

# Events and Objects in Perception, Cognition, and Language

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## Abstracts

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**Paul DEKKER**

(University of Amsterdam, The Netherlands)

***Talk about things non-existent***

In order to make sense of talk about things non-existent, philosophers and linguists tend to construe them as things and not as non-existent. The temptation to do so is obviously strong but wrong. I argue that we can sensibly resist the temptation leaving it up for discussion whether we eventually should.

**Michael GLANZBERG**

(Northwestern University, USA)

***Events as arguments and events in composition***

This paper explores the specific ways language is structured around events. In particular, it overviews ways that events form a core or 'spine' for sentence structure. It shows how language takes a cognitive resource like event cognition, and harnesses it for its own distinctive purposes of forming grammatically structured forms.

**Accenture MadScience talk**

**Michael GLANZBERG**

(Northwestern University, USA)

***Truth and models in science***

Especially in today's world, it is important to emphasize the fundamental role of truth. And it would seem that science is perhaps the best tool we have for gathering and learning truths. In this talk, I show how science's relation to truth is not as simple as we might have hoped. Science often works through models. While models are answerable to data, they involve aspects of abstraction that lead to approximation of truth rather than simple truth.

## **Robert Blumberg distinguished lecture in cognitive science**

**Robert GOLDSTONE** (presenting collaborative work with  
**Francisco LARA-DAMMER and Douglas HOFSTADTER**)  
(Indiana University, USA)

### ***Computational models of mental models of computational models of the world***

In classroom and laboratory observations of students interacting with computer simulations to learn systems principles, we have observed systematic misinterpretations of these simulations. Students (and scientists) often discover erroneous patterns in the simulations, and construct underlying rules for the interactions among simulation parts that diverge substantially from the actual rules underlying the simulations. At the same time, students can also sometimes learn a considerable amount about the causal mechanisms underlying a simulation by interacting with it. To understand both the successes and failures of students' interpretative efforts, we have developed a computational model of the process by which human learners discover patterns in natural phenomena. Our approach to modeling how people learn about a system by interacting with it follows three core design principles: 1) perceptual grounding, 2) experimental intervention, and 3) cognitively plausible heuristics for determining relations between simulation elements. In contrast to the vast majority of existing models of scientific discovery in which inputs are presented as symbolic, often numerically quantified, structured representations, our model takes as input perceptually grounded, spatio-temporal movies of simulated natural phenomena. Given this relatively raw visual representation, instilling plausible (per/con)ceptual constraints is key to building apt and efficient relation detectors. We will consider the recognition of relations such as: collide, attract, repel, change state, transfer state, excite, and inhibit. An application of the model to the discovery of ideal gas laws will be described.

**James PUSTEJOVSKY**  
(Brandeis University, USA)

### ***How events and objects occupy space***

Most research into event semantics has focused on questions relating to either aspectual classifications (Aktionsarten) or temporal semantics of event predicates. One area that has received far less attention is the question of where events happen: that is, the problem of spatially situating events in a model. I propose a framework for identifying where events and their participants, as expressed in natural language, are located in space. I argue that events are interpreted as much for how they are “spatially shaped” in the model, as they are temporally anchored. This event shape is determined by a process we call “event localization”. This refers to the process of identifying the spatial extent of an event, activity, or situation, its minimum embedding space. I argue that language makes a distinction between the “event locus” and the “spatial aspect” of an event, analogous to Reichenbach’s event and reference time in the temporal domain.

In the process, I discuss how localization is supervenient upon the participants (objects) in the events. I provide both a relational and a modal interpretation of the model.

### Accenture MadScience talk

**James PUSTEJOVSKY**

(Brandeis University, USA)

### *Visualizing meaning: Semantic simulation of actions and events*

The success of both natural language understanding and AI will depend on being able to communicate effectively with computers and robots in a natural fashion. In order to achieve this goal, human-computer/robot interactions will require at least the following capabilities and competencies: robust recognition and generation of multiple modalities (language, gesture, vision, action); understanding of contextual grounding and co-situatedness; and appreciation of the consequences of behavior and actions. In this talk, I describe an approach to modeling human-computer interactions based on creating multimodal simulations (MMS). A multimodal simulation is an embodied 3D virtual realization of both the situational environment and the co-situated agents, as well as the most salient content denoted by communicative acts in a discourse. It is built on the modeling language VoxML, which encodes objects with rich semantic typing and action affordances, and actions themselves as multimodal programs, enabling contextually salient inferences and decisions in the environment. Since a simulation reveals the elements of the common ground in discourse between speakers, it offers a rich platform for studying the generation and interpretation of expressions, as conveyed through multiple modalities, including: language, gesture, and the visualization of objects moving and agents acting in their environment. I will present current research demonstrating multimodal human-computer interactions in a collaborative task, and discuss ongoing lines of research in using a multimodal simulation context for introducing novel concepts and situations to a computational agent.

**Chris SINHA**

(Hunan University, China)

### *Events in mind, space and time*

I outline an *event-based* account of the neurocognitive and linguistic representation of time and temporal relations. Human beings differ from non-human animals in entertaining and communicating elaborate detached (as opposed to cued) event representations and temporal relational schemas. I will distinguish deictically based (D-time) from sequentially based (S-time) representations. On the basis of crosslinguistic data, I conclude that all cultures and languages employ both D-time and S-time event-based temporal representations. I then outline a cognitive model of event structure, emphasizing that this does not entail an explicit, separate representation of

a time dimension. I will emphasize the importance of distinguishing what is universal from what is variable in cultural and linguistic representations of time, hypothesizing that the notion of an event-independent, metric *Time as Such* is not universal, but a cultural and historical construction based on cognitive technologies for measuring time intervals. I will critically evaluate, based primarily on research on Amazonian languages, claims that time is universally conceptualized in terms of spatial metaphors, and hypothesize that systematic space-time metaphor is only found in languages and cultures that have constructed the notion of time as a detached domain. I conclude by suggesting that events, and event structure, are the fundamental building blocks of human conceptualization, and question the ontological primacy accorded in Western philosophies to objects.

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#### **Alexis Wellwood**

(University of Southern California, USA)

#### ***Events in language and mind***

Research in cognitive psychology reveals systematic correspondences between the grammatical mass/count distinction and the cognitive distinction between substances and objects. Research in formal semantics supports a strong analogy between nominal mass/count and verbal telicity phenomena. In this talk, I apply methods and results from both areas—formal semantics and cognitive psychology—to explore the distinction between events and processes. Throughout, I emphasize the kinds of foundational questions that such research raises, and suggest that it may be key to understanding certain core aspects of linguistic structure, like the differentiation of functional from “contentful” vocabulary items.



**Amanda WOODWARD**  
(University of Chicago, USA)

***Action and infant cognition***

In the study of early cognitive development there is considerable debate not only as to what infants understand, but also how best to characterize the nature of their knowledge. In this talk, I will engage this broad question in considering infants' knowledge about others' intentional actions. Drawing on recent findings from our laboratory, I will make two claims: (1) Young infants' analysis of meaningful structure in others' actions is grounded in information derived from their own actions; and (2) This fact does not mean that infants' understanding of others' actions is concrete, low-level, or cognitively uninteresting. In fact, infants' action knowledge is cognitively generative. I will discuss research that illustrates this generativity in infants' generalization of knowledge to new actions, their learning from social partners, and their memory for events. In each case, our findings suggest that infants' engagement in action fuels their thinking and learning about actions.

**Jeffrey M. ZACKS**  
(Washington University in Saint Louis, USA)

***Object-like properties of events in perception and memory***

Objects and events (along with other people) are central contents of human experience. Philosophers, linguists, and psychologists have found it useful to analyze events using analogies to objects: Both objects and events can be mentally represented at the level of individuals and categories and both have boundaries. However, there may also important disanalogies between objects and events. In this talk, I will describe recent work from our laboratory on the individuation of events in perception and memory that focuses on the roles of time and prediction in event perception and memory. I will describe a theoretical framework that attempts to integrate the object-like and not-object-like properties of events.

**Paolo ACQUAVIVA**  
(University College Dublin, Ireland)

***Possible nouns for visual experiences: Relating visually- and linguistically-defined objects***

We propose an interpretation of the vision process and a structural analysis of nouns and nominal reference which make it possible to relate the visual/cognitive and the linguistic encapsulation of objecthood in a rigorous way. The result of this integrated theory is a predictive account of possible and impossible nouns lexicalizing visual objects. Visual objects are indexed relations between stimuli interpreted via visual properties, such as [round], and what we define as object concepts: a red ball is

the relation between the red and spherical features and the object concept of a ball. In language, nouns identify object concepts, semantically modelled as kinds, and the noun phrases they head can refer to instances of those kinds. No aspect of grammatical structure links up to visual properties directly, so no noun in natural language can denote an arbitrary subset of visual properties; the interaction is only at the level of objects, whether an abstract concept or a fully specified referent (the latter expressed by a full noun phrase). We formalize the relation between the two by means of an informorphism, a formal representation of information flow between systems. This translates the objects of the visual and linguistic systems in terms of information types and tokens, constraining the possible lexicalization of object concepts. For instance, a visual property cannot be identified by a choice of noun unless it is interpreted as instantiating an object concept, because nouns can denote object concepts but not directly properties.

**Riccardo BARATELLA**

(University of Salzburg, Austria)

### *On the identification of events with material objects*

Aim.

Given the assumption of perdurance theory for both events and objects, one metaphysically substantive question is whether events occurring at some time  $t$  should be identified with the objects participating in them at  $t$  (call it “the identification thesis”). Famously, Quine and Goodman maintain this is the case. In this talk, I will investigate such a fundamental question.

Background

I will assume the orthodox Lewisian definition of perdurance. I will adopt the most widely-accepted theory of events, according to which events are property-instances, i.e. tropes. I will call “eventive universals” those universals whose being instantiated gives rise to events.

Argumentative Strategy

The theory of events as property-instances allows to state an argument (called “AID”) against the identification. Roughly, consider any temporal part  $x$ -at- $t$  and two distinct eventive properties  $P_1$  and  $P_2$  had by  $x$ -at- $t$ . By the theory of events as property-instances, there are two distinct events  $e_1$  and  $e_2$  identified with  $[x, P_1, t]$  and  $[x, P_2, t]$  respectively. This conclusion is incompatible with the identification thesis. This talk aims to investigate which premises of AID can be plausibly denied by the friends of the identification thesis for blocking its conclusion.

Results

Two strategies will turn out to be more plausible than the others. The first one is the assumption of austere nominalism. The second one rejects that instances of eventive universals are tropes, and assumes that instances of eventive universals are those temporal parts that have the universals in question.

**Kristina LIEFKE**

(Goethe University Frankfurt, Germany)

**Markus WERNING**

(Ruhr University Bochum, Germany)

### *Objects and events in situated single-type semantics*

Situated single-type semantics (see Liefke and Werning 2018) is a compositional theory of natural language meaning that interprets DPs and CPs in the same semantic type (i.e. parametrized sets of situations). Single-type semantics is motivated by its ability to explain the distributional similarities between DPs and CPs (cf. Bayer 1996, Kim 2008) and the semantic inclusion relations between DPs and CPs (cf. Carstairs-McCarthy 1999, Potts 2002; see (1)):

- (1) a. Bill remembers [<sub>CP</sub>that Mary was dancing].  
b. ⇒ Bill remembers [<sub>DP</sub>Mary].

This paper presents an ontology for situated single-type semantics that enables this explanation. The proposed ontology is an ontology of information particles. The latter are particulars, i.e. entities that occur only once in a single world. Basic information particles include concrete particulars (i.e. individuals; e.g. Mary) and abstract particulars (i.e. tropes; e.g. Mary's dancing at ⟨@, here@, now@⟩). The trope 'Mary's dancing at ⟨@, here@, now@⟩' is identified with an event particular.

Situations are identified with complex information particles that are built from individuals and tropes by the operation of information accumulation,  $\oplus$ . This operation applies to Mary and her dancing at ⟨@, here@, now@⟩ to yield the informational depletion of the world-part ⟨@, here@, now@⟩ that is inhabited (only) by Mary and in which Mary is (only) dancing.

The full paper defines a partial ordering on situations that is defined in terms of  $\oplus$ , and identifies relations between individuals, tropes (incl. event particulars), and situations. These relations are then used to explain DP/CP similarities and semantic inclusion relations like the ones exemplified in (1).

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**Olga MATROSOVA**  
(University of Latvia)

***Children in space***

The basic spatial terms of language share properties of both content and function morphemes: on one hand, they express rich content regarding spatial relationships; on the other hand, they form a relatively small, closed set. The majority of prepositions are polysemous. Accounts of the semantics of locatives are different in terms of the nature of representation underlying their meaning. Broadly speaking, there are two kinds of accounts: geometric accounts and functional accounts. Geometric accounts treat basic locatives in terms of basic geometric relations, e.g. for *in* the referent must be included in, enclosed by or interior to the relatum, for *on* the referent firstly must be in contact with relatum, secondly, it must be supported by it. Functional accounts assume that prepositions reflect functional or physical relations between objects in the world.

The current research aims at ascertaining the way children perceive basic locatives *in*, *on* and *under* in their second language. The groups of children with Russian and Latvian mother tongues are tested, and the tests' results are compared. Placement task (Carlson and Hill, 2008) is used. As can be seen, children have no problems using basic spatial prepositions in their direct, or central, or prototypical meaning, though they make mistakes when prepositions are used in peripheral meaning. Systematic mistakes are outlined and statistical analysis of data is provided, taking into account such factors as participants' age, duration of English studies and mother tongue.

**Stephanie REEVES**  
(Connecticut College, USA)

***The effects of background music and noise on cognitive performance testing in musicians and non-musicians***

Undoubtedly, the variability of music — its sound, speed, lyrical qualities, and tone — affects attentional performance. Previous research indicates that the presence of sound negatively affects the outcome of tasks that require a high cognitive demand, which supports the theory that language and music processing take up cognitive capacities. This between subjects design study examined the effects of background noise and music on cognitive performance testing in musicians and non-musicians. Study participants (N=61) were randomly assigned to one of four music conditions and were directed to listen to sound tracks while they filled out a reading comprehension and mathematics performance tests. They were assigned to lyrical music, non-lyrical music, foreign language music, or background 'white noise' conditions. It was hypothesized that those in the non-lyrical music or background noise conditions would perform better on cognitive performance tests than those in the lyrical and foreign language music conditions. Furthermore, it was predicted that musicians would score overall higher than non-musicians. Multivariate analyses indicated no significance of musical condition on cognitive performance, however, trends indicated that participants who were assigned to the non-lyrical or background noise conditions indeed scored higher than those in the other two conditions. Additionally, univariate

results reveal that musicians performed significantly better than non-musicians ( $p = .027$ ), suggesting either a general cognitive advantage in musicians or the importance of musical training in achieving high cognitive functioning. The implications of this work are discussed as well as recommendations for future studies.

**Nezrin SAMEDOVA**

(Azerbaijan University of Languages, Azerbaijan)

### *Events in the world and “in the head”: The case of so-called semelfactives*

The aspectological theory I follow claims that the meaning of any verb in Russian contains the seme ‘process’. However, this statement contradicts the totally dominating perspective that Russian perfectives like *прыгнуть* (*to jump*) are “instantaneous” (“momentary”, “punctiliar”). And, indeed, these terms quite adequately reflect linguistic intuition, cf. *прыгнуть до стола* ‘to get to the table in one jump’ and *допрыгать до стола* ‘to get to the table in a few jumps’.

The research designed to resolve the paradox involves both linguistic analysis through classical structuralist methods and extrapolating data of self-paced reading, MEG, and ERP experiments carried on the English verb *to jump* and other so-called semelfactives, cf. [1; 2; 3; 4; 5; 7; 8; 9].

As a result, first of all, homonymous imperfectives like *прыгать<sub>1</sub>* (non-momentary) and *прыгать<sub>2</sub>* (momentary) have been differentiated. Momentary imperfectives 1) rarely occur with phrases indicating the process duration, and these phrases are only of the type *за долю секунды* ‘in a split second’; 2) combine with *медленно* ‘slowly’ and phasal verbs only in situations like commenting on a slowed down film [6:42-43]. The explanation is that these verbs refer to very brief physical actions that take some fraction of a second to happen. The events are conceptualized in full accordance with the characteristic and, correspondingly, the verbs have the peculiar seme ‘process of short (i.e. non-standard) duration’. It is also true for their purely aspectual partners, cf., e.g. *Смотри, он прыгает<sub>2</sub> / прыгнул с балкона* ‘Look, he is jumping / jumped from the roof’.

Note also that imperfectives like *прыгать<sub>Non-mom</sub>* possesses the seme ‘process of standard duration’ and correlates with perfectives like *допрыгать, запрыгать, попрыгать, пропрыгать, отпрыгать*, etc., as they refer to another type of events.

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**Miguel SANTIN, Angeliek van HOUT**

(University of Groningen, The Netherlands)

**Monique FLECKEN**

(Max Planck Institute for Psycholinguistics, The Netherlands)

### ***Means and results: changes of state events in the memory of Mandarin, Dutch and Spanish speakers***

Spanish differs from Mandarin and Dutch in how they verbally encode *resultative* events (i.e. events with resultant changes of state). While Mandarin and Dutch use resultative constructions to encode manner and result of actions together (e.g. in Mandarin: *dào-mǎn* ‘pour-full’, Chen 2016; in Dutch: *vol-schenken* ‘pour-full’, van Hout 1996), Spanish uses single verbs to encode either the manner or result (e.g., *vertir* ‘pour’ / *llenar* ‘fill’, García del Real, 2015). We investigated whether the use of different verbal constructions to encode results influences their representation in memory.

We compared how native speakers memorized event results in two experiments: Experiment 1 involved describing events shown in short videos (verbal experiment) and experiment 2 involved a non-verbal substitute task (non-verbal experiment). Participants saw 24 event-videos: *resultative events* in which objects suffered a change of state, and *non-resultative events* in which objects did not (n=12 each). Crucially, events were shown either as ceased (action came to an end at video offset) or ongoing (action still in progress at video offset). In a subsequent surprise recognition task, participants judged whether screenshots of the videos correctly depicted (as ceased or ongoing) the endings of the events they watched.

Results of the verbal experiment show that ceased *resultative events* had a positive effect on the recognition accuracy across languages groups (Figure 1). In the non-verbal experiment, Dutch and Mandarin speakers recognition accuracy of ceased *resultative events* was lower compared to Spanish speakers (Figure 2). We discuss that the habituation to use single verbs to express resultant changes of state boosted the

representation of event results in the memory of Spanish speakers in the non-verbal encoding context.

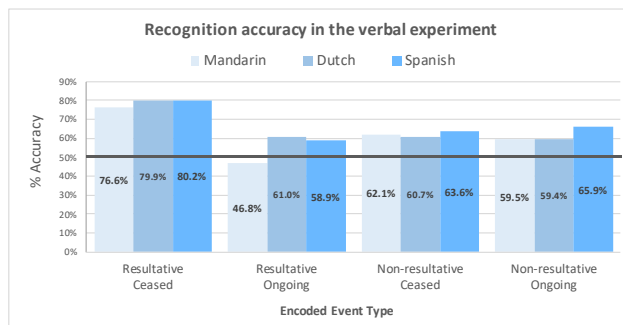


Figure 1. Accuracy results of Mandarin, Dutch and Spanish speakers on the memory task in Verbal experiment

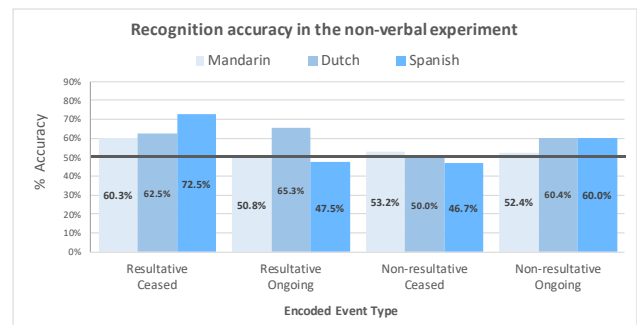


Figure 2. Accuracy results of Mandarin, Dutch and Spanish speakers on the memory task in Non-verbal experiment

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## Carla UMBACH

(Centre for General Linguistics, Berlin (ZAS), Germany)

### *The role of similarity in the interpretation of perception verb complements*

Perception verbs embed wh-complement clauses expressing manner, as e.g. in German, (1a). In a number of languages these complement clauses have a second reading which, for German (as well as Polish and Russian) can be shown to denote events in progress, (1b). Assuming that this is not a coincidence, the question arises how manners of events are related to events in progress.

- (1) *Anna sah, wie Berta die Straße überquerte.*  
 (a) Anna saw how Berta crossed the street. (manner interpretation)  
 (b) Anna saw Berta crossing the street. (event-in-progress interpretation)

The analysis in a nutshell:

- A. The wh-word *wie* ('how') has two different base positions: a verb-adjacent position and a position above TP, (Legate 2010).  
 B. The wh-word *wie* ('how') is interpreted as denoting similarity. The notion of similarity is spelt out as indistinguishability in multi-dimensional attribute spaces equipped with convex closures of classifier predicates (Umbach & Gust 2014).

- C. In the manner reading, the wh-word is associated with the event type given by the verb, thereby generating similarity classes that are subtypes of the verb event type.
- D. In the event-in-progress reading, the wh-word is associated with the event token, thereby generating similarity classes of natural continuations of an initial stage of the token (Landman 1992, Bonomi 1997).

This analysis explains the relation between the manner and the event-in-progress reading of (1): While the former provides different ways of realizing events of a given type, the latter provides different ways of continuing a given initial stage of an event token.

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#### *Time in terms of space in Baltic*

Temporal relations are usually expressed linguistically using spatial terms. Such a process is due to structural similarity between both domains (Gentner et al., 2002) and is well attested cross-linguistically (e.g., Haspelmath, 1997, Majid et al., 2013). Research on grammaticalization also provides extensive evidence indicating that spatial markers are prior to temporal ones in the process of grammaticalization (e.g., Heine and Kuteva, 2002).

Structuring temporal domain in spatial terms is a prevalent principle in the Baltic languages (Lithuanian and Latvian). However, despite of the fact that both languages are closely related, they employ slightly different strategies to convey certain temporal meanings. For example, simultaneous temporal units (names of hours, parts of days, days, months, seasons, years and festivals) are used in the Locative case in Latvian whereas Accusative and Instrumental are usually applied in Lithuanian (Haspelmath, 1997).

Our study has several research purposes. First, it provides an outline of linguistic coding of the basic topological and geometric relations in Baltic languages obtained from experiments (production tasks conducted in a repeated measures design with 45 Latvian and 45 Lithuanian participants). Second, it shows how our data from spatial domain is related to temporal domain, viz., which descriptions locate objects both in space and time and which are rather characteristic for one of the domains. Third, our



results will highlight differences between spatio-temporal representation in languages. Finally, we will be discussing some tentative grounds for these differences. Our study is in line with cross-linguistic research of temporal adverbials (Haspelmath, 1997) and uses tools of qualitative spatio-temporal representation (Allen, 1983, Cohn et al., 1997).

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