitive effort required for event representation. While Experiment 1 established that perspective tendency differed concurrently with changes in cognitive effort, Experiment 2 extended this finding by establishing the causality and directionality of this relationship. While Experiment 2 focussed on activities, further research is necessary to investigate how differences in perspective affect event representation, based on cues that provide different temporal information.

General Discussion

The two experiments conducted examined the roles of GA/LA and perspective in constraining representations of imagined events. These experiments show that the difficulty of event representation is dependent on both of these factors. In Experiment 1, it was predicted that people would imagine activities as being ongoing and accomplishments as having ended. It was further predicted that a relative increase in cognitive load would be required to imagine activities and accomplishments when either type of verb was presented in a form of GA that placed focus on a temporal state other than that which is most naturally represented (i.e., the end points of activities; the ongoing states of accomplishments). This prediction was confirmed by the SCP measures used to index ease of imagining in this study.

Based on the results of Experiment 1, it was predicted in Experiment 2 that imagining activities from the third-person perspective would be more difficult relative to the first-person perspective. Using SCP negativity as an index of cognitive load, this was observed to be the case. A discussion follows of the findings of both experiments in the context of previous research in this area.

Experiment 1

The results of Experiment 1 are most consistent with those of Yap et al. (2009), which found GA/LA to constrain reaction times in a forced-choice picture task. Experiment 1 builds on these findings by showing that GA and LA similarly constrain the imagination of events when cued by written stimuli. This experiment also serves to provide electrophysiological evidence of the effects of differences in GA/LA on processing and event representation. The consistency of results between these two experiments contributes to both studies' validity and generalizability.

The results of the current research also complement research by Larsen and Ferretti (2014), on the role played by GA and LA in constraining representations of autobiographical memories. Notably, the method used in that study was almost identical to that of the current study. The study used verb stimuli categorized into two sets: Standard activity verbs and non-standard activity verbs. The standard activity verbs used were similar to the activity verbs in the current study, while the nonstandard verbs represented a set of verbs distinct from the current study's accomplishment verbs. The nonstandard verbs referred to actions of non-directed motion (e.g., run), which may or may not possess natural endpoints depending on context. For example, the verb 'run' would not possess a natural endpoint in the context of a person going for a run, whereas it would possess a natural endpoint were the person running towards the finish line of a race. Thus, when presented in isolation, these verbs are more likely to be perceived as lacking a natural endpoint. Therefore, as in the current study, these categories represented verbs that sometimes possess natural endpoints and verbs that do not. These stimuli were given in the imperfective aspect or in the perfect aspect (e.g., I had ran). Like the perfective aspect used in the current study, the perfect aspect references events as being completed. Thus, the stimuli used by Larsen and Ferretti's (2014) are similar to those used in the current study in terms of the manner in which they convey temporal information. Larsen and Ferretti (2014) observed that GA by LA interacted to constrain the representation of autobiographical memories in a pattern similar to how GA and LA constrained the representation of imagined events in the current study. Previous research, using EEG and fMRI methodologies to compare the neural correlates of real and imagined events, has found that many neural regions are commonly recruited for both processes (Addis et al., 2007; Conway el al., 2003; Hassabis et al., 2007). As such it is likely that GA and

LA constrain representations of autobiographical memories and imagined events in a similar manner.

The SCP results in Experiment 1 also demonstrated either a significant or marginally significant interaction between GA and anteriority across all time regions examined. Mean amplitudes were more negative for imperfective than perfective aspect at prefrontal and frontal locations, whereas amplitudes were more negative for perfective than imperfective aspect at posterior locations. During the last second of the measured imagination period, amplitudes were more negative for imperfective than perfective aspect at all topographical areas, although this difference remained much larger at anterior head locations.

According to Conway et al. (2001; 2003), left prefrontal cortex activation during the process of event construction is associated with the retrieval of knowledge relevant to the real or imagined event being represented, while occipital-temporal activation is associated with accessing sensory-perceptual information (see Dwivedi, 2006). Thus, the current research indicates that event construction based on imperfective phrases is more effortful than construction based on perfective phrases. Conversely, sensory-perceptual information is more accessible given imperfective cues as compared to perfective cues. Further research is necessary for specifying how GA influences the brain mechanisms that underlie the construction and content of event representations.

Previous research has shown that the imperfective, but not the perfective aspect, functions to maintain information in working memory (e.g., Magliano & Schleich, 2000), and that the imperfective aspect leads to greater activation of the content associated with the ongoing nature of events (e.g., Ferretti et al., 2007; Truitt & Zwaan, 1997). It is possible that these properties of imperfective aspect contribute to greater difficulty for mechanisms associated with

the construction of event representations in general. Furthermore, the content of events has been found to be easier to retrieve when events are described as ongoing with imperfective aspect as opposed to when those events are referenced as completed with perfective aspect. This difference may have led to more negative amplitudes at posterior locations for perfective than imperfective aspect. It is also important to keep in mind that the greater negativity for imperfective aspect at frontal locations was only found for accomplishments. Thus, it is evident that both LA and GA influence the pattern of SCPs at frontal regions.

The behavioural findings also demonstrated that the people and locations in the imagined activities were more vivid when the phrases were in imperfective form than when they were in the perfective form. In contrast, GA had no influence on the vividness of people and locations for accomplishments. Our findings suggest that when participants imagine events, enhanced vividness of people and locations is obtained for the imperfective aspect when the events have an ongoing nature and no natural, temporal endpoint. These findings are consistent with Ferretti et al.'s (2007) finding of enhanced activation of location knowledge for imperfective events.

Accomplishments and activities differentially influenced vividness for the different event properties examined. For example, accomplishment phrases led to higher vividness ratings for people and locations, and also higher ratings for sensory attributes of sight, sound and taste. In contrast, activity phrases led to higher vividness ratings for imagined objects and the sensory attribute of touch. It is important to note, however, that the two types of verbs are composed of completely different verbs, denoting events with different content. In other words, a different set of accomplishments and activities may produce a different pattern of vividness simply because the content of those events are different. This fact makes the GA contrasts within the different

verb types much more theoretically interesting in general because we can examine the effect of aspect on identical events (see Becker et al., 2013, for a similar argument).

The ratings for how important the imagined events would be if they were to actually occur demonstrated that the accomplishments were considered more important events than the activities. More important events are known to elicit more vivid event recollections (Conway & Pleydell-Pearce, 2000) and therefore it is not surprising that the accomplishments were rated higher on most vividness measures than were activities. Participants also rated the activities as having longer "real world" durations than the accomplishments. Finally, participants indicated that they imagined more people for accomplishment phrases, but a similar amount of objects for both verb types. The imperfective aspect was found to increase the number of objects present in the imagined events, but this effect was only found for activity verbs.

Our behavioural results for the event temporal components imagined (beginning, middle, end) demonstrated the people were far more likely to imagine the middle of the events than the beginning and end components. GA and LA influenced the frequency of the temporal components imagined, however. As expected, participants indicated they imagined the end of the events more often when they were described with perfective aspect than with imperfective aspect. In contrast, the imperfective aspect led to a greater increase in the number of middle event components imagined, but this increase was only found for activities. These findings confirm the influence of GA on focussing on different temporal components of events, and also show that the existence of natural temporal endpoints matters for how GA influences the frequency in which people imagine the middle period of events.

The behavioural results demonstrated that both GA and LA contributed to the perspective (first vs. third person) and content of the imagined events. Participants were more likely to

imagine activities than accomplishments as if they were actually experiencing the event unfold in front of their eyes (first person perspective) as opposed to looking at themselves (third person perspective). Recall that one of the crucial differences between activities and accomplishments is that the former do not have natural endpoints and thus have a natural ongoing property associated with them. Our findings suggest that the ongoing nature of activities leads to imagined event representations that are consistent with how people actually experience events (i.e., from the first person perspective).

A second important finding was that GA had a greater effect on event perspective for accomplishments than for activities. Specifically, participants were more likely to imagine themselves participating in accomplishment events from the first person perspective when those events were described as completed as opposed to ongoing. Accomplishments are events that involve a process that leads to a goal being obtained (i.e., "to build", the goal is obtained when something is built). Our results suggest that when the goal is obtained, as when the phrases were described with perfective aspect, people imagine the obtained goal as if looking from their own eyes. Interestingly, GA had no influence on the perspective taken when imagining activities. This finding for activities may be the result of these events not having a different event structure at the beginning and end as they have no natural endpoints (Becker et al., 2013).

Taken together, these findings show that events that are naturally ongoing or that naturally have a goal that is obtained, lead to event representations that are consistent with reliving the events (i.e., embodied) as opposed to a third person (or disembodied perspective). As such, our findings extend previous research examining perspective-taking while forming event representations (Avraamides & Kelly, 2005; D'Argembeau & Van der Linden, 2012; Eich et al., 2009; Ferretti & Katz, 2010; Nigro & Neisser, 1983; Valenti, Libby, & Eibach, 2011).

The present findings regarding perspective-taking tendencies are especially notable when contrasted with those of Larsen and Ferretti (2014), which used a similar methodology to investigate the manner in which grammatical aspect and lexical aspect constrain autobiographical memory recall. Unlike the results of the current study, Larsen and Ferretti did not find changes in GA and LA to lead to differences in perspective recruitment. This apparent discrepancy was likely due to the fact that Larsen and Ferretti (2014) used standard and nonstandard activity verbs (i.e., non-directed motion verbs that are also sometimes accomplishments). In the current study, a difference in perspective recruitment rate was found between activity-based and accomplishment-based representations. Unlike accomplishment verbs, which always refer to events with natural endpoints, non-directed motion verbs are unlikely to be perceived as possessing natural endpoints when not used in contexts which reference is explicitly made to a natural endpoint (Levin, 1993). As the previous study provided no such context to participants, it is reasonable to conclude that non-directed verbs may, more frequently than accomplishment verbs, be perceived as standard/activity verbs that do not have natural endpoints. As such, they may be associated with rates of perspective recruitment more similar to those seen for standard activity verbs than for accomplishment verbs or with recruitment rates lying in between those associated with standard/activity and accomplishment verbs.

Another possibility is that the observed differences in perspective rates is due to the difference in the nature of the task performed in each study. While the current study had participants imagine events, participants in the previous study were to recall autobiographical memories. As an autobiographical memory is a representation of a personally experienced past event, such a memory was necessarily experienced previously from the first-person perspective.

It has been shown previously that altering the perspective of representation diminishes spatial memory ability (Mou, McNamara, Valiquette, & Rump, 2004) and makes less efficient use of cognitive resources than maintaining the original perspective or representation (Avraamides & Kelly, 2005). Thus, changing perspectives is counter-productive, in terms of effective and efficient memory recall, and accordingly unlikely to occur during this process. In contrast, a representation of an imagined event is not inherently associated with the first-person perspective. Without this constraint, it is likely that imagined events are more often associated with the third-person perspective than are recalled autobiographical memories. This may explain why GA/LA-dependent differences in perspective recruitment were observed in the current study on imagined events, but not in the previous study on autobiographical memory.

Experiment 2

In Experiment 1, it was found that imagining activities lead to the greatest frequency of first-person perspective use. Experiment 2 builds on these results by manipulating the perspective used by participants during the process of imagining activities. In this way, examined the impact of perspective on event imagination, in isolation of the impact of GA and LA.

The main finding of Experiment 2 was that SCP amplitudes were consistently more negative for third-person than for first-person perspective in prefrontal, frontal, central, and occipital regions. However, this difference was not observed in parietal regions. A possible explanation for the difference pattern at parietal regions comes from participant-reported ratings of sensory vividness. The senses of smell, sound, taste, and touch would be expected to diminish with decreasing physical proximity. A representation from the third-person perspective necessarily involves the usage of a viewpoint that is at least somewhat physically removed from the representation of the self, taking part in the cue-described action. Thus, vividness of smell,

sound, taste, and touch would be expected to be lesser for third-person than for first-person representation. Indeed, behavioural measures showed vividness of touch to be greater for first-person versus third-person perspective representation. There was also a trend towards greater vividness from the first-person versus the third-person perspective for smell, sound, and taste. The aforementioned absence of a perspective-based difference in parietal regions may be explained by the increased cognitive effort required to represent these senses with a greater degree of vividness for the first-person than for the third-person perspective.

A possibility for why differences in vividness of taste, smell, and sound did not reach statistical significance is due to the particular list of verbs used in this study. As uncovering differences in sensory vividness was not the primary focus of this study, the currently employed verbs were not designed to evoke events that feature any particular sense with a great degree of salience. It is hypothesized that these differences would reach statistical significance, given a stimulus list featuring a variety of sensory-rich events.

Unlike with the aforementioned sensory measures, ratings for vividness of sight were found not to differ at all according to perspective of representation. A possible explanation for the absence of a difference for the sense of sight is that this sense is typically diminished significantly only by physical distances exceeding those that an individual would be expected to naturally employ during event representation (i.e., It is unlikely that an individual would spontaneously take a third-person viewpoint from a distance that would make it difficult to see the event he/she is trying to view). According to Conway et al. (2003), increased visual imagery should be reflected by increased SCP negativity in temporal-occipital regions. It was found in the current study that third-person representation produced greater negativity than first-person representation in occipital regions. While this could be interpreted as third-person representation

requiring greater cognitive effort, this is perhaps not the case. Based on behavioural results, it may be that third-person representation leads to greater negativity, regardless of topographical region, and that this difference was not obscured, as it was in parietal regions, by differences in sensory vividness.

A number of previous examinations have used fMRI to investigate how changes in perspective use are reflected in the fMRI blood-oxygen-level dependent (BOLD) response, in various neural regions, during the representation of autobiographical memories (Eich et al., 2009; Freton et al., 2013). This body of research has found perspective-related differences in a number of neural regions. In all regions in which perspective-related responses were found, response levels were either equivalent for first-person and third-person perspective recall or were greater for first-person than for third-person perspective recall. SCP negativity has previously been taken as an indicator of neural activation, including sub-cortical activation (Conway et al., 2001; Skinner & Yingling, 1976) as indicated by BOLD responses (He & Raichle, 2009; Nagai et al., 2004). Thus, the SCP amplitudes recorded in the current study may be indicative of a similar difference in activation as that observed in previous research.

The current study also provides novel insight regarding the time course of event representation from different perspectives, which is not possible with the temporal resolution of fMRI. As such, the results of the current research extend those of past fMRI investigations into the process of imagining events by examining how this process is constrained by differences in temporal information. Overall, the results of the current study are consistent with previous research on visual perspective, which have found topographical and behavioural differences associated with the use of different perspectives.

Conclusion

Combined, the two experiments investigated how event representations are constrained by temporal information associated with verbs and by the visual perspective of representation. This research used SCP amplitudes as an index of the cognitive ease of event imagining. The results of this research indicate that both of these factors play a key role in determining the amount of cognitive effort required to imagine an event. As such, this study represents a novel extension of previous research on GA/LA and visual perspective, providing new information on the processing of temporal information in language from different visual perspectives.

Future research will be aimed at further investigating event representation from different perspectives based on cues that vary by temporal information. This research will further employ the forced-perspective paradigm, developed for Experiment 2, to investigate perspective-based differences in forming event representations, based on cues in different forms of GA/LA.

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Appendix A

Experiment 1 Materials

Table 1

Experiment 1 Activity Verbs

scrounge	battle	kiss	party
elope	flirt	debate	fish
volunteer	shop	huddle	study
hunt	loiter	play	struggle
visit	teach	vacation	fidget
act	collaborate	splash	exercise
read	watch	cuddle	golf
camp	dissent	squabble	gamble
pet	ml	cooperate	pray
compete	date	plot	consult
listen	lounge	pretend	
train	meet	speak	

Table 2

Experiment 1 Accomplishment Verbs

dust	shovel	fabricate	recreate
mow	style	derive	coil
invent	recite	mend	rake
produce	organize	pour	vacuum
squish	manufacture	polish	create
dig	build	bend	chop
design	draw	shred	drink
construct	knit	paint	form
sketch	alter	eat	trim
compress	sweep	prepare	wash
pack	compute	type	
concoct	compos	calculate	

Table 3

Experiment 1 Expected Pattern of Results

	Imperfective	Perfective
Activity	+	-
Accomplishment	-	+

Note. The "+" and "-" signs refer to a relative SCP positivity and a relative SCP negativity, respectively, during the process of event imagination. This pattern of results also applies to the response times observed in Yap et al., 2009. For this study "+" and "-" refer to faster and slower reaction times to picture times, respectively.

From which perspective was the imagined event viewed?	From my eyes		Looking at self	
Rate how vivid your sensory experience was in the imagined event, from 1 (not at all) to 7 (very much):				
Sight	_____	Touch	_____	Taste	_____	Smell	_____	Sound	_____

How vivid were the people/entities in the imagined event from 1 (not at all) to 7 (very much)?	_____	How vivid were the objects in the imagined event from 1 (not at all) to 7 (very much)?	_____
How vivid was the location of the imagined event from 1 (not at all) to 7 (very much)?			_____
Which components of the event did you imagine? (Circle all that apply)	Beginning	Middle	End
How many people/entities were involved in the imagined event?	_____	How many objects were present in the imagined event?	_____
How long would the imagined event take if it actually occurred?	_____	Rate how important the imagined event would be if it actually occurred:	_____
Imagined Event Cue:	_____		

Figure 1. Experiment 1 Behavioural Questionnaire

Figure 2. Experiment 1 Stimulus Example

Introduction

> Stephanie and Kate had been best friends all through grade school and high school.
>
> Right after her senior year of high school, Kate's family moved to the West coast.
>
> It had been years since they had seen each other.
>
> Finally, Stephanie decided it was time for a visit.
>
> She was on her way to the airport when she got a flat tire.

Aspect sentence

> Stephanie was changing the flat tire. (imperfective)
>
> Stephanie changed the flat tire. (perfective)

Post-aspect sentences

> She was worried about being late for her flight.
>
> She thought about how upset Kate would be.
>
> She decided she would have to catch a later flight.

Conclusion

> Stephanie was unable to get to the airport on time.
>
> She was extremely disappointed.
>
> Later that day she heard that the plane crashed.
>
> She was relieved not to be on the flight.

Critical test question

> Is Stephanie back on her way to the airport yet?
>
> *Figure 3*. Magliano and Schleich (2000) Example Stimulus

Appendix B

Experiment 2 Materials

Table 4

Experiment 2 Verbs

scrounge	battle	kiss	party
elope	flirt	debate	fish
volunteer	shop	huddle	study
hunt	loiter	play	struggle
visit	teach	vacation	fidget
act	collaborate	splash	exercise
read	watch	cuddl	golf
camp	dissent	squabble	gamble
pet	mingle	cooperate	pray
compete	date	plot	consult
listen	lounge	pretend	
train	meet	speak	

Rate how vivid your sensory experience was in the imagined event, from 1 (not at all) to 7 (very much):								
Sight	_____	Touch	_____	Taste	_____	Smell	_____	Sound	_____

Rate how vivid the people/entities were. 1 (not at all) to 7 (very much)	_____	Rate how vivid the objects were. 1 (not at all) to 7 (very much)	_____
Rate how vivid the location was. 1 (not at all) to 7 (very much)	_____	Rate how difficult it was to imagine the event. 1 (not at all) to 7 (very much)	_____

Which components of the event did you imagine? (Circle all that apply)	Beginning	Middle	End

How many people/entities were involved?	_____	How many objects were present?	_____
How long would the imagined event take if it actually occurred?	_____	Rate how important the imagined event would be if it actually occurred (1-7):	_____

Imagined Event Cue:	_____	Perspective of imagined event:	Looking from my eyes ◯
			Looking at self ◯

Figure 4. Experiment 2 Behavioural Questionnaire

Ready?	From my eyes	XXXX	I	was	skating	Record answers now
Prompt	Prompt	5000 ms	300 ms	300 ms	5000 ms	Prompt

Break (500 ms)   Break (200 ms)   Break (200 ms)
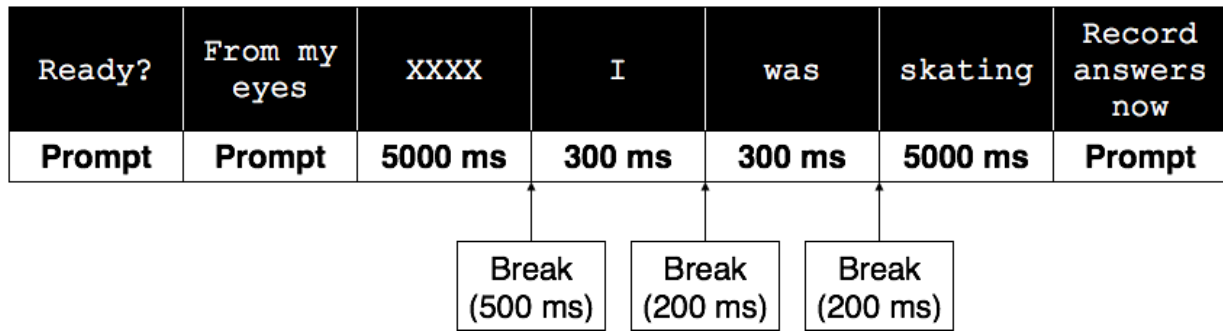
Figure 5. Experiment 2 Stimulus Example

Appendix C

Experiment 1 Results

Table 5

Experiment 1 SCP Results ANOVA (0-1500 ms)

Effect	0-500 ms	500-1000 ms	1000-1500 ms
GA	$F(1,48)=2.807$	$F<1$	$F<1$
LA	$F<1$	$F(1,48)=4.067$*	$F(1,48)=1.449$
Anteriority	$F(4,192)=2.819$†	$F(4,192)=15.344$*****	$F(4,192)=26.305$*****
Laterality	$F<1$	$F<1$	$F(1,48)=4.53$*
GA × LA	$F(1,48)=2.002$	$F(1,48)=4.898$*	$F(1,48)=6.758$*
GA × Anteriority	$F(4,192)=3.041$*	$F(4,192)=8.115$***	$F(4,192)=10.232$*****
GA × Laterality	$F<1$	$F<1$	$F(1,48)=1.521$
Laterality × Anteriority	$F<1$	$F<1$	$F(4,192)=1.142$
LA × Anteriority	$F<1$	$F<1$	$F<1$
LA × Laterality	$F<1$	$F<1$	$F<1$
GA × LA × Anteriority	$F<1$	$F<1$	$F(4,192)=1.673$
GA × LA × Laterality	$F<1$	$F(1,48)=1.747$	$F<1$
GA × Anteriority × Laterality	$F<1$	$F<1$	$F(4,192)=1.188$
LA × Anteriority × Laterality	$F(4,192)=1.952$	$F<1$	$F(4,192)=1.046$
GA × LA × Anteriority × Laterality	$F<1$	$F<1$	$F<1$

*$p<$ .05, **$p<$.01, ***$p<$.001,****$p<$.005, *****$p<$.0005, †.05$<p>$.10

Table 6

Experiment 1 SCP Results ANOVA (1500-3000 ms)

Effect	1500-2000 ms	2000-2500 ms	2500-3000 ms
GA	$F<1$	$F<1$	$F<1$
LA	$F<1$	$F<1$	$F<1$
Anteriority	$F(4,192)=21.428$*****	$F(4,192)=14.798$*****	$F(4,192)=9.452$*****
Laterality	$F(1,48)=5.35$*	$F(1,48)=3.993$†	$F(1,48)=4.788$*
GA × LA	$F(1,48)=6.142$*	$F(1,48)=7.407$**	$F(1,48)=3.9$†
GA × Anteriority	$F(4,192)=4.846$****	$F(4,192)=2.572$†	$F(4,192)=2.689$†
GA × Laterality	$F(1,48)=1.79$	$F<1$	$F<1$
Laterality × Anteriority	$F(4,192)=1.226$	$F(4,192)=1.059$	$F<1$
LA × Anteriority	$F<1$	$F<1$	$F<1$
LA × Laterality	$F<1$	$F<1$	$F<1$
GA × LA × Anteriority	$F<1$	$F<1$	$F<1$
GA × LA × Laterality	$F<1$	$F<1$	$F<1$
GA × Anteriority × Laterality	$F(4,192)=1.349$	$F(4,192)=1.113$	$F(4,192)=1.042$
LA × Anteriority × Laterality	$F(4,192)=1.296$	$F(4,192)=1.18$	$F<1$
GA × LA × Anteriority × Laterality	$F<1$	$F<1$	$F<1$

*$p< .05$, **$p<.01$, ***$p<.001$,****$p<.005$, *****$p<.0005$, †$.05<p>.10$

Table 7

Experiment 1 SCP Results ANOVA 3000-6000 ms)

Effect	3000-4000 ms	4000-5000 ms	5000-6000 ms
GA	F<1	F<1	$F(1,48)$=2.807
LA	F<1	F<1	F<1
Anteriority	$F(4,192)$=6.793*****	$F(4,192)$=4.422*	$F(4,192)$=2.819†
Laterality	$F(1,48)$=3.164†	$F(1,48)$=1.151	F<1
GA × LA	$F(1,48)$=2.896†	$F(1,48)$=1.484	$F(1,48)$=2.002
GA × Anteriority	$F(4,192)$=2.487†	$F(4,192)$=2.341†	$F(4,192)$=3.041*
GA × Laterality	$F(1,48)$=1.962	F<1	F<1
Laterality × Anteriority	F<1	F<1	F<1
LA × Anteriority	F<1	F<1	F<1
LA × Laterality	F<1	F<1	F<1
GA × LA × Anteriority	F<1	F<1	F<1
GA × LA × Laterality	F<1	F<1	F<1
GA × Anteriority × Laterality	$F(4,192)$=1.267	F<1	F<1
LA × Anteriority × Laterality	$F(4,192)$=1.11	$F(4,192)$=1.586	$F(4,192)$=1.952
GA × LA × Anteriority × Laterality	F<1	F<1	F<1

*p< .05, **p<.01, ***p<.001,****p<.005, *****p<.0005, †.05<p>.10

Table 8

Experiment 1 Behavioural Means

Measure	Activities Imperfective	Activities Perfective	Accomplishments Imperfective	Accomplishments Perfective
Perspective (%)	63.7	65.6	53.7	58.0
Sight (1-7)	4.778	4.811	4.922	4.998
Smell (1-7)	1.956	2.028	2.001	2.017
Sound (1-7)	3.353	3.346	3.909	3.821
Taste (1-7)	1.51	1.435	1.542	1.594
Touch (1-7)	3.749	3.744	3.392	3.397
Location Vividness (1-7)	4.21	4.085	4.527	4.592
Object Vividness (1-7)	4.683	4.601	4.146	4.137
People Vividness (1-7)	4.013	3.842	4.454	4.436
Beginning	0.37	0.366	0.386	0.383
Middle	0.822	0.785	0.829	0.824
End	0.225	0.311	0.202	0.264
People (Number)	4.368	4.211	10.351	9.261
Objects (Number)	6.053	8.89	8.01	9.097

Table 9

Experiment 1 Behavioural Results ANOVA

Measure	GA	LA	GA × LA
Perspective (%)	$F(1,48)=3.208$	$F(1,48)=27.328$*****	$F<1$
Sight (1-7)	$F(1,48)=1.37$	$F(1,48)=15.202$*****	$F<1$
Smell (1-7)	$F(1,48)=1.285$	$F<1$	$F<1$
Sound (1-7)	$F(1,48)=1.01$	$F(1,48)=50.894$*****	$F<1$
Taste (1-7)	$F<1$	$F(1,48)=4.562$*	$F(1,48)=1.624$
Touch (1-7)	$F<1$	$F(1,48)=28.884$*****	$F<1$
Location Vividness (1-	$F<1$	$F(1,48)=40.028$*****	$F(1,48)=3.263$†
Object Vividness (1-7)	$F(1,48)=1.161$	$F(1,48)=44.103$*****	$F<1$
People Vividness (1-7)	$F(1,48)=3.178$†	$F(1,48)=66.503$*****	$F(1,48)=2.193$
Beginning	$F(1,48)=6.17$*	$F<1$	$F<1$
Middle	$F<1$	$F(1,48)=23.83$*****	$F<1$
End	$F(1,48)=2.968$†	$F<1$	$F<1$
People (Number)	$F(1,48)=3.208$	$F(1,48)=27.328$*****	$F<1$
Objects (Number)	$F(1,48)=1.37$	$F(1,48)=15.202$*****	$F<1$

*$p<.05$, **$p<.01$, ***$p<.001$,****$p<.005$, *****$p<.0005$, †$.05<p>.10$
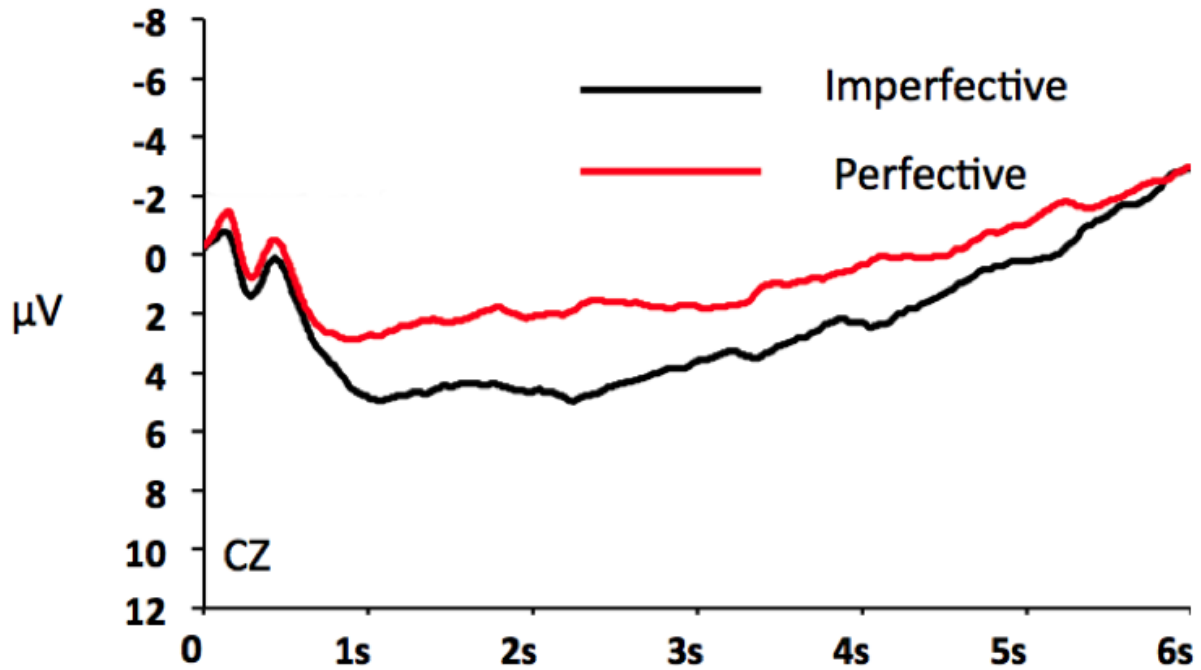
Figure 6. Experiment 1 activity SCP amplitudes
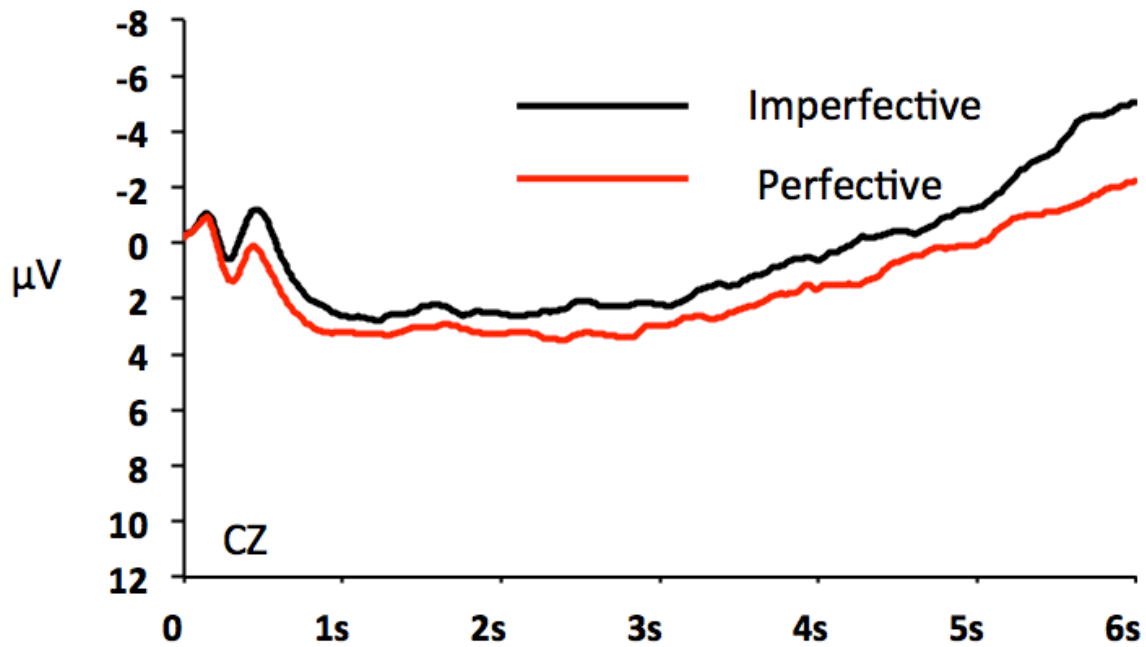
Figure 7. Experiment 1 accomplishment SCP amplitudes
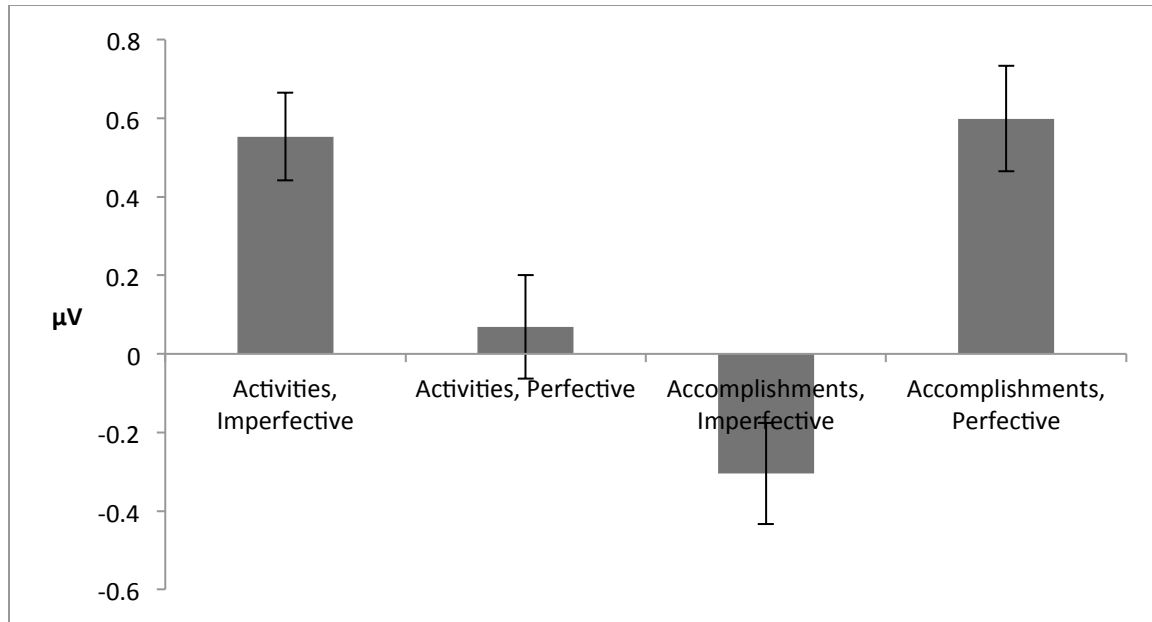
Figure 8. Experiment 1 GA/LA-dependent differences in SCP amplitudes (0-500 ms)
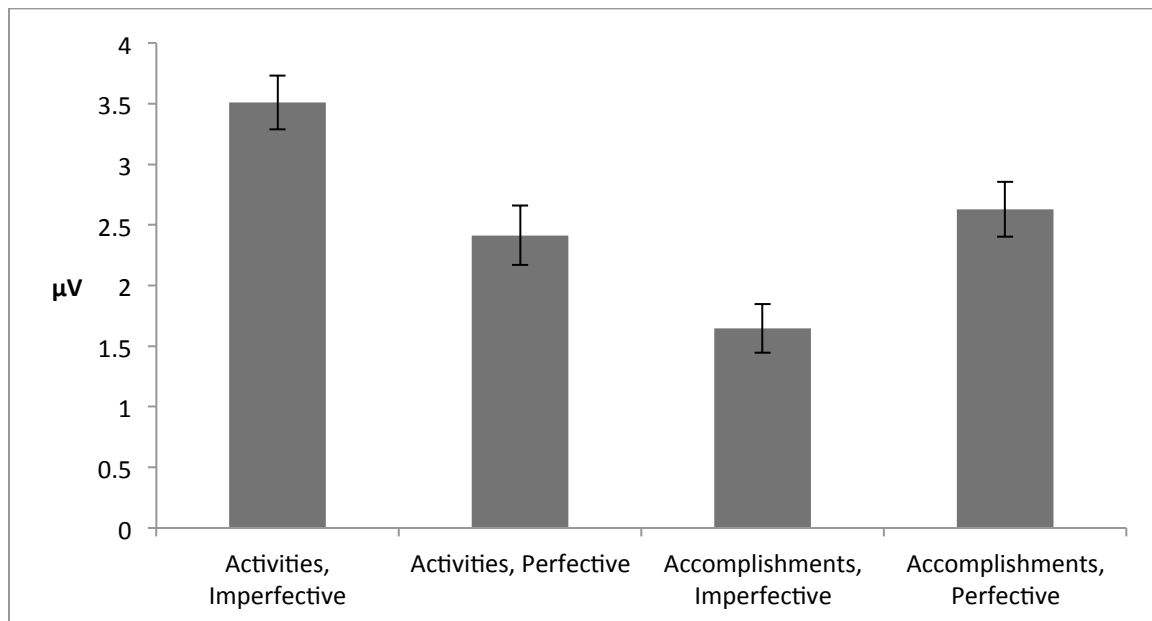
Figure 9. Experiment 1 GA/LA-dependent differences in SCP amplitudes (500-1000 ms; significant at the $p<.05$ level)
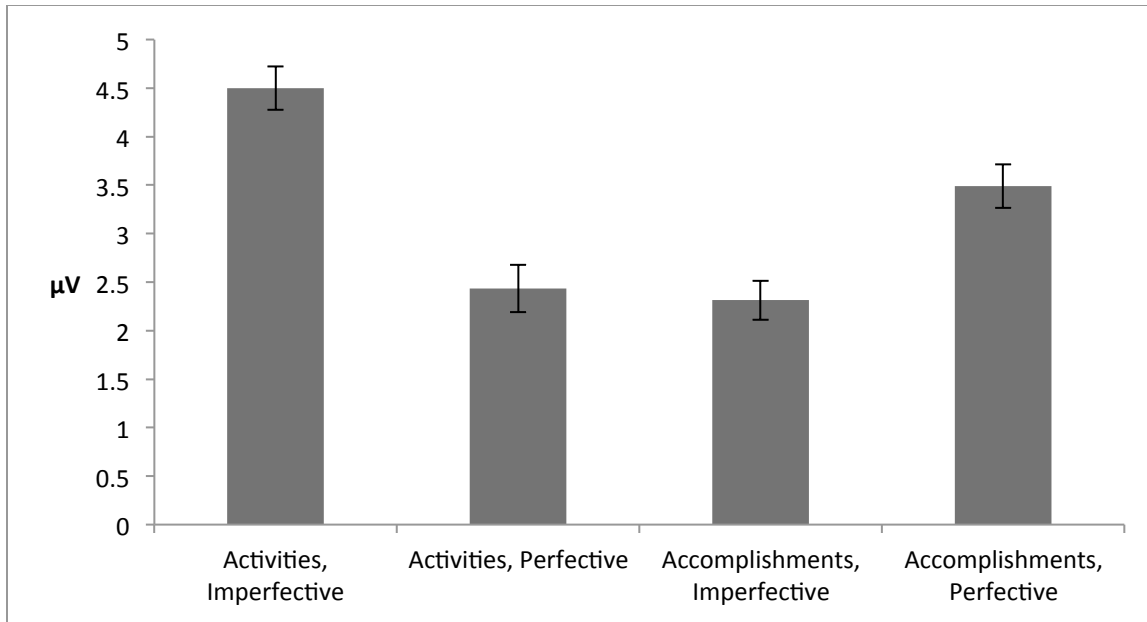
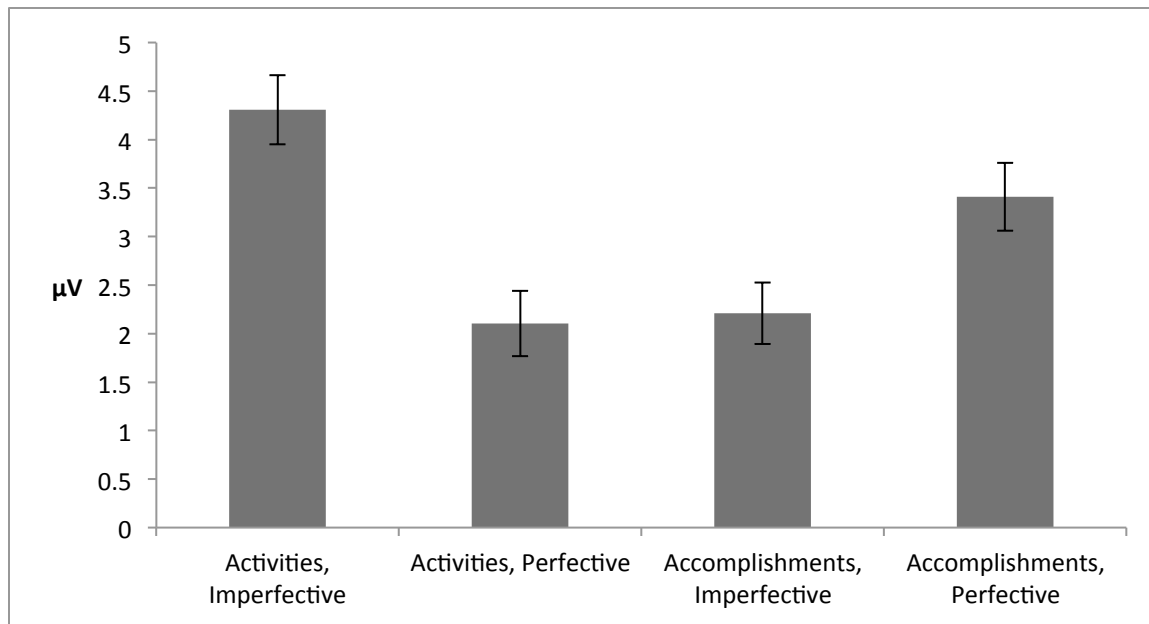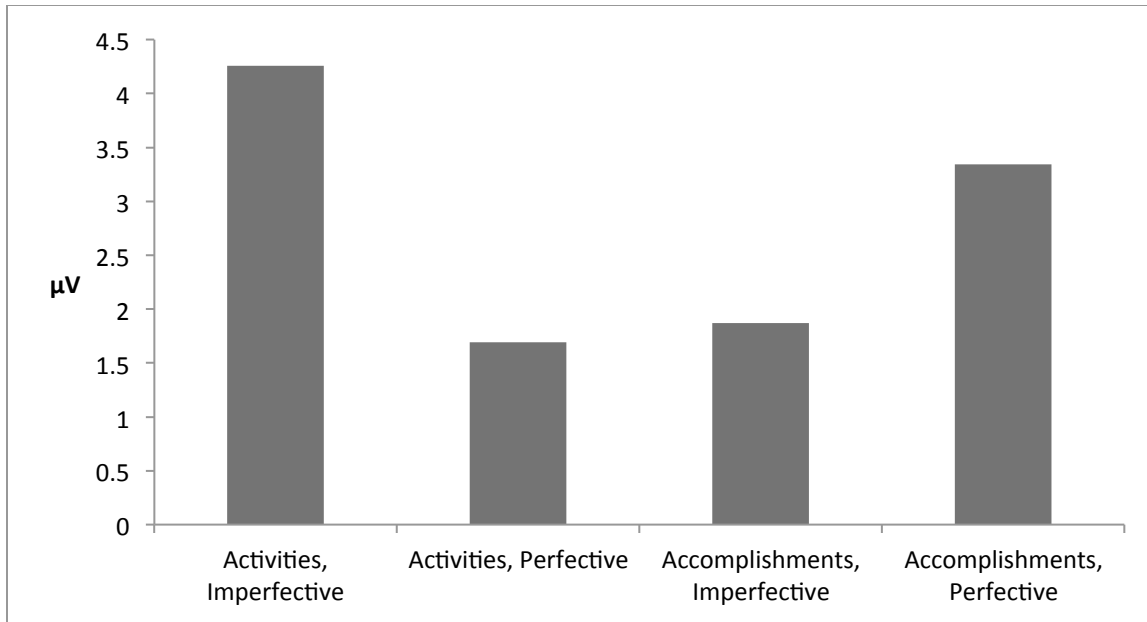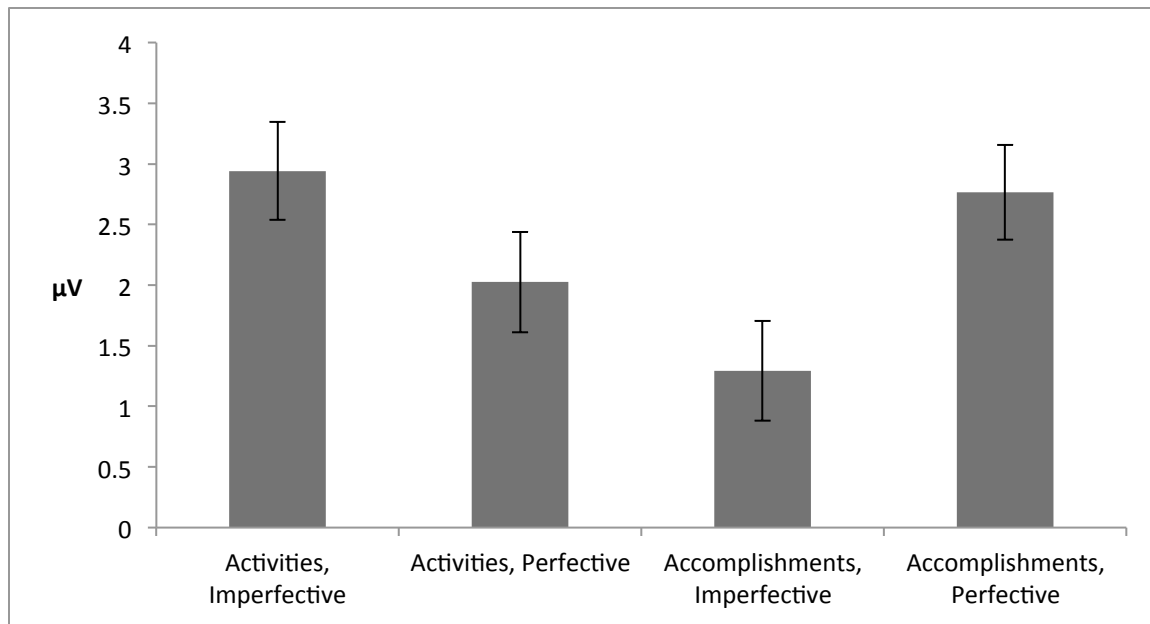*Figure 10.* Experiment 1 GA/LA-dependent differences in SCP amplitudes (1000-1500 ms; significant at the *p*<.05 level)

Figure 11. Experiment 1 GA/LA-dependent differences in SCP amplitudes (1500-2000 ms; significant at the *p*<.05 level)

Figure 12. Experiment 1 GA/LA-dependent differences in SCP amplitudes (2000-2500 ms; significant at the *p*<.01 level)

Figure 13. Experiment 1 GA/LA-dependent differences in SCP amplitudes (2500-3000 ms; marginally significant at *p*<.10)
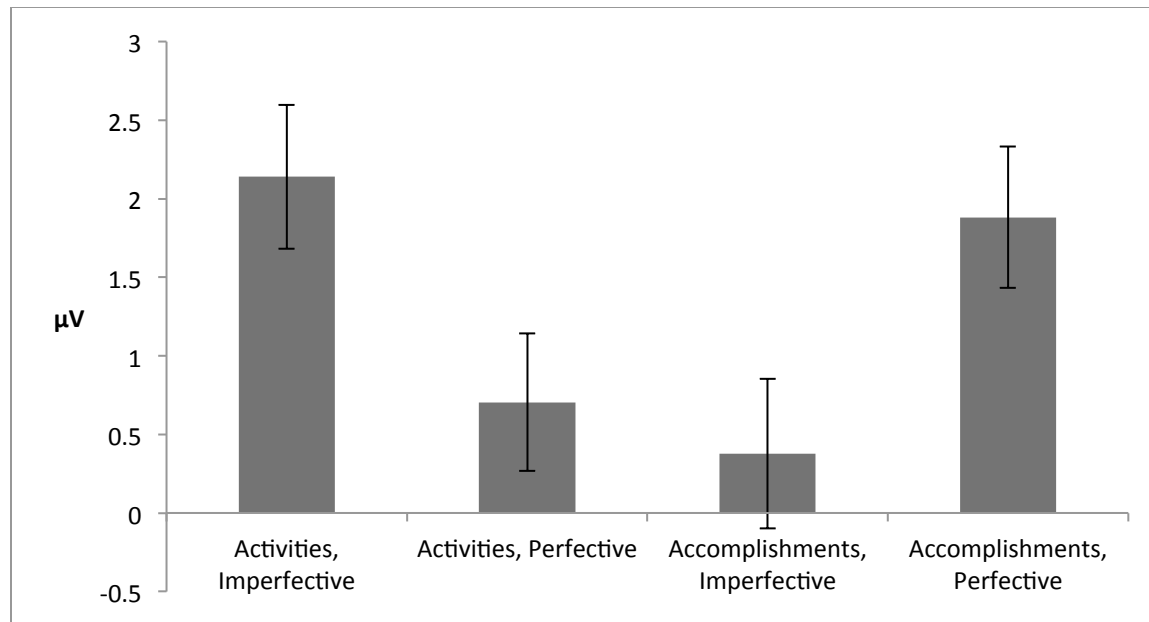
Figure 14. Experiment 1 GA/LA-dependent differences in SCP amplitudes (3000-4000 ms;

marginally significant at *p*<.10)

Appendix D

Experiment 2 Results

Table 10

Experiment 2 SCP Results ANOVA (0-500 ms)

Effect	0-500 ms
Perspective	*F<1*
Anteriority	*F*(4,160)=46.817*****
Laterality	*F<1*
Perspective × Anteriority	*F*(4,160)=2.589†
Perspective × Laterality	*F*(1,40)=1.964
Laterality × Anteriority	*F*(4,160)=2.826*
Perspective × Anteriority × Laterality	*F<1*

*p< .05, **p<.01, ***p<.001,****p<.005, *****p<.0005, †.05<p>.10

Table 11

Experiment 2 SCP Results ANOVA (500-1500 ms)

Effect	500-1000 ms	1000-1500 ms
Perspective	*F*(1,40)=4.901*	*F*(1,40)=4.37*
Anteriority	*F*(4,160)=18.414*****	*F*(4,160)=27.972*****
Laterality	*F<1*	*F*(1,40)=5.664*
Perspective × Anteriority	*F*(4,160)=3.617*	*F*(4,160)=4.349**
Perspective × Laterality	*F*(1,40)=2.498	*F*(1,40)=2.629
Laterality × Anteriority	*F<1*	*F*(4,160)=1.051
Perspective × Anteriority × Laterality	*F<1*	*F*(4,160)=1.014

*p< .05, **p<.01, ***p<.001,****p<.005, *****p<.0005, †.05<p>.10

Table 12

Experiment 2 SCP Results ANOVA (1500-3000 ms)

Effect	1500-2000 ms	2000-3000 ms
Perspective	*F*(1,40)=4.645*	*F*(1,40)=2.863†
Anteriority	*F*(4,160)=19.745*****	*F*(4,160)=12.762*****
Laterality	*F*(1,40)=5.429*	*F*(1,40)=2.721
Perspective × Anteriority	*F*(4,160)=4.457**	*F*(4,160)=3.979**
Perspective × Laterality	*F*(1,40)=3.517†	*F*(1,40)=1.937
Laterality × Anteriority	*F*(4,160)=1.161	*F*(4,160)=1.208
Perspective × Anteriority × Laterality	*F*(4,160)=1.128	*F*(4,160)=1.458

*p< .05, **p<.01, ***p<.001,****p<.005, *****p<.0005, †.05<p>.10

Table 13

Experiment 2 SCP Results ANOVA (3000-5000 ms)

Effect	3000-4000 ms	4000-5000 ms
Perspective	$F(1,40)=2.008$	$F(1,40)=1.046$
Anteriority	$F(4,160)=8.049****$	$F(4,160)=6.58****$
Laterality	$F<1$	$F<1$
Perspective × Anteriority	$F(4,160)=2.361$	$F(4,160)=1.623$
Perspective × Laterality	$F<1$	$F<1$
Laterality × Anteriority	$F(4,160)=1.094$	$F<1$
Perspective × Anteriority × Laterality	$F(4,160)=1.187$	$F(4,160)=1.425$

*$p< .05$, **$p<.01$, ***$p<.001$,****$p<.005$, *****$p<.0005$, †$.05<p>.10$

Table 14

Experiment 2 Behavioural Means

Measure	First-Person Perspective	Third-Person Perspective
Sight (1-7)	4.993	4.976
Touch (1-7)	3.416	3.164
Taste (1-7)	1.471	1.339
Smell (1-7)	1.869	1.780
Sound (1-7)	3.812	3.733
People Vividness (1-7)	4.280	4.429
Object Vividness (1-7)	3.995	3.921
Location Vividness (1-7)	4.354	4.515
Difficulty (1-7)	2.888	2.841
Beginning (%)	38	40
Middle (%)	79	78
End (%)	14	16
People (Number)	15.983	31.451
Objects (Number)	8.966	10.082
Duration (Seconds)	1081262.107	1328378.252
Importance (1-7)	3.258	3.280

Table 15

Experiment 2 Behavioural Results Paired t-tests

Measure	Perspective
Sight (1-7)	$t(47)=0.289$
Touch (1-7)	$t(47)=2.601$*
Taste (1-7)	$t(47)=1.83$†
Smell (1-7)	$t(47)=1.509$
Sound (1-7)	$t(47)=1.174$
People Vividness (1-7)	$t(47)=1.77$†
Object Vividness (1-7)	$t(47)=0.878$
Location Vividness (1-7)	$t(47)=1.923$†
Difficulty (1-7)	$t(47)=0.698$
Beginning (%)	$t(47)=0.778$
Middle (%)	$t(47)=0.570$
End (%)	$t(47)=1.427$
People (Number)	$t(47)=0.931$
Objects (Number)	$t(47)=0.356$
Duration (Seconds)	$t(47)=0.632$
Importance (1-7)	$t(47)=0.307$

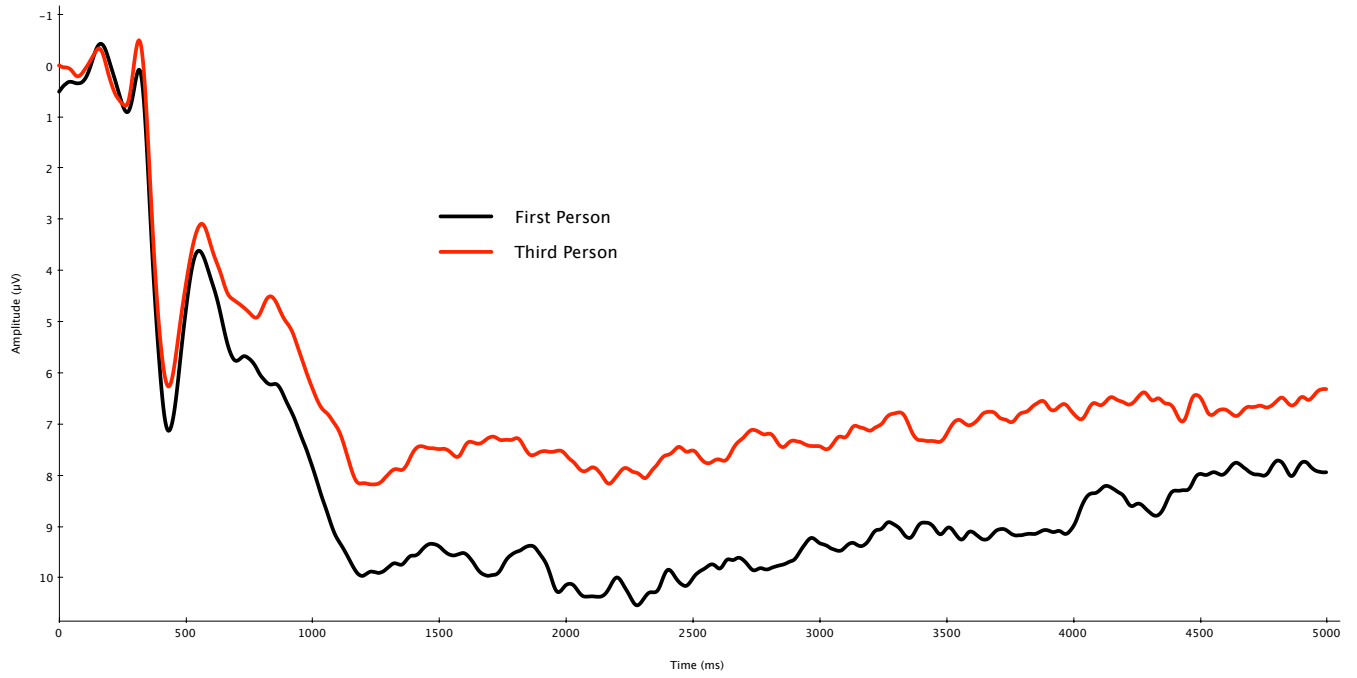*$p< .05$, **$p<.01$, ***$p<.001$,****$p<.005$, *****$p<.0005$, †$.05<p>.10$

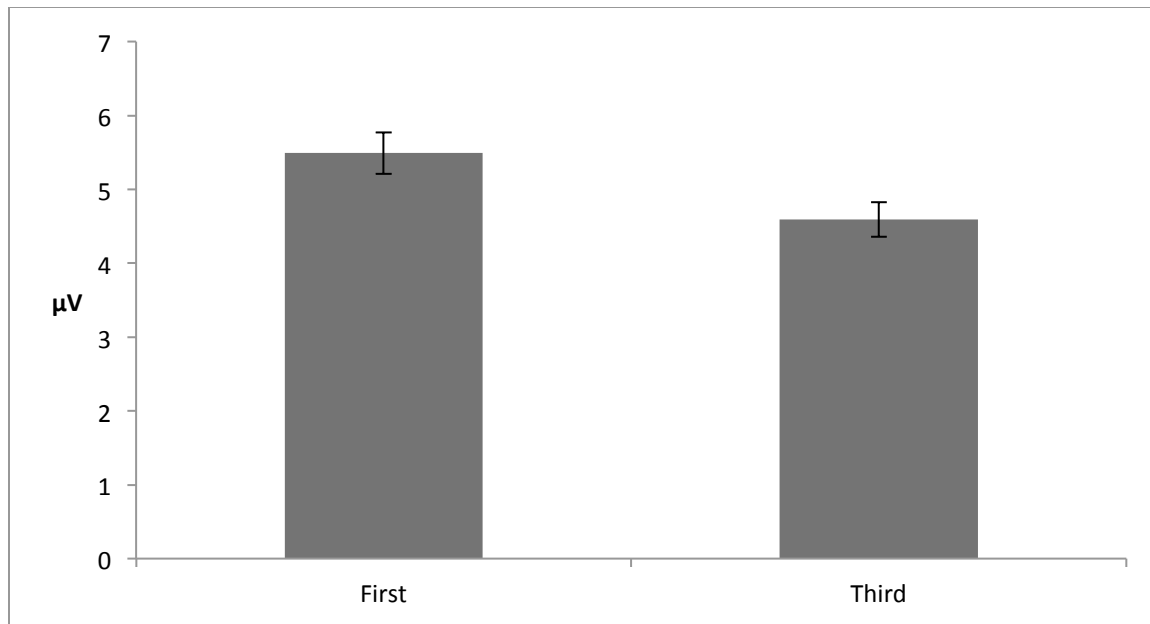*Figure 15.* Experiment 2 SCP amplitudes

Figure 16. Experiment 1 GA/LA-dependent differences in SCP amplitudes (500-1000 ms;
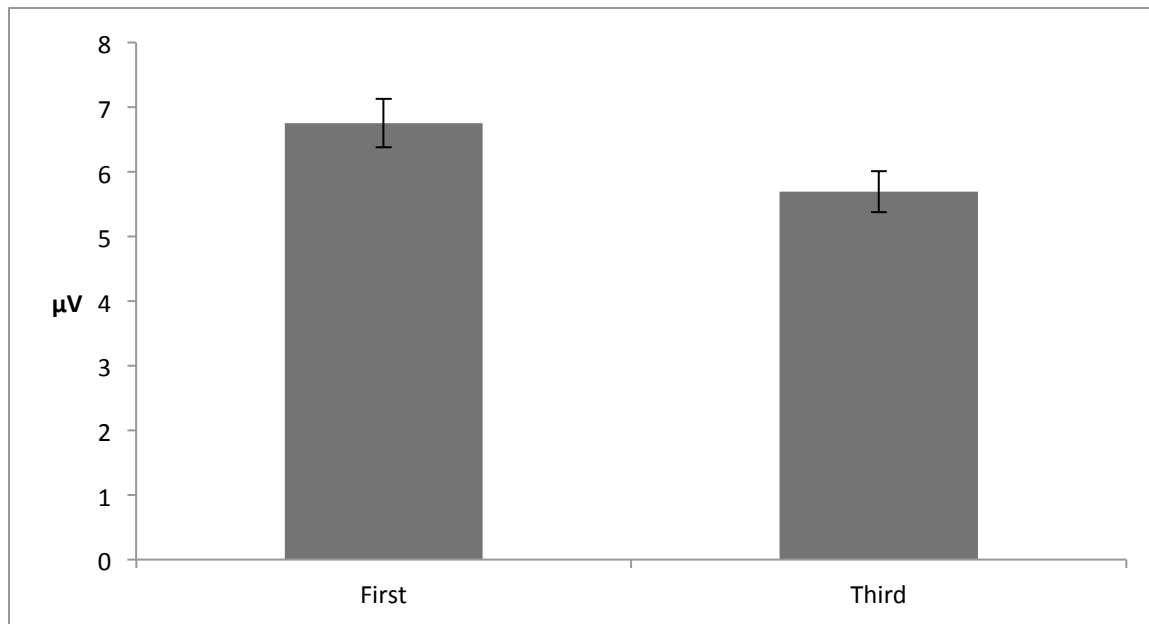
significant at the *p*<.05 level)

Figure 17. Experiment 1 GA/LA-dependent differences in SCP amplitudes (1000-1500 ms;
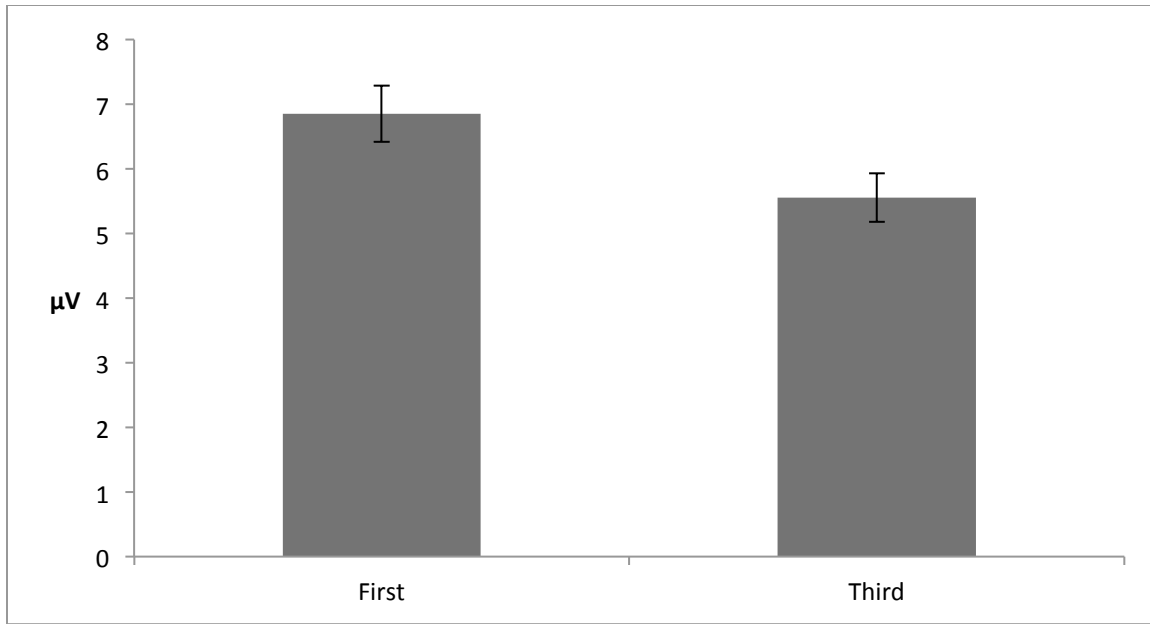
significant at the *p*<.05 level)

Figure 18. Experiment 1 GA/LA-dependent differences in SCP amplitudes (1500-2000 ms;
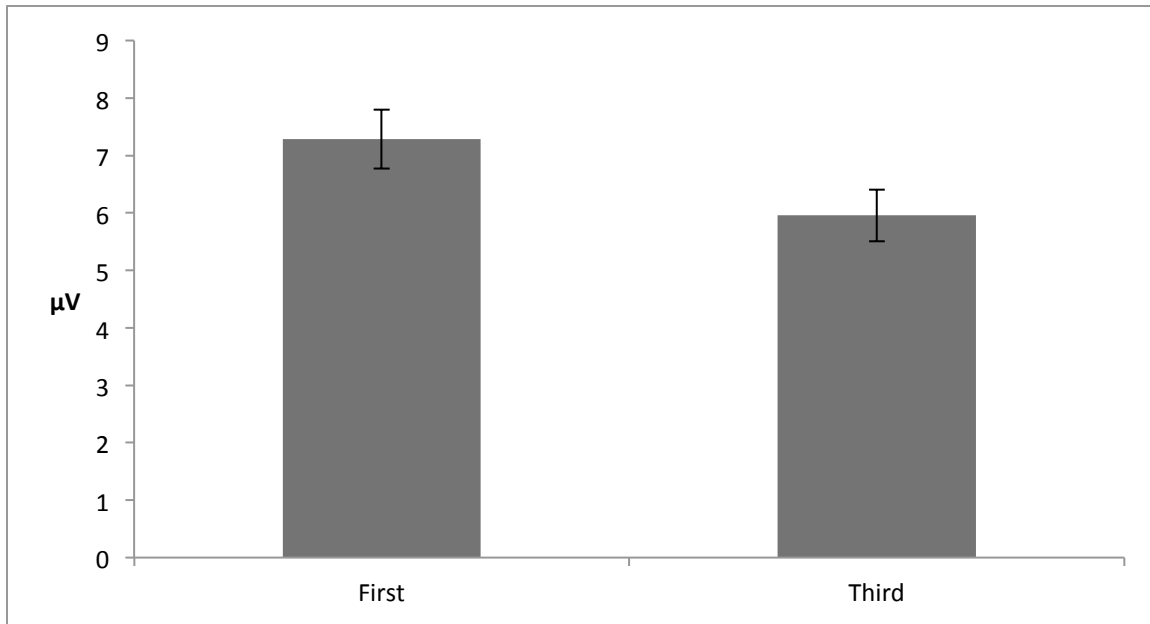
significant at the *p*<.05 level)

Figure 19. Experiment 1 GA/LA-dependent differences in SCP amplitudes (2000-3000 ms;

marginally significant at the *p*<.05 level)