Event Representations in Brain, Language and Development

October 27-28, 2017
Max Planck Institute for Psycholinguistics
Nijmegen, The Netherlands
Organizers

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Acknowledgements

We gratefully acknowledge funding by the Max Planck Institute for Psycholinguistics and a VICI grant awarded to A.Ö. by the Netherlands Organisation for Scientific Research (NWO).

We thank Carolin Lorenz for her assistance with the local organization and Dilay Karadöller, Muqing Li, Ezgi Mamus, Francie Manhardt, Julia Misersky, Gerardo Ortega, Renske Schilte, Ksenija Slivac, Marlijn ter Bekke for volunteering and chairing the sessions.
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Abstracts

Invited talks
Event segmentation and event memory across the lifespan

Jeffrey Zacks
Washington University St. Louis

Where do the episodes in episodic memory come from? I will suggest that ongoing perceptual mechanisms segment the continuous stream of experience into perceptual chunks that form the elements of what we remember later. These mechanisms are present by the school-age years but continue to mature. They appear to be impaired by healthy again and impaired further by early stage Alzheimer’s disease. Facilitating event segmentation improves memory; this may provide a unique intervention to improve memory for everyday activity throughout the lifespan.
Dynamics of hierarchical event networks in the episodic memory system

Branka Milivojevic

Donders Institute for Brain, Cognition and Behaviour, Radboud University

Once encoded, our experiences form networks of related memories. Traditionally, two types of contexts, that of space and time, have been considered as particularly important for episodic memory. However, associations between events can cut across spatial and temporal proximity to form a coherent narrative, suggesting that narratives may provide another type of context for organisation of episodic memories. Here, I present a series of experiments in which we systematically examine this hypothesis. We used a combination of realistic stimuli (movies and stimuli developed using The Sims 3 life-simulation game), fMRI and across-voxel pattern similarity to examine whether formation of narrative-based memory networks in humans also relies on hippocampal mechanisms which are critically involved in formation of spatiotemporal contexts. First, we demonstrated that patterns of hippocampal activity can also be used to differentiate between narratives and that these narrative-context representations diverge gradually over time akin to remapping-induced spatial maps represented by rodent place cells. Secondly, we showed that event representations are remarkably dynamic and follow hierarchical organisation in memory. In one study, we showed that hippocampal and medial prefrontal (mPFC) neural patterns became more similar once previously unrelated events became linked through a new event. Further, we have shown that the scale of these event networks increases along the long axis of the hippocampus, with anterior hippocampus providing coarser event representations corresponding to multi-event narratives. And finally, we have demonstrated that the degree of event consistency with previously consolidated narratives has an effect on the mechanisms involved in event integration, where consistent events are assimilated into pre-existing prefrontal schemas, while neutral events require reconfiguration of hippocampal event networks. In combination, these results suggest that memories can be organised into networks of related events based on common narrative contexts, which are highly dynamic and flexible, and follow a similar hierarchical organisation like space and time.
The challenges of event cognition: Object representation at the interface of episodic and semantic memory

Gerry Altmann
University of Connecticut

To understand the event corresponding to e.g. “the chef chopped the onion” requires understanding (i) that the things under consideration have properties shared with other similar things (i.e. inherited from their type), (ii) that they have specific properties that uniquely distinguish them from other things of the same type (i.e. they are specific tokens), and (iii) that these properties change over time; the chef and the onion have (intersecting) histories that started with them in one state and ended with them in another. These histories are in fact trajectories of changes in state across time and space, and their intersection defines the interactions between objects (in this case, the action of the chef on the onion). To comprehend events therefore requires that we access knowledge about types of objects and combine this with knowledge about the dynamic episodic properties of individual tokens – that is, it requires creating on-the-fly representations of object tokens and their changes in state. In this talk I shall outline an account of how this might be accomplished in a brain that is able to distinguish the systematic associations that define semantic memory for object types from the non-systematic accidental associations that define the episodic characteristics of object tokens.
Learning to talk about events

Anna Papafragou
University of Delaware

A foundational aspect of human cognition is the ability to parse our constantly unfolding experience into meaningful representations of dynamic events and to communicate about these events with others. Understanding the nature and development of this ability requires a multi-pronged approach to the following key questions: What is the form of pre-linguistic event representations? How do event representations make contact with language in both novice (child) and experienced (adult) communicators? How does cross-linguistic variation in event encoding affect the acquisition of language for events? In this talk, I show that theories of how events are encoded in language can inform our understanding of how events are cognitively represented. These theories predict otherwise unexplained similarities in the way learners acquire event predicates across language communities and support the presence of deep homologies between linguistic and non-linguistic event structure.
In this talk, I will discuss how infants and young children begin to learn about the actions and events they observe in their everyday world. As active explorers of their environments, infants begin to learn about events and actions from their active engagement with objects and people. Importantly, infants and young children can also learn from observation of actions and events; I review evidence for observational learning via statistical learning and comparison processes. Relying on both behavioural and neuroimaging data with infants and toddlers, I examine the advantages and limitations of each of these drivers of development. Throughout, I focus on the differentiation between actions and events and whether and when processing of one might be prioritised over the other. Implications for the potential role of language and gesture in these processes will be considered throughout.
Event unit formation under a cross linguistic perspective
Christiane v. Stutterheim & Johannes Gerwien
University of Heidelberg

Earlier crosslinguistic studies on event construal and verbal representation of events have shown that speakers of different languages a) segment visual input at different break points into event units and b) select different components of the visual input for verbal representation. So far these two aspects of event construal have not been investigated in their interrelation. A situation in the world is complex, in that different quality changes can take place at a given time interval, such as a leaf which is falling and rotating at the same time or a person who is walking and approaching a goal. In order to form an event unit an observer has to select a layer of the complex composition of the different qualities of the event, which entails the relevant criteria for identifying break points. This is where language comes into play.

We present evidence for the role of linguistically packaged conceptual categories in event unit formation from crosslinguistic experiments in the domain of motion. Results will be presented from both verbal and non-verbal tasks. Speakers of four languages which vary with respect to typological features in spatial and temporal cognition (French, Tunisian, German and English) were viewing short real-world video clips. In one experiment they were asked to segment the input non-verbally (button-press-method, cf. Newtson, 1973), in a second experiment they were asked to verbalise the scenes.

Our hypothesis is supported by two findings: a) The crosslinguistic differences found in segmentation patterns converge across the verbal and the non-verbal task. b) Crosslinguistic differences in the selection of information to represent the scenes correspond to typological differences at the level of grammar and the lexicon: Speakers of different languages select different layers of the scenes for the formation of event units.

Findings will be discussed in the context of theories of event cognition, focusing on the role of language.
Intuitive iconicity for events and objects: Telicity and the count/mass distinction across modalities

Brent Strickland, Jeremy Kuhn, Philippe Schlenker & Carlo Geraci

Département d'Etudes Cognitives, Ecole Normale Supérieure, PSL Research University, Institut Jean Nicod

Telic verbs refer to events bound in time ("decide"), while atelic verbs ("think") refer to events that are not. Analogously, count nouns typically refer to objects bound in space ("coin") while mass nouns typically refer to entities that are not ("rain"). Standard semantic theory (Jackendoff 1991, Bach 1996) draws formal parallels between the logical properties of two domains. Here, we ask whether the notion of boundedness (in space or time) is present in the fundamental cognitive representation of the entities the words denote. A first experiment showed unfamiliar Italian Sign Language signs to non-signers. Participants readily assigned telic and count meanings to signs containing "gestural stops" while they assigned atelic and mass meanings to signs lacking such stops. A second experiment asked if similar results may extend in spoken language. Here, written non-words either contained or lacked a phonological stop. "Stop" words were again more readily assigned telic and count meanings while non-stop words were more readily assigned atelic and mass meanings. Collectively, these results suggest that the telic/atelic and count/mass distinctions play similar roles in an abstract iconic system (mapping meaning to symbols), thus suggesting that these categories share deep similarities in how their typical referents are represented.

References

Language-space interface: Dynamic spatial representations of motion events in language processing

Yuki Kamide
University of Dundee

When we hear or read a sentence that describes an object moving from one place to another, we have to keep in memory where the object was initially, then where it is after the movement, in order to understand the event described in the sentence. This talk investigates how spatial representations of the objects in motion events are established and updated in the comprehenders’ minds as the sentences unfold. First I will present a few experiments that investigate mental representations of the trajectory (path) of moving objects in language-mediated motion event processing (e.g., ‘The cat will jump/crawl onto the sofa’). The second line of research explores how the speed of motion events is represented (e.g., ‘The cat will dash/crawl onto the sofa’). Our results will be discussed in relation to the issue of ‘mental simulations’ of events in language processing.
Abstracts

Oral presentations
Linguistic encoding of flexible event construal in adults and children
Lilia Rissman¹, Amanda Woodward² & Susan Goldin-Meadow²
¹Radboud University, ²University of Chicago
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Language provides tools for describing events from multiple perspectives. The active sentence *the duck is pushing the bunny* and the passive sentence *the bunny was pushed by the duck*, for example, involve the same participant roles but differ in whether the agent or the patient is the topic. We use the label "flexible event construal" to describe viewing the same event from multiple perspectives. In our study, we asked how visual perceptual factors guide language for flexible event construal in English-speaking adults and children. Participants described events where an animate causative agent is more or less perceptually salient relative to a patient. Only adults linguistically encoded this difference, suggesting that children's sensitivity to perceptual influences on flexible event construal is delayed relative to their causal language.

Animacy and agency both play dominant roles in shaping language for event construal: animates are more likely to appear as the sentence Subject than inanimates [1-2], and agents are more likely to appear as Subject than patients when animacy is controlled [3]. Nonetheless, visual perceptual factors also play a role: visually foregrounded animates appear as Subject more often than backgrounded animates [3-4]. We asked whether such perceptual influences could override the strong bias for animate agents to appear as Subject. 28 English-speaking adults described three types of scenes: Body-Agent, where a person acts on an inanimate object (e.g., tipping over a book), and face, torso and hands are visible, Hand-Agent, where only the hand is visible acting on the object, and No-Agent scenes, in which the object changes on its own (e.g., a book falling over). Figure 1 shows that adults use more passive descriptions (e.g., *the book was tipped over*) in Hand-Agent than Body-Agent scenes (β=-9.79, SE=3.48, p<.01). Thus in the competition for Subject, a perceptually foregrounded inanimate patient sometimes beats out a perceptually backgrounded animate agent.

We then asked whether children show the same influence of perceptual cues on event construal. Children show robust knowledge of causative concepts and language [5-6]. English-speaking 3-year-olds also have productive knowledge of passive [7-8], indicating ability to linguistically encode flexible event construal. This ability may be restricted, however, as children have more difficulty producing passives with inanimate rather than animate patients (e.g., *the grocery cart was pushed by the duck*) [9-10]. To test whether perceptual cues lead to increased use of passive among children, we asked 16 English-speaking 3-4-year-olds (mean = 4;0) to describe the same Body-Agent, Hand-Agent and No-Agent scenes as adults. Figure 2 shows that children produced active descriptions at the same rate for these two types of events (β=.11, SE=.48, p=.81), and never produced passives. Although children sometimes produced intransitives (e.g., *the book fell over*) for both Body-Agent and Hand-Agent scenes, they did so at the same rate (β=.53, SE=.52, p=.31), indicating they do not use intransitives to convey a patient-oriented construal. These results indicate that children do not have the same perceptual sensitivity as adults, and that children's ability to flexibly construe events may be more limited than that of adults.
References


Figure 1. Proportion of adult responses coded as active, passive or intransitive in the Body-Agent, Hand-Agent and No-Agent conditions. Error bars show 95% confidence intervals.

Figure 2. Proportion of child responses coded as active, passive or intransitive in the Body-Agent, Hand-Agent and No-Agent conditions. Error bars show 95% confidence intervals.
Can prior experience with unlabeled actions shape children’s linguistic representation of action events?

Suzanne Aussems¹, Katherine Mumford² & Sotaro Kita ¹

¹ Department of Psychology, University of Warwick, Coventry, UK; ² Words First Ltd, Birmingham, UK

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When children hear a label for an action for the very first time, they often have seen this action before. In verb learning experiments that use multiple exemplars, however, all exemplars are labeled. Thus, it is unclear whether prior exposure to a referent action can serve as a “retrospective exemplar” and help children to learn a label for this action. This study examines if retrospective exemplars facilitate subsequent verb learning and if seeing iconic gestures with these retrospective exemplars influences the process.

Children struggle to learn verbs with multiple exemplars in which the actor changes, unless their attention is focused on actions (Maguire et al., 2008). Iconic gestures (e.g., wiggling fingers for “walking”) can direct children’s attention to actions and facilitate verb learning (Goodrich & Hudson Kam, 2009). We hypothesized that children benefit from retrospective exemplars in subsequent verb learning, but only if iconic gestures accompanying the retrospective exemplars focus their attention on the referent actions.

In the first phase of an experiment task, we showed 96 children (Mage = 41 months) videos of actors performing novel actions, accompanied by either iconic gestures representing those actions, or interactive gestures (e.g., showing surprise). Note that no gesture was presented after the first phase. In the second phase, we introduced verbs for either the same actions as in the first phase (retrospective exemplar condition), or a different set of actions (irrelevant action condition). In the test phase, children were then required to generalize the newly learned verbs to scenes in which the labeled actions were performed by new actors (cf. Imai et al., 2005). Children successfully generalized the verbs at test only in the retrospective exemplar condition and when those exemplars were accompanied by iconic gestures.

In a follow-up experiment with 48 children (Mage = 39 months), we replicated the effect of seeing iconic gestures with retrospective exemplars on verb learning and we introduced a control condition in which children saw two different exemplars of the same action side by side in the first phase of the task (i.e., two videos of different actors performing the same action), without a gesture. Children in both groups extended the verbs to novel situations at test, but children in the iconic gesture condition outperformed children in the control condition. Importantly, this experiment shows that an iconic gesture does not merely function as an extra action exemplar; rather it is a schematic representation that can shape children’s linguistic representation of action events in such a way that it is ready for generalization. The findings also suggest that comparing events is an important ability for verb learning, as children in the control condition generalized verbs too.

At age 3, there are circumstances under which children can and cannot align action events for verb learning. This study is the first to show that children’s prior experience with unlabeled actions influences verb learning. The findings emphasize, once again, the importance of multimodal input in word learning as the best results were obtained when iconic gestures highlighted the action component of the action events.
References


Thoughts in motion: Effects of language experience on motion cognition
Guillermo Montero-Melis
Centre for Research on Bilingualism, Stockholm University
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Does our experience with language influence how we think of events? Three studies illuminate this question in the motion domain, using complementary methodologies and testing different populations.

Study 1 tests whether the large-scale typological patterns of encoding motion events proposed by Talmy (2000) influence motion representation. This large cross-linguistic study draws on data from 19 genealogically diverse languages that belong either to Talmy’s satellite-framing type (encoding manner of motion in the main verb and path outside of the main verb) or verb-framing type (encoding path in the main verb and manner optionally outside of it). We use a two-alternative forced choice task in which participants have to match a target event to one of two variants, one in which path is kept constant but manner changes (same-path variant) or one in which path varies and manner is kept constant (same-manner variant). After controlling for the dependencies in the data using multilevel regression modelling, we find no evidence of an effect of language type on motion representation. Computational power simulations suggest that studies using this paradigm suffer from low power, chiefly due to the substantial individual variability in responses, but also to variability between languages.

Studies 2 and 3 make use of a different methodology: a similarity arrangement paradigm (Goldstone, 1994) in which participants are not forced to choose among same-path and same-manner variants, but instead can weigh different factors into their similarity judgments. These studies zoom into caused motion events, which have received less attention in the literature than spontaneous motion.

Study 2 tests whether native speakers of Spanish (a verb-framed language) and Swedish (a satellite-framed language) differ in their similarity arrangements in a way that mirrors cross-linguistic differences in event descriptions. Indeed, Swedish speakers rely significantly more than Spanish speakers on the manner in which the object moves (if it rolls or slides), paralleling cross-linguistic differences. These differences in similarity arrangements hold both when the events are described prior to carrying out the similarity task and when they are not. However, differences disappear if participants engage in a verbal interference task throughout the experiment. We conclude that long-term linguistic experience influences the representation of motion if language can be accessed.

Finally, Study 3 combines the similarity arrangement task from Study 2 with a priming paradigm to ask whether recent linguistic experience in a second language (L2) affects what we judge to be similar events. Swedish learners of L2 Spanish were primed to use either path or manner verbs during an encoding phase in Spanish. In the subsequent test phase, they had to arrange events according to similarity. Path versus manner priming affected how participants judged event similarity. We conclude that speakers select conceptual categories ad hoc and that recent L2 experience can affect this process.

Using a variety of methods, these studies illuminate how linguistic experience can influence event representation at different time scales, highlight how language effects might depend on choice of task and language, and exemplify how to take into account linguistic experience beyond the native language.
References


A two-vector model of events

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When we talk about events, we clearly imply a relational structure. For example, linguists resort to a thematic role structure where the basic roles are agent and patient. When we think about physical phenomena, we conceive of events as relations between causes and effects. When we make plans, we think of actions and their consequences. These perspectives reveal different aspects of the same underlying structure, which is an asymmetric relation between two entities.

This common structure of events in language, physical thinking and planning can be naturally interpreted in geometric terms. The structure can be modeled as a mapping between vector spaces (Gärdenfors and Warglien 2012). The action and the result components of the event is represented as vectors in the two spaces. The action space is conceived as a space of forces (or force patterns) acting upon some target entity. The result component of the event represents changes in the properties of the target, and therefore the result space is modeled as a vector space. The changes are typically changes of location or changes of object properties.

The two-vector representation of events will be applied to two areas:

1. Causal thinking
   The event model captures a basic sense of causation: the action causes the result. Most accounts of causation analyze the relation between the action and the effect as a relation between two events. In contrast, our model views causation as a relation within an event by introducing a distinction between forces and changes of states. Unlike many other theories, our model does not treat causes and effects as symmetrical entities: they belong to different domains – causes to the force domain and results to change in location (in the case of movements) or in some property (color, size, weight, temperature, etc).

2. Events as a basis for semantics
   Gärdenfors (2014, p. 177) proposes that a construal of an event contains at least one vector (force or result) and one object (patient or agent). This leads to a general proposal concerning the semantics of sentences: A declarative sentence typically expresses a construal of an event. A construal of an event can be a complex structure that not only involves the two vectors, but also a patient and an agent with their properties, as well as counter-forces, instruments, recipients, intentions, etc.

   Linguists often distinguish between manner verbs that specify as part of their meaning how an action is performed, and result verbs that specify the resulting state. Result verbs group together verbs describing motion with verbs that describe property changes. The distinction is supposed to be exhaustive: Any particular use of a verb is either a manner verb or a result verb. On the proposed event model the distinction comes out very naturally: Manner verbs refer to force vectors of events while result verbs refer to result vectors. Another way of expressing this is to say that the manner/result distinction is basically a cause/effect distinction.
References


Abstracts

Poster presentations
Animacy and visual effects in German sentence production
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Background:
In order to facilitate communication and convey an utterance appropriately, speakers have the option to choose between diverse syntactic alternatives (e.g. Myachykov 2010: 53). The first picture in Figure 1, for instance, can be described by formulating a German active sentence like *Der Pilot misst den Clown (The pilot measures the clown)*, but it is also possible to produce a passive sentence such as *Der Clown wird vom Piloten gemessen (The clown is measured by the pilot)* or a topicalization like *Den Piloten misst der Clown (The clown [ACC], the pilot [NOM] measures)* to describe the scenario adequately. This choice between syntactic alternatives does not only depend on the pragmatic context, but also on other factors such as visual information or animacy of the referents (e.g. Tomlin 1995, 1997; Myachykov & Tomlin 2008).

For instance, studies have shown that concepts which are placed higher on the animacy hierarchy scale are preferably chosen as sentential subjects or realized in an earlier clause position leading to the production of non-canonical passive sentences or object topicalizations (Prat Sala & Branigan 2000; Van Nice & Dietrich 2003). At the same time, people canonically seem to represent actions in a left to right directionality, with agents located on the left and patients on the right (e.g. Chatterjee et al. 1999).

Figure 1

Aim of Study:
We sought to determine how patient animacy and the position of the patient determine the selection of syntactic structure in – to this date under-researched – German sentence production. Since both voice alternations and object topicalizations are feasible options in German, the study also offers the possibility to disentangle whether animacy and visual position preferably affect grammatical function assignment (McDonald et al. 1993) or word order (Prat Sala & Branigan 2000).

Method:
We conducted a sentence production experiment with 60 monolingual adult German participants who were asked to describe simple black-and-white drawings depicting diverse interactions in a single sentence. The different conditions are depicted in Figure 1. All stimuli were controlled for size of agents and patients, word length and word form frequency of their referents and depicted action verbs that require a direct accusative object and were matched in frequencies for passive voice.
Results:
A two-way repeated measures ANOVA revealed a significant main effect of patient animacy (\(F(1, 59) = 7.05, p = .010\)) and patient position (\(F(1, 59) = 5.36, p = .024\)) on the production of passive sentences. In addition, we yielded a significant interaction between both factors regarding the number of passive sentences (\(F(1, 59) = 5.36, p = .024\)). Pictures with animate and left-positioned patients lead to a significantly higher number of passives compared to sentences with an inanimate or right-positioned patient. Thus, our experiment confirmed the assumption that animacy and position of the patient affect information structure (i.e. the choice of non-canonical sentences).

Discussion:
In conclusion, our experiment shows that visual and conceptual factors determine syntactic structures. Atypical stimuli with animate and left-positioned patients lead to a higher number of non-canonical structures compared to more typical pictures with an inanimate or right-positioned patient. Since throughout the experiment no topicalizations occurred at all, the results of our study also suggest that the animacy status and position of the patient determine syntactic function assignment rather than word order. We also measured reaction times in order to find out whether animacy and the position of the patient have an impact on sentence planning insofar that animate and/or left-positioned patients lead to longer speech onset latencies than inanimate and/or right-positioned patients due to a competition between active and passive constructions whose evaluation is currently in progress.

References


Granularity effects in event descriptions: a cross-linguistic study

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Events can be described at different levels of granularity, i.e. semantic specificity or generality, both within and across languages. Within one and the same language, different strategies may be available for the verbalisation of events. In English, the caused motion event in (1) can be described by a semantically general verb (put) or by a more specific verb (roll), which encodes manner in addition to caused motion. Similarly, the same event can be described at different levels of granularity across languages. In German, the description of putting events needs to specify details of figure-ground configuration; cf. (2). German requires the use of different verbs when a bottle is put in vertical (stellen) as opposed to a horizontal (legen) position. By contrast, this information is usually unexpressed in English (put).

(1) a. Anna put the ball into the bag.
b. Anna rolled the ball into the bag.
(2) a. Eine Frau stellt/legt eine Flasche Wein in den Kühlschrank.
b. A woman puts a bottle of wine in the fridge.

At which level of detail do people talk about events across languages? Do event descriptions differ in terms of granularity? The study reported here explores whether languages encode events systematically at a finer or coarser grain (i.e. providing more or fewer details).

Research on motion events (Talmy 1985, Slobin 1987) has shown that satellite-framed languages like German and English—which conflate motion and manner in the verb—express more detail about motion events than verb-framed languages, which conflate motion and path in the verb leaving information about manner unexpressed. According to this body of work, granularity should be dependent on language type, i.e. lexicalisation patterns. On the other hand, German makes finer distinctions than English in many domains (Plank 1984, König & Gast 2009); cf. (2a). Thus, granularity could rather be a matter of the lexical profile of an individual language (cf. Wnuk 2016).

To test these hypotheses, a large-scale experimental study was conducted following a top-down approach: Ten semantic domains (PUT/TAKE, DRESS/UNDRESS, MOTION, AQUA MOTION, EAT/DRINK, CUT/BREAK, HIT/KICK, OPEN/CLOSE, WASH, LOCATION/POSTURE) were investigated in four languages: German/English (satellite-framed) and Greek/Turkish (verb-framed). For each semantic domain, a series of video clips that depict an agent performing an action was shown to native speakers who were asked to provide spontaneous descriptions of the event. The verb used in the responses is the unit of analysis.

Preliminary results show that in an individual language events are described similarly across semantic domains. German and English speakers encode more details than Greek and Turkish speakers, who prefer rather general verbs.

The results have implications for the relation between language, cognition, and perception. Do German and English speakers perceive more details of events than Greek and Turkish speakers? As a supplement to the main study, details of the event (e.g. argument realisation, properties of the agent or patient etc.) encoded in participants’ responses are compared. This information is used to generate hypotheses that can be tested with psycholinguistic methods.
References


Differences in the production of path terms in highly verbal individuals with autism and typically developing controls

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Descriptions of motion events involve the use of path terms: bounded TO, bounded FROM or VIA (Jackendoff, 1983). Interestingly, studies point to differences in the linguistic representations of different types of paths, both in typical (Papafragou, 2010; Lakusta & Landau, 2012) and atypical development (Landau & Zukowski, 2003). To investigate the production of those terms in Autism Spectrum Disorder (ASD), a developmental disorder characterized by difficulties with social interaction and communication, as well as repetitive and stereotyped patterns of behavior (APA, 2013) that is often accompanied by language delay or impairment, we have adapted a Spatial Naming Test, developed at the University of East Anglia (Markostamou, Coventry, Fox, & McInnes, 2015). The test, an analogue to the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 2001), consists of 30 pictures with simple geometrical shapes and measures the proficiency of the production of locative/relational (e.g. over, in, among) and directional/path prepositions (e.g. towards, downwards, onto). Twenty-five highly verbal individuals with autism (age range 9-27) and 25 age and IQ-matched controls participated in the study. The participants’ task was to name as accurately as possible the red ball’s position or its direction of movement in relation to the black cube abstracting away from distractor items in the scene (e.g. black ball(s)). While there were no differences in naming static position of the ball in relation to the square (e.g. “The ball is in the cube”), we have observed a significant difference in the descriptions of motion events (e.g. “The ball is moving away from the cube”) between the groups. We have investigated further those differences by looking separately at goal (bounded TO), source (bounded FROM) and via paths and observed significant group differences only in the production of source paths. Highly verbal individuals with autism produced more frequently 1) simple directional terms (down instead of down off) or simplified instead of complete prepositional phrases (from instead away from) and 2) descriptions that violate semantic constrains of the ground figure (from instead of out of), compared to typically developing controls. This pattern of more frequent errors in the context where the figure object moves FROM the ground object, but not TO or VIA, partly resembles the selective fragility observed in Williams syndrome (see Landau & Zukowski, 2003). In the current presentation, we suggest possible explanations of these differences with regard to both linguistic coding and nonlinguistic representation of paths, and we open for a discussion about other explanations of the results.
References


Incremental processing of culmination inferences: a cross-linguistic comparison

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Accomplishment predicates, such as ‘color a star’, describe events that have both duration and a culminating point (Vendler, 1967). When combined with perfective aspect they entail completion (Mike has colored the star \(\rightarrow\) the star is completely colored). Using behavioural and reading methods, previous studies show that culmination inferences are time costly (Pickering et al. 2006; Piñango et al. 1999; Todorova et al. 2000). More recently, Foppolo et al. (2016) tested the culmination inference by recording Italian participants’ eye-movements in a context with target and competitor pictures, where one picture showed the result state of a completed event and the other showed the same event in progress, contrasting these with early and late control sentences. Employing the same visual world paradigm we extended this research to a cross-linguistic investigation of Dutch, Russian and Spanish, which differ as to how perfectivity is realized (Table 1). Our goal was to investigate how different ways of perfective marking affect the incremental processing of accomplishments. By comparing Dutch and Spanish we aimed at testing whether auxiliary alone triggers an inference of completion, and whether the type of auxiliary affects this process; by comparing Dutch and Russian we wanted to test how perfective prefixes (on main verb or on the past participle,) are used as cues to completion. Figure 1 visualizes the results and Table 2 summarizes the relevant pairwise comparisons.

In all three languages, the cues for perfective aspect were effective in triggering the completion entailment during processing. In line with Foppolo et al.’s results, perfective morphology is indeed exploited during incremental processing to trigger the inference of completion, as shown by the significant advantage of the critical condition w.r.t. Late controls, that emerged earlier in Dutch and Russian than Spanish. Nonetheless, the incremental derivation happened at equally “late” stages, as shown by the significant advantage of the Early condition w.r.t. Critical, showing that auxiliary alone does not trigger this inference quickly (in Dutch and Spanish) and neither does the perfective prefix in Russian.

Table 1. Cross-linguistic variation in aspectual marking for ‘Tell me where Sara has colored the star’

<table>
<thead>
<tr>
<th>Language</th>
<th>Test sentence</th>
<th>AUX</th>
<th>PERFECTIVE marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italian</td>
<td>… ha colorato la stella</td>
<td>Ambiguous (Aux or main V)</td>
<td>suffix on participle</td>
</tr>
<tr>
<td>Dutch</td>
<td>… heeft de ster gekleurd</td>
<td>Ambiguous (Aux or main V)</td>
<td>prefix on participle</td>
</tr>
<tr>
<td>Russian</td>
<td>… zakrasila zvezdu</td>
<td>NO aux</td>
<td>prefix on main verb</td>
</tr>
<tr>
<td>Spanish</td>
<td>… ha coloreado la Estrella</td>
<td>Unambiguous</td>
<td>suffix on participle</td>
</tr>
</tbody>
</table>

Figure 1. Time course of fixations to completed (target) vs. incomplete action (competitor) in three languages (from the left: Dutch, Russian, Spanish) across conditions: Perfective=blue; Early = Red; Late = Green.

Table 2. Pairwise comparisons across conditions and languages

<table>
<thead>
<tr>
<th></th>
<th>Dutch</th>
<th></th>
<th>Russian</th>
<th></th>
<th>Spanish</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t</td>
<td>df</td>
<td>p</td>
<td>t</td>
<td>df</td>
<td>p</td>
</tr>
<tr>
<td>Critical – Late Control</td>
<td>2,574</td>
<td>22</td>
<td>.017</td>
<td>-3,090</td>
<td>24</td>
<td>.005</td>
</tr>
<tr>
<td>Late Control – Early Control</td>
<td>-6,638</td>
<td>22</td>
<td>.000</td>
<td>6,680</td>
<td>24</td>
<td>.000</td>
</tr>
<tr>
<td>Critical – Early Control</td>
<td>-5,318</td>
<td>22</td>
<td>.000</td>
<td>3,099</td>
<td>24</td>
<td>.005</td>
</tr>
</tbody>
</table>
When you eat from the cake, is it all gone? Structuring events using morphosyntax as a cue

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Recent studies show children can use the accusative and nominative case to incrementally construct a plausible event structure.1,2 However, this might be because these cues are reliable and early-acquired. Also, these tasks require decoding who-does-what-to-whom, which is arguably more straightforward than focusing on certain properties of event participants. This study investigates whether children use a fairly ambiguous morpheme (with multiple functions) to interpret the quantificational properties of an affected event participant.

Morphosyntax might provide children with an access to the meaning of quantity expressions.3,4,5,6 English children use partitivity frame (X of cars) to deduce X denotes quantity.3 However, English marks partitivity via a separate preposition (two of them, eat up/from it), which might ease interpretation. What happens when the partitivity is encoded via a nominal morpheme? Finnish children, for instance, cannot use the partitive-accusative distinction as a cue to aspevtual properties of events until age six.8, c.f., 9,10,11 We focus on partitivity marker in Turkish, which is similar to Finnish.

Case marking on the object of consumption verbs in Turkish can encode partitivity (i.e., whether the object is fully or partly consumed; eat up/from the cake). One could mark the larger portion in the ablative case (kek-ten/cake-Abl) and have the extracted portion in the bare form (biraz/some)(1a). Importantly, the extracted portion -revealing the exact quantity-can be dropped; hence, the only remaining cue to partitivity would be the ablative (1b). Accusative, instead, indicates the object is fully consumed (2). We investigate whether 4-year-old children can use the contrast between accusative and ablative to interpret the part-whole denotation without (Study-1) and with (Study-2) a supportive context priming part-whole relations.

Study-1 presented children (N=11;MeanAge=4:07) with two animation-videos showing two girls consuming a mass entity (cake), where one of them finishes up the entity while the other consumes some of it. Following this, children saw two pictures portraying the final-state of the events (empty dish/dish with half-consumed-cake), accompanied by a spoken utterance in the ablative (3a) versus accusative condition (3b). Children selected the correct picture depicting the utterance. In Study-2, to test whether priming the quantity-denoting nature of the event would improve the performance, this target task was preceded by a quantifier-comprehension test.12 Children (N=12;MeanAge=4:05) saw pictures depicting boxes containing some vs. all of some objects and judged the truth-value of utterances (4). No morphosyntax/word was shared across two studies. A-generalized-estimating-equations model showed significant effect of priming $[\beta=-1.23;SE=.3051;p<.0001]$ and case $[\beta=-.77;SE=.3104;p=.013]$, and the interaction of both $[\beta=.986;SE=.3803;p=.01]$. Priming enhanced interpretation in ablative $[X^2(1,N=138)=6.181,p=.013]$, but not in accusative condition $[X^2(1,N=138)=1.185,p=.276]$(Figure).

Children assigned a whole interpretation to utterances regardless of the case in Study-1 but the interpretation improved in Study-2 when quantity-denoting aspect of the event was primed. This suggests children have a default focus on what-happens when perceiving events; and they begin to realize the aspectual or quantificational properties of events when the hypothesis-space is constrained by a supportive context (c.f., tendency treating quantifiers as generic statements13). We now test a larger participant/age group with a similar task further comparing mass vs. count nouns.
Sentences

(1)

   A. cake-Abl some ate
   ‘Ali ate some of the cake’

   A. cake-Abl ate
   ‘Ali ate from the cake.’

(2)

Ali kek-i yedi.
A. cake-Acc ate
‘Ali ate (up) the cake.’

(3)

a. Hangi abla kek-ten yedi?
   which girl cake-Abl ate
   ‘Which girl ate from the cake?’

b. Hangi abla kek-i yedi?
   which girl cake-Acc ate
   ‘Which girl ate up the cake?’

(4)

a. Elma-lar-in hep-si kutu-da mı?
   apple-Pl-Gen all-Poss.3sg box-Dat quest-particle
   ‘Are all of the apples in the box?’

b. Elma-lar-in bazı-lar-i kutu-da mı?
   apple-Pl-Gen some-Poss.3sg box-Dat quest-particle
   ‘Are some of the apples in the box?’

References


Figure

[Graph showing Part and Whole Preference Proportions for two studies, with bars indicating percentages for Accusative and Ablative cases.]

Part = Whole
Grammatical aspect and motion event endpoints in Dutch and Chinese
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Recently, researchers have shown how grammatical aspect may affect how people conceptualize and memorize motion events (e.g., Athanasopoulos & Bylund 2013; von Stutterheim et al., 2012): Speakers of languages with grammaticalized markers of progressive aspect tend to focus on the “ongoingness” of an event, thereby defocusing the “end state” of the event, while speakers of languages that lack progressive aspect take a holistic view of an event, with a higher likelihood of including the event’s boundary (motion event goals or endpoints).

The current study examined whether Dutch speakers and Chinese speakers encode motion events differently in terms of their different aspectual systems. As was shown in von Stutterheim, Carroll, & Klein (2009), and Van Beek, Flecken, & Starren (2013), Dutch speakers seldom use the progressive construction “aan het” to describe events such as “a person walking toward somewhere” (endpoint-oriented motion). In Chinese, however, the progressive maker “-zai” is both semantically and grammatically correct in expressing the “on-goingness” of endpoint-oriented events. Thus, it was hypothesized that Dutch speakers would encode endpoint-oriented motion events (with potential endpoints in the distance, which are not actually reached by an entity in motion) with verbal references to these endpoints more often than Chinese speakers. At the same time, they should have superior memory of potential endpoints compared to Chinese speakers since verbal descriptions also enhance memory.

The experiment consisted of a verbal description task followed by a surprise memory task and was conducted in the Behavioral Lab at Erasmus University Rotterdam. Motion event stimuli from von Stutterheim et al. (2012) & Flecken et al. (2014) were used. 30 Dutch and 31 Chinese individuals participated in the experiment either for course credit or payment.

Contrary to the prediction, Dutch and Chinese speakers were quite similar in mentioning the potential endpoints of goal-oriented motion events, with a slightly higher percentage for Dutch speakers (44.2%) than for Chinese speakers (43.53%). In the recall task, Dutch speakers were slightly more accurate, but not significantly so, than Chinese speakers with a d’ score of 2.10 for Dutch speakers and that of 2.08 for Chinese speakers. Possible explanations are that although the progressive marker “zai” in Chinese is acceptable in goal-oriented event descriptions, only about 31% of the Chinese participants used it in their verbal descriptions. 5% of the Dutch speakers used the “aan het” construction in their verbal descriptions. This difference in the use of aspect between Chinese and Dutch languages is not substantial enough to create great divergence in the two groups’ cognitive processing of the motion events. Predictions made on the basis of a dichotomy of aspect-languages and non-aspect languages may be problematic: More fine-grained language comparisons will provide a better understanding of the extent to which linguistic categories can affect humans’ conceptualization of the world.
References


The role of L1 and event type in processing aspectual mismatches in L2
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Aspect (different ways of viewing a situation, e.g., the completed action of 'entered' in The polar bear entered the igloo vs. the ongoing The polar bear was entering the igloo) is notoriously difficult for language learners to acquire, and the extent to which a learner's first language influences their ability to learn such grammatical contrasts is not fully clear (Roberts & Liszka, 2013). This study explores what the neurophysiological activity of the brain can tell us about how L2 users and native speakers understand such aspectual differences online and offline, by investigating how they process matching vs. mismatching aspectual cues during sentence comprehension. Of particular interest was the potential influence of the learners' L1s, and to this end we compared proficiency-matched advanced users of English (N=20 per group) with L1 Russian (grammaticalised aspect), and L1 German (no grammatical aspect). A group of 20 English native controls also took part.

In the first task, EEG recordings were taken while participants read sentence pairs involving two event types (80 activities and 80 accomplishments), with one lexical and one grammatical aspect marker per sentence (examples below). Critical sentences contained matching (a, c) or mismatching (b, d) aspect markers. In the second task, each participant provided acceptability judgments of the same sentences in an offline condition (on a 5-point scale). Differences were expected between the two event types in the online condition, with participants from L1-aspect languages showing greater sensitivity for mismatches in activities than in accomplishments (Yap et al., 2009).

Despite both learner groups performing in the same way as the native speakers in the offline judgment task, there was an L1 influence in evidence in the online data. Sentences with mismatched aspectual operators elicited a significantly more robust N400 over the central electrodes in the Russian group. A match-mismatch effect, restricted to activity-type events, was also observed in the English group, but not in the German group. The different pattern of results observed for the off- vs. online tasks suggests that important crosslinguistic differences arise in how rapidly L2 learners activate knowledge about aspectual information. They bring novel support for the view that online processing in the L2 varies as a function of crosslinguistic structural similarity (Alemán Bañón et al., 2014), which also extends to grammatical aspect marking.

Example stimuli
a) ACCOM_MATCH: David was emptying the aquarium for ages without any help.
b) ACCOM_MISMATCH: David was emptying the aquarium instantly without any help.
c) ACTIV_MATCH: Charlotte was singing popular songs the whole time in the shower.
d) ACTIV_MISMATCH: Charlotte was singing popular songs suddenly in the shower.
References


Investigating how anticipation of object states drives event comprehension

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Altmann & Kamide (1999, henceforth A&K) presented participants with e.g. “The boy will eat the cake” while depicting a boy, a cake, and distractors. At eat, participants looked at the cake, suggesting they anticipated the object that afforded the action; i.e. the anticipated object in its initial rather than final state. More recently, Kang (2015) presented participants with e.g. “The woman will drop the ice-cream”, while depicting the initial and end states of the ice-cream (an upright ice-cream cone and a dropped ice-cream cone). When hearing drop, there were more looks to the end state than the initial state. This result contradicts A&K. Here, we explore (i) whether people do in fact anticipate objects’ end states more than their initial states, (ii) why they might do so, and (iii) how this can be reconciled with A&K.

In Experiment 1, participants heard e.g. “The pedestrian will open/close the umbrella”, while viewing both object states (an open and a closed umbrella) and two distractors. Similar to Kang (2015), participants looked significantly more at the verb to the end state than the initial state. In Experiment 2 we used non-reversible creation verbs, as in “The woman will knit the sweater” (a ball of yarn depicted the initial state, and a sweater the end state). There were again more looks to the end state than to the initial state. In both experiments, there were also more looks to the initial state than to the distractors. We propose that, as in action planning (e.g. Hommel, 2009), the intended end state (the goal state) is more salient than the initial state, although this initial state is still relevant – it is a means to the end.

How do we reconcile preferential looks to the end state in our two experiments with A&K’s looks to the initial state? Altmann & Kamide (2007; A&K07) depicted both an initial state (an entire cake) and an end state (an empty plate). Their data patterned similarly to A&K (in contrast to our results). We argue that verbs like “eat” are verbs of destruction – the end states they entail are not readily visualized (ingested cake), and the actual “end states” depicted in our study (which replicated A&K07) were not in fact states of the cake (or its equivalent), but rather were “correlated states” – an empty plate results from something having been eaten, but it is not the goal state (the goal is to have ingested the cake). Though initial and end states take part in actions, with end states being more salient, correlated states are neither a part of the primary goal (the ingested state, the opened umbrella, the completed sweater) nor a part of any subgoal.

We conclude that anticipatory eye movements during sentence processing reflect anticipated states of the world with goal states more salient than initial states followed by correlated states. This is similar to action planning which encodes the initial and goal states. Sentence comprehension and action planning share common goals – anticipating how the world will be.
References


Participant assignment to thematic roles in Tzeltal: Eye tracking evidence from sentence comprehension in a verb-initial language

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Studies using eye-movements to investigate predictive processing (i.e. anticipation of upcoming words) during sentence comprehension have mostly focused on subject-initial languages [1,2] and have found that thematic role knowledge is used to restrict the set of possible interpretations quickly [3-5]. In subject-initial languages, participant assignment to thematic roles might be difficult to assess because one argument is always available from the outset (often the Agent) but usually needs the verb to be interpreted semantically. Therefore, it is not clear what type of information comprehenders actually use to anticipate upcoming event participants in these languages. Verb-initial languages provide the opportunity to investigate the early interpretation of events and the type of information that drives anticipatory processing.

In a visual world eye tracking experiment on Tzeltal (Mayan), we investigated how information provided by verbs is used to predict thematic role assignments. Basic word order in Tzeltal is Verb-Patient-Agent (actives) or Verb(-ot)-Agent-Patient (passives). Thus, the verb is always encountered first, making argument structure and syntactic information available at the outset (in contrast to subject-initial languages). By hypothesis, this should facilitate anticipation of the post-verbal content of an utterance. Thus, Tzeltal allows us to test whether anticipatory eye movements to agents and patients are driven by 1) verbal semantics, 2) voice marking and word order (active: VPA or passive: VAP), or 3) if listeners follow a (potentially universal) Agent preference [6-7].

Ninety-two Tzeltal speakers listened to verb-initial sentences as in (1) while seeing a visual display showing two potential referents (e.g., doctor, patient) and two distractors (e.g., swimmer, violinist). We manipulated verb type (predictive: verb has typical agents/patients, e.g. “cure”; non-predictive: verb does not select typical agents/patients, e.g. “address”) and voice marking (active vs. passive).

(1)

a. La yusubtes / La sk’opon woje chamel te jpoxtawaneje.
Cured / addressed yesterday patient (P) the doctor (A)
‘The doctor cured (predictive) / addressed (non-predictive) the patient yesterday.’

b. Utsubtes-ot / K’opon-ot woje yu’un poxtawane te jchamele.
Was cured / Was addressed yesterday by doctor (A) the patient (P)
‘The patient was cured (predictive) / was addressed (non-predictive) by the doctor yesterday.’

We found differences in anticipatory processing in active and passive sentences. After having heard a sentence-initial passive-voice verb, listeners quickly integrated semantic and syntactic information to fixate on the agent and turned their gaze towards the patient before it was mentioned. After hearing active verbs, participants’ looks to the sentence-final agent were modulated by information from both verb and patient. However, there was no difference in fixations to agents or patients with predictive and non-predictive verbs.

In sum, we suggest that 1) verbal semantics alone is not sufficient to guide visual attention towards referents in Tzeltal (predictive verbs did facilitate anticipatory looks), 2) voice marking drives anticipatory processing towards agent and patient referents (in passive sentences), and 3) there is no evidence for a preference towards early agent fixations, challenging the universal salience of agents in sentence comprehension [7].
References


Does the result justify the means? Verbal and non-verbal memory of resultative events in Mandarin, Dutch and Spanish speakers

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Languages differ as to how they verbally encode resultative events (i.e. events in which actions are directed towards the achievement of a result, e.g. “burn the paper”): While Mandarin has resultative verb compounds (RVCs), encoding both manner and result of action in a verbal compound (e.g., shao-hui can be glossed as burn-destroy, Chen 2016), and Dutch can highlight event results with verbal prefixes and particles (e.g., ver-branden can be glossed as burn away, van Hout 1996), Spanish has a wealth of telic verbs, specifying the result of actions (Slobin, 1996; Talmy, 2000). In fact, Spanish main verbs encode either manner of action or result of an event (e.g., quemó / destruyo are translated as burned / destroyed, García del Real, 2015) and it has been shown that Spanish is less manner-oriented compared to languages like Mandarin and Dutch (Slobin, 1996; 2006).

We compared how Mandarin, Dutch and Spanish native speakers memorized event results in both a verbal (event description) and a nonverbal experiment. We investigated to what extent habituation to the use of different verbal structures influences the representation of resultative events in memory. Our hypothesis was that, resultative constructions in Mandarin and Dutch would be used to mark the results of events when required, leading to a memory boost in the verbal experiment; however, Spanish participants’ strong habituation to encode resultativity will influence their memory in the verbal and non-verbal experiments.

Participants saw 24 event-videos: Resultative events progressing towards a clear result, and non-resultative events (N=12 each). Events were shown as either ceased (action came to an end) or ongoing (action still in progress at video offset). In the Verbal experiment, participants (Mandarin n=21; Dutch n=24; Spanish n=22) described the events. In the Nonverbal experiment participants (Mandarin n=21; Dutch n=24; Spanish n=20) detected event repetitions (a screenshot appeared; participants indicated whether the image matched the preceding video). In a subsequent surprise recall task, participants were shown screenshots of the videos’ final frames, depicting events either as ceased or ongoing, and they had to judge, by pressing a button, whether the screenshots showed the actual ending of the videos watched previously.

Verbally, Mandarin speakers differentiated between conditions using RVCs to describe ceased resultative events (60%), whereas Spanish and Dutch speakers used telic verbs for all resultative events. Recall accuracy is shown in Table 1: Overt verbalization of results with RVCs boosted memory of resultative event endings in Mandarin speakers, supporting the thinking for speaking hypothesis (Slobin, 1996). Similarly, Dutch speakers showed better performance in the verbal than the non-verbal experiment. In contrast, Spanish participants outperformed the other groups at recalling ceased resultative events in the nonverbal experiment, with no difference from the verbal condition.

We interpret these findings as a pervasive effect of the stronger orientation towards event results in Spanish. Differently form Mandarin and Dutch speakers, Spanish speakers are more focused on this event dimension, regardless of whether language is used to describe events or not.
References


Table 1 Recall accuracy (%) of resultative events in the memory task of experiment 1 and 2

<table>
<thead>
<tr>
<th>Condition per language group</th>
<th>Verbal experiment</th>
<th>Non-verbal experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceased resultative (Mandarin)</td>
<td>76.2%</td>
<td>60.3%</td>
</tr>
<tr>
<td>Ongoing resultative (Mandarin)</td>
<td>47.6%</td>
<td>50.8%</td>
</tr>
<tr>
<td>Ceased resultative (Dutch)</td>
<td>79.9%</td>
<td>62.5%</td>
</tr>
<tr>
<td>Ongoing resultative (Dutch)</td>
<td>59.7%</td>
<td>65.3%</td>
</tr>
<tr>
<td>Ceased resultative (Spanish)</td>
<td>79.5%</td>
<td>72.5%</td>
</tr>
<tr>
<td>Ongoing resultative (Spanish)</td>
<td>58.3%</td>
<td>47.5%</td>
</tr>
</tbody>
</table>
Establishing a bio-marker of object-state competition

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Altmann and colleagues have postulated the need to represent not simply types (e.g. onions as a kind of vegetable) and tokens (a specific onion grounded in space and time) but also token-states (e.g. the onion peeled or chopped). fMRI studies [1,2] have demonstrated during comprehension of action sentences such as “The chef will chop the onion. Then, she will weigh the onion” that the different states of the onion (intact/chopped) are simultaneously active. Maintaining representations of the same token in its different states results in a more “costly” retrieval of the relevant state when the token is referred to again, as upon reading the onion in the second sentence [1]. Such cost has been indexed by increased activation in brain areas (VLPFC), recruited during Stroop interference, that are traditionally associated with conflict resolution. This conflict is not found in sentences describing minimal or no change, such as The chef will smell the onion. Then, she will weigh the onion. Moreover, introducing a new token instead of referring back to the same token, as in “The chef will chop the onion. Then, she will weigh another onion” [2] eliminates the need to resolve the competition and doesn’t cause increased activation in VLPFC.

We ask (i) how do these effects manifest in EEG? And (ii), do these effects differ from known effects due to lexical and referential ambiguity?

High-density EEG was acquired while participants (n=26) read sentences presented to them one word at a time. Each participant saw 320 sentences, 40 in each of the following conditions:

1. Token state change
   a. Minimal change, same object token: The chef will smell the onion. Then, she will weigh the onion.
   b. Substantial change, same object token: The chef will chop the onion. Then, she will weigh the onion.
   c. Minimal change, another object token: The chef will smell the onion. Then, she will weigh another onion.
   d. Substantial change, another object token: The chef will chop the onion. Then, she will weigh another onion.

2. Lexically ambiguous words in context
   a. Lexically ambiguous: The zookeeper will play with the dolphin. And then he will feed the seal.
   b. Lexically unambiguous: The zookeeper will play with the dolphin. And then he will feed the turtle.

3. Referential ambiguity in lexically biased contexts
   a. Referentially ambiguous: Katrina attracted Melanie because she had a great voice.
   b. Referentially unambiguous: Katrina attracted Parker because she had a great voice.

A time-frequency analysis of EEG power, time-locked to the final noun in (1) and (2) and the critical pronoun (3) revealed a significant increase in alpha power (8-12 Hz) only in the 1a-1b contrast in response to words referring back to a token that had undergone substantial change (i.e. 1b) – an effect we believe might be an EEG marker for conflict due to multiple object-states. This finding is consistent with literature relating alpha oscillations to cortical inhibitory processing which fits the hypothesis advanced by [1]: selecting the relevant token state requires inhibition of the irrelevant one.
References


Event novelty and task demands shape adults’ attention to unfolding activity
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Human activity generates dynamic, multi-modal sensory streams. Effectively processing this complex flow of information on-the-fly is essential to remember and respond to others’ actions, anticipate what they might do next, and learn how to perform new actions. Adult observers rise to the challenge, rapidly redescribing the dynamic, multi-modal information as event sequences unfold. Selectively attending to information-rich regions with dynamically unfolding sensory streams seems key to successful redescription (e.g., Newtonson, 1973; Kurby & Zacks, 2008; Hard, Recchia, & Tversky, 2011). However, what counts as information-rich likely depends on numerous factors including event novelty, local opportunity for repeated viewing, and processing goals of the observer.

When events are familiar, observers increase attention to transitions, or boundaries, between units of unfolding activity (e.g., in a drinking event, the transition between grasping a mug and raising the mug to one’s lips is an event boundary). We hypothesize that such event boundaries represent regions of information-rich “predictable unpredictability.” That is, if an action is familiar, one can anticipate moments within the action stream at which predictability drops (i.e., at event boundaries) and increase attention to resolve this unpredictability. Thus, selectively attending to “predictably unpredictable” moments conceivably facilitates event processing.

On this account, event novelty should impact patterns of attention as processing proceeds. Viewers can anticipate and target regions of “predictable unpredictability” only if the event is familiar enough that such regions can be identified. Thus, as familiarity with a novel event grows, attention should reorganize to increasingly display enhancement at event boundaries. Our first study tested this hypothesis: viewers’ dwell times were measured as they advanced through a slide show depicting a highly novel activity sequence – a strikingly novel method of shoelace tying. Findings revealed that reorganization to structure within the activity stream was very rapid: after just one passive viewing of the distinctively novel content, viewers selectively directed attention to boundaries that they apparently failed to identify on their first viewing.

A second study queried whether reorganization patterns differ depending on the task demands guiding viewers’ action processing. Prior to advancing through a slide show of the novel shoelace tying method, one group was instructed that they would later be asked to enact the novel activity while the other was merely asked to remember the novel activity. As predicted, across both groups observers displayed enhanced attention to event boundaries across repeated viewings. Especially striking, however, was the effect of instructions, depicted in Figure 1. Across viewings, participants given an “enactment” instruction selectively attended to regions of the slideshow depicting content uniquely distinctive to the novel method (i.e., “distinctive” regions). Simply being asked to remember the activity failed to elicit comparable targeting of distinctive regions. Taken together, these findings provide altogether new information regarding how viewers’ action processing 1) rapidly reorganizes around novel activity, and 2) responds to the processing task at hand.
Figure 1. Effects of slideshow region across viewing and processing task. Purple and green bars represent mean residualized log_{10} dwell time to distinctive and non-distinctive slideshow regions, respectively.

References

**Functional connectivity underlying the processing of object-state change**

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Language comprehension often involves tracking an object that undergoes a change in state across time: to fully understand the event “he chopped the onion” one needs to know the typical semantic qualities of the type “onion” and attribute episodically bound characteristics to a particular object-token (e.g. this particular onion is now in a chopped state). Recent work\(^1,2\) has shown that when language later refers to objects that have previously undergone substantial changes in state (e.g. “chop the onion”), portions of the left ventrolateral prefrontal cortex (VLPFC; an area generally implicated in cognitive control\(^3\)) show greater activation compared to later reference to minimally changed objects (e.g. “weigh the onion”). This increased activation for reference to substantially changed objects seems to be token specific, as later reference to a different token of the same type shows no degree of change effect (“She chopped the onion and then smelled another onion.”). The authors suggest that this is indicative of a need to select between competing states of the same object token (does “the onion” refer to the newly chopped state or the previously intact state?), and lends crucial support for a theory of event representation in which object token-states act as representational primitives.

In order to more fully examine the relationship between the cognitive control, long-term, and short-term memory systems underlying event processing in this framework, we have begun to examine functional neural connectivity during reading in an ongoing reanalysis of fMRI experiments\(^1,2\) that manipulated both the degree of state change that the critical objects underwent and whether reference was made to previous vs novel tokens (“She will \textbf{weigh/chop} the onion and then she will smell \textbf{the onion/another onion}.”). One primary focus of these analyses is centered on the relationship between cognitive control regions and individual subsegments of the hippocampus, a region implicated in episodic memory function\(^4\) which is not typically a focus in work on language processing.

Our preliminary analyses show increased connectivity between left pars triangularis (in VLPFC) and left hippocampal body for sentences referring to novel tokens compared to those referring to the same, but substantially changed, object (“chop the onion... smell \textbf{the onion/another onion}”). No difference in connectivity between these regions is observed in a comparison between sentences referring to novel tokens vs the same token when the objects have only minimally been changed however (“\textbf{weigh} the onion... smell the onion/another onion”). We take our findings to be suggestive of cognitive control regions playing a role in modulating the features being attributed to objects in hippocampal, episodic memory systems during reference in event processing.

Further connectivity differences and an analysis of an additional data set which includes a shift in attentional focus to a different object state without invoking any new token (“She will chop the onion \textbf{but first/and then} she will smell the onion.”) will also be included.
References


Behind the scenes of word-learning: objects’ attributes and functions as cues for generalisation

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Language processing relies on the mechanisms of classification, pattern extraction and memorisation, which are not unique to language [1]. In addition, the correct interpretation of situations/events across all information domains, including language, involves processing a lot of noisy data with irregular and often conflicting patterns. Thus, one of the key tasks underlying first language acquisition includes identifying reliable cues useful for categorisation of the input information. For early word-learning, this means that children need to extract meaningful features/attributes of objects and to construct generalised concepts, such as a ‘dog’, ‘table’, etc. Importantly, in the presence of linguistic labels this generalisation process is facilitated in children as young as 12–18 months of age [2, 3]. However, little is known about which attributes of the visual scene serve as more reliable cues for this generalisation of meanings. Specifically, despite the prevalent opinion that nouns are typically mastered before verbs [4, 5], the underlying reasons for this are not clearly understood. One possibility is that it is a specific type of visual cue that is considered more reliable and meaningful at this early stage. For example, the label can be associated with visual attributes of an object (e.g., its shape, colour etc.) or, alternatively, with its functional features (e.g., a type of action it performs). Relying on the former would explain the earlier mastery of nouns in young children. However, if at this stage children are already capable of generalising the idea of an action, this would suggest that their skills in learning the concepts underlying verbs are much more advanced that has been previously assumed.

The main objective of this study is therefore to explore whether the concept of a novel action (i.e., prototype of a verb) could be learned and generalised to similar typical situations at an early age, and also whether children’s strategies change as they grow older. Also, this project explores which cues—the object’s attributes or its actions—are more reliable for interpreting the visual scene when the speaker is given both types of patterns. These questions are addressed using eye-tracking experiments with nonce words as labels of novel object–action pairs tested in two groups of children and a group of adult controls— for establishing developmental trajectories of the speakers’ pattern extraction abilities.
References
Chasing brain activity in second language users through perceptual learning

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Recent research shows that brain activity during event perception can be influenced in language-specific ways (Flecken et al., 2015). This leads to the question of learnability, i.e. whether a new linguistic system can comparably affect perceptual processes of second language (L2) users and native speakers. The proposed project addresses this point through a systematic manipulation of linguistic activity in a perceptual learning context (Kersten, 2010). The aim is to measure how much behavioural and neural responses of learners change when their L1 and L2 highlight different perceptual features. Chinese learners of English will form the participant base. The key cross-linguistic contrast is that, in achievement-type events, Chinese is more-oriented”resulta)The (train arrived at platform one; and English more ‘action-oriented’b)The (train is arriving at platform one. This is attributable to grammatical differences (constructions such as (b) are highly infelicitous in Chinese (Xiao & McEnery, 2004)). If linguistic contrasts lead to speakers of various languages perceiving events differently, then a perceptual learning approach presents a fruitful way to show how strong a boost a new language provides to a new kind of perception.

RQ1: How strongly do Chinese and English aspect contrasts affect perceptual processing?

RQ2: What is the extent of overlap between learners’ behavioural and neurophysiological responses?

RQ3: When the learner’s brain is trained to process achievement-type events in specific ways, do shifts in focus on perceptual cues change as a function of target language involvement?

A visual oddball paradigm will be used. First, 20 native speakers of English and 20 Chinese advanced learners of English will complete a picture-animation matching task. The stimuli are short achievement-like animations: a black circle contacts a white square in 12 different ways (e.g. bounce off, break, split). The animations will serve as a primes, each will be followed by a picture showing the same or a partially/fully modified event. The task will be to pay attention to the event phase in the animation (1000ms) and then verify its match with a picture (600ms). There will be four prime-target combinations (inspired by Flecken et al., 2015): (a) full match (same phase) (b) full mismatch (no object contact), (c) source-phase biased partial mismatch, (d) target-phase biased partial mismatch. The P3 component (reflecting visual stimulus evaluation) will be extracted for analyses. Predictions: English natives will exhibit a larger P3 in Condition C than in Condition D as a result of increased attention to source phases in this event type. For C vs. D, L2 users will show similar P3 amplitudes.

Second, 80 advanced Chinese learners of English will be tested under four different types of training. Participants will be randomly assigned to 3 experimental groups and a control group. Group 1 will receive training in English-like matching, Group 2 in Chinese-like matching, Group 3 in matching with explicit verbal cues in English and the control group will perform the matching task combined with a verbal distractor. Predictions: accuracy will progressively improve in conditions without verbal interference. If the engagement of language amplifies the key perceptual dimension (English habitually draws attention to the distinction between ongoing vs. completed phases of achievement-type events), matching with added verbal labels is predicted to improve the learning rate as well as to modulate initial neural sensitivity most.

![Animation Diagram]
References


Specificity at the basic level in events: The case of Maniq verbs of ingestion

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It is well-documented that basic-level concepts vary across cultures. For instance, while for some Western urban dwellers, ‘tree’ is a basic-level label, for communities with greater botanical experience, more specific categories, e.g. ‘pine’ or ‘elm’, are basic. Research in this area so far has centered on objects, but other ontological categories have the potential to shed new light on this aspect of categorization. The present study explores the basic level in events, focusing on the field of ingestion. I examine basic-level ingestion verbs in Maniq—an Austroasiatic language spoken by mobile hunter-gatherers in Thailand—illustrating a highly specific categorization of ingestion events. For example, events referred to with a single English verb eat are expressed with multiple monomorphemic verbs covering more specific event concepts, e.g. hāw ‘to eat mainly by chewing, as of e.g. rice, non-fibrous yams, some types of vegetables and fruit’, lik ‘to eat with little biting or chewing, as of e.g. soft fruit’, hop ‘to consume nutritious/savory liquids’. Crucially, these verbs are default descriptors applicable at a basic level of contrast. By that, they differ from the specific manner-of-eating verbs in English such as devour, gobble, peck, etc., which are not default, but are typically used when the manner constitutes a salient aspect of the eating event. A detailed analysis of these verbs reveals they tap into culturally salient notions. Yet, cultural salience alone cannot explain specificity of basic-level verbs, since ingestion is a domain of universal human experience. Another key factor is the language itself. Maniq’s preference for encoding specific meaning in basic-level verbs is not a peculiarity of one domain, but a recurrent characteristic of its verb lexicon, pointing to the significant role of the language system in the structure of event concepts.
Moving beyond Talmy's Typology: The Representation of Boundary-Crossing Caused Motion Events in Turkish

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Languages vary considerably in how they represent motion\textsuperscript{1} and the traversal of a spatial boundary (i.e. motion into/out of/over a bounded region) has been construed as a strong constraint that shapes both the lexicalization and the syntactic packaging of motion. When describing spontaneous motion events that involve boundary crossing, speakers of verb-framed languages (e.g. Turkish) tend to use a Path verb such as enter, exit, cross to mark the change of location, whereas speakers of satellite-framed languages (e.g. English) typically use Manner verbs coupled with path satellites such as crawl into, creep out of\textsuperscript{2,3,4}. When required to mention Manner in their descriptions, Turkish speakers utter multiple clauses (e.g. he crawls towards the carpet, and crosses it, then he crawls away), whereas speakers of English use a single clause (e.g. he crawls through the carpet)\textsuperscript{3}. These typological differences, however, have been tested only in the domain of spontaneous motion. Caused motion events involve the motion of an entity by an agent (e.g. a girl kicks a ball down the hill). It has been found that Turkish-speaking adults predominantly use single clauses when representing caused motion events that do not involve boundary crossing\textsuperscript{5}, thus displaying a non-typological pattern. These results raise the question whether the representation of caused motion events with boundary-crossing follow the typological constraints documented previously for spontaneous motion events in Turkish\textsuperscript{3}.

The current study examined the representation of boundary-crossing caused motion events in Turkish. Given that the traversal of a spatial boundary has been found to impose strong typological constraints on the representation of spontaneous motion\textsuperscript{3}, Turkish-speaking adults were expected to use multiple clauses in their descriptions of these events.

We collected elicited data from 10 Turkish-speaking adults who watched 16 videoclips depicting various caused motion events instigated by human agents that involved boundary crossing (e.g. a woman pushes a box into a building) and described them to a listener.

Overall, Turkish speakers used single-clause event descriptions more frequently than multiple-clause ones when talking about boundary-crossing caused motion events. When we focused on the encoding of events that featured a distinct causal Manner (e.g. a woman rolls a ball into a box), we found that speakers produced single-clause and multiple-clause descriptions equally frequently. Finally, all speakers used single-clauses and Manner verbs in multiple event descriptions, indicating that these patterns were not due to the idiosyncratic preferences of individual speakers.

Caused motion events, whether they involve boundary crossing or not, are encoded in Turkish in ways that are not consistent with Talmy’s typology. Our results show that languages can make use of different typological patterns depending on the type of motion event represented, and also indicate that classifying languages as satellite- and verb-framed is too limiting. Finally, although Talmy\textsuperscript{6} has described Cause and Manner as external events that either cause or modify the motion event, and claimed that they are lexicalized in identical ways within a given language, there seem to be important differences between these semantic elements that influence event representation in terms of both lexicalization and syntactic packaging.
References


First things first: cross-linguistic analyses of event apprehension
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Apprehension is the rapid process of extracting the ‘gist’ of a visual stimulus. People can retrieve information on an event’s category, structure and roles from real-world event photographs in as little as 20-400ms (Dobel et al., 2007; Hafri et al., 2013; Castelhano & Henderson, 2007). However, isolating the apprehension stage from later processing is difficult, especially when using verbal output as the only measure. The current study analyzed first fixations on briefly displayed event stimuli to shed light on apprehension.

We asked to what extent this process is guided by the task demands (nonverbal, agent/action naming, event description task) and a speaker’s language background. A previous study found that first fixation locations were influenced by stimulus exposure time (300-500-700ms), as well as by speakers’ language background but only within the shortest exposure condition (300ms) (Gerwien & Flecken, 2016). As participants only performed an event description task in this previous study, further investigation is required to validate the method.

The current study compared Dutch and Mandarin Chinese speakers, who differ in how they typically encode events: In contrast to Dutch, Mandarin a) allows topic-drop, b) does not mark gender in the pronunciation of pronouns, c) marks grammatical aspect, and d) specifies action-results by resultative verb compounds. We hypothesized that these features lead to differences in the saliency of agents and/or actions in events, which might be reflected in first fixation locations on agents or actions depicted in the stimuli, under various task demands.

Dutch and Mandarin native speakers (N=24 each) were exposed to pictures depicting causative events (i.e. agent performing action on an object) for 300ms. Pictures appeared randomly in one of the four corners of the screen, so that the location of relevant event elements was unpredictable (Figure 1). Participants performed three tasks across blocks: 1) Nonverbal task: participants responded to pictures that were repeatedly presented; 2) Agent or Action identification task (between subjects): participants named the actor (e.g., Tom) or the action (e.g., cutting paper); 3) Event description task: participants constructed a full sentence to describe what happened in the picture. Task order and photo sequence were pseudo-randomized. We examined first fixation locations by analyzing the y-coordinates of this first fixation on the screen. In addition, the specificity of participants’ verbal responses was coded.

Results showed an influence of task demands on first fixation locations: the mean y-coordinate of the first fixation in the Agent task was closest to the agents depicted in the stimuli, while the fixations in the Action task were closer to the action/object area. Between-language differences were found in the Event and Action tasks: Mandarin speakers’ fixations in these two tasks were similar, while Dutch speakers’ fixations in the Action task were closer to the action/object area and were significantly lower than those in the Event task. These findings suggest that the apprehension of an event as a whole is similar to the apprehension of an action alone for Mandarin speakers, but not for Dutch speakers. We are currently further exploring this finding.
Figure 1: Stimuli appeared randomly in 1 of the 4 corners of a screen, after participants had fixated a centered fixation cross (circles indicate Areas of Interest: Agent area and Action/object area, not visible to participants) (the fixation cross disappeared when a stimulus appeared).
The interaction of event structure and agentivity. An event-related potential study on German intransitive motion verbs

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The way we conceptualize event structure is determined by various factors, among which the verb's meaning and properties of its semantic roles play an important part. Our study focusses on the interaction between agentivity and telicity, which is intensively discussed in connection with the unaccusative hypothesis. According to this hypothesis, typical unaccusative verbs such as *grow* are telic and select a patient role, while typical unergative verbs such as *work* are atelic and agentive (Zaenen 1993, Dowty 1991, Keller & Sorace 2003). Hence, telicity and agentivity are negatively correlated in this line of research. A different picture emerges from psycholinguistic research (Rakison and Poulin-Dubois 2001, Carpenter et al. 2005, Spelke and Kinzler 2007, Carey 2009). Here, the telicity-related notion of goal-directedness characterizes agents. Thus, telicity and agentivity are positively correlated.

We present an ERP-study investigating how agentivity and event structure interact with each other and the verb's meaning. Our study examined six verbs of motion in German which are indeterminate with respect to the agentivity of the subject argument and to telicity (*fliegen* ‘fly’, *rollen* ‘roll’, *schweben* ‘float, hover’, *schlingern* ‘swerve, lurch’, *schwimmen* ‘swim’, *wirbeln* ‘swirl, whirl’). In a fully-crossed design, agentivity was manipulated via animacy, since animates with indeterminate verbs are preferably interpreted as agents (Van Valin & Wilkins 1996) and inanimates as themes. Telicity was manipulated by introducing a locative vs. goal phrase; the locative phrase leads to an atelic reading, the goal phrase to a telic interpretation (Tenny 1994). Our test-item structure is illustrated in (1):

(1)  Dass der Ballonfahrer / das Seidentuch letzten Mittwoch
    über der Wiese / in die Baumkrone geflogen ist, überraschte den Touristen.  
    That the balloonist / the silk scarf flew above the meadow / into the tree crown last Wednesday surprised the tourist.

The two lines of research mentioned above lead to opposite predictions about agent prototypicality with this type of intransitive verbs. In accordance with the unaccusative hypothesis, prototypical agents are predicted to harmonize with atelic motion and prototypical patients with telic motion. In accordance with the psycholinguistic research, prototypical agents are predicted to harmonize with telic, i.e. goal-directed, motion and prototypical patients with atelic motion. In ERP-research a non-prototypical role constellation is assumed to be indexed by the N400 (Philipp. et al. 2008, Nieuwland et al. 2013). The unaccusative hypothesis leads to the prediction of increased processing costs reflected in an N400-effect in the animate-telic and the inanimate-atelic conditions. The prediction derived from the psycholinguistic research is reversed, namely an N400-effect in the inanimate-telic and the animate-atelic conditions. We expect the clearest N400-effects at the verb lexeme, since role-prototypicality is decided here. Our results match the pattern predicted by psycholinguistic research and disagree with the prediction extracted from the unaccusative hypothesis.
References


The role of sensory and motor simulation during narrative reading: Insights from eye-tracking

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A large body of research shows the importance of event representations and event boundary perception during the understanding of narratives. For instance, it has been found that people are able to detect boundaries between the events in stories, and that these event boundaries get clearer when more features of a story change (see, for example, Speer, Zacks & Reynolds, 2007). This is not only the case at the behavioral level, but can also be seen in the brain activity of these participants. Interestingly, it was also found that the brain activity of participants reading stories changed as a result of visual and motor experiences (Speer, Reynolds, Swallow & Zacks, 2009). It has been suggested by Zacks (2010) that simulation is one mechanism for successful event representation during narrative comprehension. Here we investigate how sensory and motor simulation play a role during narrative understanding using eye-tracking methodology.

In a first step we asked a group of participants to underline motor and sensory events in three literary short stories, resulting in one motor and one sensory simulation score for each word in all three texts. This score is obtained by adding the times a word is underlined, resulting in a score ranging from 0 to the total number of participants. A different group of participants was asked to read these same short stories without an additional task, while their eye movements were being tracked. After reading the stories they completed immersion and appreciation questionnaires regarding each story individually.

This experimental set-up allowed us to investigate if the motor and sensory events as underlined by the first group of participants can predict the gaze duration of the second group when reading these stories.

After acquiring a subset of the planned sample (current N=22) we find that this may very well be the case, but there appears to be a difference between the way participants react to different types of events: Motor events speed up reading, whereas sensory events slow down reading. Follow up analyses have to point out if the influence of motor and sensory events in a story on the gaze duration follows the same pattern in all participants.

Although self-reported immersion in the stories does predict gaze duration during reading (people read faster for stories they report more immersion for), this does not depend on motor and sensory scoring. Appreciation of a story is not related to gaze duration, nor does it interact with motor or sensory scoring in predicting gaze duration.

The results of this study could shed light on the behavioral mechanisms underlying the neuronal responses to events and event boundaries, as found by Speer and colleagues (Speer, Zacks & Reynolds, 2007; Speer et al., 2009). Specifically, the results offer suggestions about the respective roles of motor and sensory simulation in narrative understanding as reflected by eye movements during reading.
References


The Influence of Iconic Linguistic Expressions on Spatial Event Cognition across Signers and Speakers: An Eye-Tracking Study

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All humans have the capacity to understand and linguistically express spatial events. However, signed and spoken languages differ radically from each other. Speakers use arbitrary linguistic forms such as pre- and postpositions and spatial nouns (‘left’, ‘on’) through which three dimensional events are categorized into different types of spatial relations. However, signers use visually motivated form-to-meaning mappings (iconicity) to describe spatial events (Emmorey, 2002). For example, to represent a pen next to paper, signers use a flat handshape to represent the paper and an index finger to represent the pen, placing both hands next to each other, matching their view of the spatial event (Figure 1). Spatial encodings in sign languages are therefore not only iconic but also analogue to the real space than the arbitrary and categorical structures used in spoken languages.

Previous research has shown that cross-linguistic variability in encoding spatial events in spoken languages might guide visual attention to events differently (e.g., Flecken et al., 2011). However, it is less explored whether the iconic linguistic forms guide signers’ attention to events differently than that of speakers. To investigate this, the present study used a visual world production eye-tracking experiment to compare visual attention of signers and speakers to left-right spatial configurations during planning of linguistic production.

We tested 20 signers and speakers from different languages (Sign Language of the Netherlands, Turkish Sign Language, Dutch, Turkish). We presented participants with displays containing four pictures with a target configuration (left/right), viewpoint-dependent configuration (behind/front) as a viewpoint competitor and topological configuration(s) as distractor (in/on/under). Participants described the target pictures indicated by an arrow.

We had two experimental conditions: Contrast condition contained both left AND right configurations, whereas No-Contrast condition contained either left OR right configurations in one display, serving as a baseline. Importantly, the difference between the Contrast and No-Contrast conditions was the presence of the contrast competitor (left/right, depending on the target) (Figure 2). The presence or absence of the contrast competitor gives insight into whether competition in eye gaze occurs between left-right configurations. We predicted that signers would be less likely than speakers to look at the contrast competitor in the Contrast condition than speakers due to the use of iconic, thus less categorical, constructions.

For the analyses, we focused on the time window between the presence of the arrow until linguistic production. Preliminary results showed that speakers paid more attention than signers to the contrast competitor versus the distractors in the Contrast condition, whereas in the No-Contrast condition eye-gaze patterns were similar across groups (Figure 3). These findings suggest that speakers’ categorical language tunes their attention to the categorical distinctions in the presented pictures. Conversely, signers focus only on the target picture and not on the contrast competitor due to the fact that their spatial encodings are not categorical but iconic to the event to be described. This study provides first evidence that the iconic structure of sign languages influences the way signers conceptualize left-right spatial configurations differently than that of speakers during planning of linguistic production.
Figure 1. An example of how to describe "pen is to the left of the paper" in Sign Language of the Netherlands (left image) and in Turkish Sign Language (right image).

<table>
<thead>
<tr>
<th>Experimental displays (N=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contrast Condition (N=16)</strong></td>
</tr>
<tr>
<td><strong>Target</strong> right/left</td>
</tr>
<tr>
<td><strong>Contrast-Competitor</strong> left/right</td>
</tr>
<tr>
<td>Viewpoint-Competitor front/behind</td>
</tr>
<tr>
<td>Distractor in/on/under</td>
</tr>
</tbody>
</table>

Figure 2. Examples of experimental displays.

Figure 3: Eye-gaze pattern for speakers (left panel) and signers (right panel) in the Contrast condition (top) and No-Contrast condition (bottom). The blue square indicates the time in which the arrow was presented.

References
The role of language on spatial representations and event processing: evidence from similarity-judgement tasks and eye tracking

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Background: A growing number of studies has begun to investigate the role of language on human experience and whether linguistic variation has an impact on cognitive mechanisms such as attention allocation and categorization (e.g., Naigles & Terrazas, 1998; Gennari et al., 2002; Slobin, 2006; Papafragou & Selimis 2010; Soroli, 2011). In the domain of motion events, languages differ strikingly in the means they provide for the encoding of spatial information. Speakers of Satellite-framed languages (i.e., English), typically lexicalize MANNER OF MOTION accompanied systematically by PATH adjuncts, while speakers of Verb-framed languages, (i.e. French), prefer to lexicalize PATH and omit MANNER or express it peripherally (Talmy, 2000). Some languages encode motion in mixed ways, for example Modern Greek. Greek, despite a general classification as Verb-framed (i.e. Papafragou et al., 2006), is a system with Parallel conflations employing: equally verb- and satellite-framed constructions (Talmy, 2000), multiple morphological preverb configurations (Ralli, 2004; Soroli & Verkerk, 2017), as well as complex Manner-first syntactic patterns (Soroli 2012). Such cross-linguistic differences raise questions concerning the relation between language and thought. To what extent across- and within-language variation influences the ways in which speakers conceptualize and process on-line crucial aspects of motion events?

Method: 80 native speakers of three typologically different languages (20 English, 20 French and 40 Greek) were tested in three tasks coupled with an eye-tracking paradigm:

a. a production task: participants had to describe visual scenes showing voluntary motion events,
b. a visual similarity-judgement task: participants had to group together visual target events with Path- or Manner-congruent variants,
c. and a verbal similarity-judgement task: participants had to decide which variant among two best fitted a sentence describing a motion event.

Results: The findings are three-fold:

- English speakers produce semantically dense utterances (Manner verbs together with Path adjuncts), French speakers show a preference for Path, while Greeks show a mix of V- and S-framings.
- In the similarity-judgement tasks French participants choose Path as their main criterion significantly more often than the English and Greek groups, who showed no significant preference for Manner over Path.
- While no difference across languages was found with respect to the proportion of time spent looking at Path vs. Manner areas, French fixated Path areas significantly more often than the two other groups especially in the verbal tasks (a and c). With respect to scanpaths: French opted for a global scanning strategy, English for focal scanning, while a mix of the two strategies depending on the specific components involved in the events were noted for the Greek participants.

Discussion: Speakers of typologically different languages are influenced by the patterns of their linguistic system when they provide descriptions of motion events and perform similarity judgements, however to a lesser extent when the task doesn’t involve explicitly language. In addition, attention allocation patterns capture well within-system variation suggesting that visual behaviour is based on both parallel universal (physiological) and language-specific constraints, thus supporting a moderate view that allows for dynamic mutual interaction between discourse and cognitive factors.

1 The Greek participants’ group was further subdivided into two groups: half performed task c with Verb-framed sentences and half with S-framed constructions.
References

The Virtual Reality of Events of Motion (VROEM)

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In event cognition theory, agents are thought to have desires and goals, which are brought about by actions such as motion (Magliano & Radvansky, 2001). Psycholinguistic research has shown that when people attend to agents in motion events, they focus on different features of the scene depending on the grammar of their language. In this project we focus on the temporal domain of grammatical aspect marking. Progressive aspect can be used to express the inner temporal structure and ongoingness of an event such that the time discussed falls within the boundaries of the event (Klein, 1994). Using motion video clips and eye-tracking, Flecken et al. (2014) have shown that speakers of Arabic, an aspectual language, attended more to the ongoing motion in an event compared to speakers of German, a non-aspectual language, who focused more on the potential endpoint of the motion they were seeing. This pattern was only present for video clips in which the agent did not actually reach the goal. Further, this difference, i.e., in the extent to which potential endpoints were mentioned (‘A woman is walking to a house (endpoint mentioned) vs A woman is walking along the road (endpoint not mentioned)’ was also reflected in how people described the video clips. We follow up on this previous work by utilising the MPI’s virtual reality (VR) environment in combination with eye-tracking. This will allow us to assess the effects of language on motion perception when participants of different language backgrounds themselves become the agent compared to when they make inferences about others. In other words, we can use VR to test whether previous results generalise to first-person experiences of moving through space.

We are currently testing speakers of an aspectual language (English) and speakers of a non-aspectual language (German). Each trial is set in a naturalistic environment (four possible environments in total: park, countryside, forest, and city), creating a realistic setting to reflect day-to-day walking situations. In these environments, participants will navigate on a straight road using a treadmill. In experimental trials, participants will always encounter two objects, one as a landmark on the side of the road (e.g., a bike) and one as an endpoint at the end of the road (e.g., a park bench). There are 48 unique objects (partly taken from a subset of Peeters, 2017) and participants will see each item once in either position. Landmark position (i.e., left or right of the road) is counterbalanced across subjects. Trials can be split into three phases. In phase 1 the landmark object becomes visible. In phase 2, both landmark and endpoint object are visible. In phase 3, the landmark will no longer be visible and participants approach the endpoint. Further, half the trials will end before the endpoint is actually reached. Control trials include avatars crossing the road; we will use these to compare visual attention patterns in the absence of our experimental manipulation. Participants engage in a non-verbal task, requiring them to press a button when they hear a bird sound. Following the VR experiment, participants will also carry out a verbal event description task (Flecken et al., 2014) as well as a non-verbal task in which they have to judge the similarity of motion events with different degrees of goal orientation (ABX task, Athanasopulous & Bylund, 2013).

For the analysis of eye movements, we focus on visual attention to landmarks and endpoints during phase 2 when both are visible. As in previous work, we hypothesize language differences: German participants may look sooner and longer at endpoint objects than English participants.
References


Cross-linguistic effects of co-speech gesture production on memory of motion event details

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A central aspect of our daily lives involves perceiving and remembering constantly unfolding, dynamic events. How does the way we speak and gesture about these events influence our memories for various aspects of these events? Here, we propose a study in which we address this question in the domain of motion events. Motion events involve a Figure (a ball) that changes location with respect to a Ground object (the hill), with a particular trajectory or Path (down the hill) and with a particular way or Manner of moving (rolling). Languages use various means to encode these different components of motion events (Talmy, 2000). “Path languages” (e.g., Turkish, Spanish, Greek) typically encode the direction of the motion in the main verb, and information about how the motion unfolds is either encoded in a subordinate verb or omitted altogether (e.g., the ball ascended the hill while rolling). “Manner languages” (e.g., English, Dutch, German) typically encode information about the manner of motion in the main verb and path information is encoded in a prepositional phrase, or other nonverbal elements (e.g., the ball rolled down the hill). Several studies have investigated whether these cross-linguistic differences in event encoding are reflected in speakers’ memories for Paths and Manners and found no such cross-linguistic differences (Gennari et al., 2002; Trueswell & Papafragou, 2010). Nevertheless, information about event details is not only encoded in speech but also in the co-speech gestures that vary cross-linguistically (Kita & Özyürek, 2003). Furthermore, spontaneously produced gestures during speaking and thinking have been found to affect various cognitive processes (Kita et al., 2017). This leaves open the question: Do spontaneously produced gestures also enhance recognition memory for motion event components? And how does this change cross-linguistically?

Currently we are collecting data from adult native speakers of Dutch and Turkish. Target events shown during the exposure phase consist of 25 videos of spontaneous motion events in which a person is moved in relation to a ground object with particular path and manner (e.g., a woman walked into a phone booth). Participants are asked to describe the events to an addressee. In the memory phase, half of the events have a change to either the Manner (e.g., a woman leapt into a phone booth) or the Path (e.g., a woman walked out of a phone booth) of motion. The other half of the events remain the same. Participants are asked to press a button to indicate whether or not they had seen that exact video before. We are interested in whether producing gestures would have an effect on memory over and above linguistic encoding such that, speakers would have enhanced memory for motion event components when they produce co-speech gestures at encoding compared to when they do not. We are also interested in whether recognizing Manner (Turkish < Dutch) and Path (Turkish ≥ Dutch) changes would vary cross-linguistically and whether such cross-linguistic differences would be modulated by co-speech gesture production.
References


Effects of Delayed Sign Language Exposure on Acquisition of Spatial Event Descriptions

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Even though signed and spoken languages share many linguistic structures, in the case of spatial descriptions there are differences. In sign language expressions of spatial relations signers use signing space to represent the relative shape and location of entities in an analogue way to the real space. Signers frequently use morphologically complex forms (i.e., classifiers; CL) to represent entities to express Figure and Ground elements in signing space (Fig1a). Albeit less frequently, they use relational lexemes (RL) that are mostly iconic to the spatial relations as well (Fig1b). These then differ from the categorical and arbitrary forms used in spoken languages (e.g., post or prepositions such as “left”, “right”, “in”, “on”, “under”). In spite of these differences, previous research has shown that children learning sign language natively form their parents can show similar acquisition patterns to children learning spoken languages in Turkish Sign Language (TİD) and Turkish (Sümer, 2015). It is not known however how “late” sign language acquisition impacts the acquisition trajectory of expressions of spatial relations for deaf children as well as adults who have been exposed to sign language after 6 years of age.

We collected data from 10 late signing adults and 11 late signing children (age-range 7-9) of TİD and compared them to native signers reported in Sümer (2015) who had similar age groups. Our stimuli, identical to Sümer (2015), included 36 displays. Each display had 4 pictures showing two entities placed in various spatial configurations (left, right, in, on, under, front and behind). Within each display only one picture was the target, marked with a red frame (Fig2). Participants described target items to a confederate signer. For the analyses, we focused on the displays that required signers to take a viewpoint such as left and right as well as those that did not such as the topological relations, in-on-under, separately.

All groups were equally likely to place entities in signing space to express spatial relations in relation to each other. Also in terms of strategies representing entities in topological relations, late signing adults and children preferred native like linguistic strategies, and preferred mostly classifiers over relational lexemes and other forms (e.g., pointing; Fig3; Fig4). However, for descriptions containing left-right, late signing children, but not adults, preferred other forms as frequently as classifiers and thus were not native like (Fig5).

Our results first to show native like linguistic strategy use by late signing adults in static spatial descriptions and challenge previous literature claiming that late signing adults do not achieve native like proficiency (see Newport, 1988; 1990). This previous work however focused on motion events and it is possible that linguistic strategies for encoding static spatial relations might be simpler and less sensitive to early input. Furthermore our study is first to show developmental patterns for delayed sign language acquisition where topological relations display native-like characteristics earlier than those requiring viewpoint such as left and right, following the trends in spoken language acquisition with earlier acquisition of in-on-under compared to left-right (Clark, 1973).

References

Figure 1: Native TİD adult signer’s descriptions of the spatial relation of the pen with respect to the paper using (a) classifiers and (b) a relational lexeme for left.

(a) RH: CL (Paper)$_{locR}$
LH: CL (Pen)$_{locL}$

(b) RH: LEFT
LH: LEFT

Figure 2. Example Display of the Stimuli

Figure 3: TİD signer’s descriptions of spatial relation of the horse with respect to the house by using index finger pointing.

RH: CL (house)$_{locR}$
LH: Point (horse)$_{locL}$

Figure 4. Mean proportions of type of linguistic forms as a function of Age (Adults vs Children) on in-on-under spatial relations for Native Signers (a) and Late Signers (b).

Figure 5. Mean Proportions of type of linguistic forms as a function of Age (Adults vs Children) on left-right spatial relations for Native Signers (a) and Late Signers (b).