

# The Verbal Symbol and Natural Language Ontology: Rethinking Event Kinds

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- lexical vs. functional elements (the former ordered below the latter in a functional sequence)
- ROOTs vs. syntactic contexts
- conceptual vs. structural semantics (the former coming from the lexical item/root, the latter coming from the functional elements/syntactic context)
- ‘universal’ cartographic sequences.

# What do We Really Mean by Conceptual vs. Structural Semantics?

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- (i) Aspects of meaning that can vary freely and without limit, not constrained by UG
- (ii) The content of open class items, or ROOTs.
- (iii) Unstructured, idiosyncratic or memorized meaning.

# The Syn-Sem Question

Is there something qualitatively special or characterizable about the semantic content that is contributed in the lower (inner domains) of linguistic representation?

# Why We Need A New Ontology

Classical truth conditional semantics (i.e. the tradition starting with Frege and progressing through Tarski and Church to Montague, Lewis, and later modern formal semantics), despite its undoubted achievements, has failed to deliver on three important desiderata for a theory of meaning for actual human languages.

- (i) providing an explicit account of productive concept composition and polysemy of actual lexical items.
- (ii) underwriting generalizations concerning meaning layering within morphosyntax that are virtually exceptionless typologically.
- (iii) providing a theory can be the computational stepping stone into a more algorithmic psychologically real account of meaning in the brain.

# Crosslinguistic Generalizations

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- Cartography tells us that there are robust crosslinguistic generalizations about the ordering of meaning elements in an extended functional projection (cf Cinque 1999).
- At the bottom of every functional sequence, we find evidence for a kind of substantive, conceptual, rich, yet flexible kind of meaning, as denoted by open class items.
- Evidence for this kind of *layered meaning* are pervasive and exceptionless crosslinguistically, yet they currently look 'accidental', 'templatic' from the point of view of our formal ontologies.

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- Demonstrate some consequences and extensions of that system for other more exotic phenomena

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Even those who are uncomfortable with the universalist claims coupled with fine grained 'cartography', nevertheless subscribe to the C > T > V template of extended verbal projections and language specific rigid ordering.

(see also Ramchand and Svenonius 2014)

# Who Should Bear the Explanatory Burden?

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- Syntacticians describe, and then stipulate the labels in their hierarchic structures. Any such generalizations are either primitive or will eventually be explained by their semantics colleagues.
- Formal semantics has not traditionally cared about the evidence for semantic layering that comes from morphosyntax or cartography. Compositional semantics can be made to track the syntax, but does not attempt to explain it.

# Classical Formal Semantics Cannot Save us From Templates

This is because the reliance on extensional formal ontologies where situations themselves, or referents, are fully specified particulars, makes the internal structuring of propositions a templatic matter for the semanticists as well.



# Evidence for Event Kinds

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Parallel to that, we now have strong evidence for an event kind domain in the lowest part of the verbal functional sequence.

Gehrke (2013), Gehrke (2015) and subsequent work has argued from the interpretation of adjectival passive participles for the existence of event kinds (see also Gehrke and McNally 2015 )

# Comparing Ontologies: Kinds vs. Particulars

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## The Formal Semanticist

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## The Morphosyntactician

But the functional sequence tells us that there is some notion of kind/property that resides lower down, close to the root and is the basis for the build up of reference to particulars. In morphosyntax, particulars are built out of essences.

# Empirical Phenomena in the Verbal Domain that require Essential/Non-Instantiation-Related Content

- Adjectival Participial meaning (Gehrke 2013, Gehrke 2015 etc.)
- Causative verbal meanings with defeasible actuality entailments of the caused state. Martin and Schäfer 2014, Kratzer 2004
- The progressive paradox (Dowty 1979, Landman 1992 etc.)
- Thematic Roles (generalizations over the 'type' of relationship between verb and any potential participant).

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With the exception of Gehrke and collaborators, the work cited in these domains all use some kind of modal/possible worlds apparatus to formally describe these kinds of meanings. But if modality can be invoked this low down, within root meanings, and across syntactic categories, then what is the source for the layering pattern found in the morphosyntax of the verbal extended projection?



## Essences as Basic

You could do this all with possible worlds, and in fact, for the formal semanticist this has been seen as the only option, but there are dissenting voices.

*“Finally, it will be suggested that the identity of an object— what it is— is not, at bottom, a worldly matter; essence will precede existence in the sense that the identity of an object may be fixed by its unworldly features even before any question of its existence or other worldly features is considered.” (Kit Fine. Necessity and Non-Existence)*

Also event ‘properties’ as in recent work by McNally and Gehrke (Gehrke and McNally 2015, Gehrke 2015, Grimm and McNally 2015). These authors are very clear that they think of the notion of event essence as *preceding* information about instantiation in the verbal functional sequence.

# The Problem with Formalizing Essences Directly

If semantics is to follow morphosyntax in such a way that what is simple and underived in the one system corresponds to what is simple and underived in the other, then essence must precede existence in the cumulative building up of a natural language proposition.

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In Gehrke and McNally, 'event property' is a primitive which underwrites particulars, but the details of the compositionality are difficult to make precise. (See also Pietroski 2018 for a discussion of the problem)

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In some sense the problem with Kinds is very similar to the problem with Roots in the DM literature.

It is very difficult to understand concept-concept compositionality using either kinds or roots since they have a primitive monolithic quality with respect to the rest of the system that is interfacing with truthmaking.

# The Internalist vs. Externalist Question

## **The Externalist:**

“There is a crucial ‘aboutness’ to language, and that if we attempt to ground our theories in internalist notions then we are condemned to theories that make no sense of the intersubjectivity of language and which end up being at best unfalsifiable, and mystical at worst.

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But what about the fact that language is represented in the mind-brain of actual individual speakers? What is it they have memorized? And how is it deployed?



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(News Flash: Formal Semanticists are externalists.)

# Chomsky (1995)

But Chomsky is entirely right when he points out that mental phenomena, and the meanings of our natural language symbols, do not seem to be explicable in purely extensional terms, not even with the help of Lewisian possible worlds. Citing Nagel 1993, Chomsky argues that:

*' It is a hopeless task to "complete the materialist world picture" by translating accounts of "mental phenomena" in terms of a "description that is either explicitly physical or uses only terms that can apply to what is entirely physical" or perhaps give "assertability conditions" on "externally observable grounds". (Nagel 1993. pg.37)*

*Chomsky 1995. pg 4 '*

# Pietroski (2018) and Lexical Meaning

Pietroski (2018) argues persuasively that the notion of meaning as a mappings between extensionally justified ontological entities cannot do justice to the notion of meaning that is required to understand the contribution of the lexical symbol as deployed in our natural language systems (what he calls *Slangs*):

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In fact, Pietroski ends up arguing that Slang meanings are instructions to fetch bundle of associated concepts and percepts, an idea which will be intuitively quite close to what I will propose here.

# The Symbolic Primes of Natural Language Meaning

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In fact, if we allow the lambda calculus to abstract over higher types, then the principle of Fregean compositionality which says that the 'meaning' of a complex piece of linguistic structure is calculated by function-argument composition from the 'meanings' of the daughters, expressed as functions becomes **trivially satisfiable in all cases**. It is both trivial and complicated.

# The Representational Question

Even so, compositionality is trivial (if complex) only by sidestepping the question of what individual lexical items denote and denying that there is a common representation for all its uses. The mystery is tucked away in the choice of variant, and no one is theorizing about what constraints and generalizations are concerning those meaning primes of the system.

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It is as if we are describing the phonetic realization of meaning in greater and greater detail, but not asking what the psychological building blocks of those meanings are.

# Marr's Different Levels: Where Are We?

*Computational theory:* What is the goal of the computation, why is it appropriate, and what is the logic of the strategy by which it can be carried out?

*Representation and algorithm:* How can this computational theory be implemented? In particular, what is the representation for the input and output, and what is the algorithm for the transformation?

*Hardware implementation:* How can the representation and algorithm be realized physically? [Marr (1982), p. 25]

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The right computational theory should be constructed so that it can be systematically converted into hypotheses about the next, algorithmic and representational, level

# Meaning in the Brain (Location and Timing)

According to a recent overview of what we know, Baggio (2018) divides the different stages of meaning composition as involving:

- (i) Relational Meaning (lexical concept composition and local contextual effects)
- (ii) Referential Meaning (reference tracking, pragmatic inferencing etc.)
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The first of these seems to occur in a window leading up to the peak of the N400 cycle of activity.

# Early Conceptual Composition in the Left Anterior Temporal Lobe

The LATL is particularly interesting because it is implicated very early in processing terms, and is activated in both the comprehension and production of phrases such as *red car* as compared to control conditions consisting just of two unconnected words in a list (Bemis Pytkäinen, 2011, 2013a, 2013b)).

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It also appears to be an interaction between the specificity of the left member of the phrase when it needs to be integrated with a noun (more specific left members as in *tomato soup* producing greater activity than compounds with vaguer left members (*vegetable soup*) (Zhang and Pykkänen 2015 )

# The Approach in Ramchand (2018)

We first need to adopt a slightly different view of the connection to extensions and the world than in the Fregean inspired system, one that will leave room for internalist 'meanings' to build up to referential import systematically in the context of a particular used sentence, but does not require the lexical primes themselves to be truth functional.

- The verbal extended projection *gradually builds up* a description of a situation (the CP).
- Situations are real world particulars that stand in a truth making relation to this description.

Truth making: "Something on the side of the world— in this case, a state of affairs— verifies something on the side of language."  
(Barwise and Perry 1983, Kratzer 2014, Fine 2013, etc.)

# Truth Making and Natural Language Ontology

According to Fine “Truthmaking is a not a guide to metaphysics.”  
...” But if our aim is to understand language, then our focus  
should be on immediate truth makers, not the ultimate  
truthmakers, and the question of *how* they make the statements of  
the language true will be of greatest concern.”

In fact, I will argue that in language, the verbal extended  
projection structures the situational description in a very particular  
way, which has implications for the immediate truth makers we  
have to assume in natural language and how they function.

# Barwise and Perry (1983)

Barwise and Perry (1983) were very clear about the properties of the symbolic primes of a natural language system and what they need to be able to do. Here, the emphasis is on reusability, and user perspective, rather than the more traditional formal semanticist fixation on 'aboutness' and 'intersubjectivity'.

## **Properties of the Symbolic Primes of an NL System**

- Re-usability
- Perspectival relativity
- Ambiguity
- Acquirable on the basis of immediate cognitive/sensory uptake

# Digression on Ideophones and Demonstrations

Henderson (2015) states that work on the formal semantics of ideophones is scarce because of the 'difficulty in formalizing the distinction between descriptive meaning and depictive meaning, which ideophones seem to traffic in'. In giving his own account, Henderson explores a formal foundation for the notion of demonstrations from Davidson (2015) and extends it to account for the ideophonic data. *Intuitively, demonstrations are a special type of communicative event that stand in a similarity relation with the event demonstrated.*



# The Radical Move

**ALL linguistic symbol use is deployment via a  
speech event.  
(i.e. not just ideophonic elements)**

# Quotational Quantificational Semantics (QQS)

## Preview:

For human language to get off the ground, we need to have

- (i) common possession of symbols that are *abstractions over the different actual situations encountered in the learning phase*, and
- (ii) a speaker to deploy those symbols as a means of characterizing new situations in the world as she comes across them.
- (iii) The eventuality corresponding to the speech event explicitly represented in the build up of the propositional meaning.
- (iii) The 'meanings' of the symbols themselves devoid of temporal or worldly information. They form the hierarchically inner core which are clothed with the contingent information of time, place and world, to link descriptions to actual particulars.

# The Metalinguistic Turn

In order to do this we need to add to the usual model, a domain  $D_{\mu}$  which is the domain of well-formed linguistic entities of type  $\mu$ , after Potts (2007). These linguistic objects are triples, consisting of a `< phonological string, syntactic features, SEMANTICS >`.

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Full expressions of type  $\mu$  will be written in sans serif. So for example, the verb `run` might have the denotation:

$$[[ \text{run} ]] = \langle \text{run}, \langle \mathbf{init}, \mathbf{proc} \rangle, \lambda e[\text{run}(e)] \rangle$$

For convenience, we adopt the convention in Henderson (2015) which uses the bottom corner notation to pick out the semantic part of the triple denoted by something of type  $\mu$ . Thus,

$$\lfloor \text{run} \rfloor = \lambda e[\text{run}(e)]$$

# Language Symbols as Objects in the Ontology

- (a) Symbols of the language constitute the domain  $D_\mu$ , which are triples consisting of a  $\langle$  phonological string, **syntactic features**, SEMANTICS  $\rangle$
- (b) The semantics of a verbal LI are partial descriptions based on sensory and cognitive abstractions over experience.
- (c) The syntactic part of the information in a triple that is a member of  $D_\mu$ , is a subtree of the language. The merge of  $u_1 \in D_\mu$  and  $u_2 \in D_\mu$ , creates a derived element of  $D_\mu$ ,  $u_3$ , which has the syntactic representation built by merging the syn-rep of  $u_1$  with the syn-rep of  $u_2$ , and a semantics is composed by ordinary argument identification of  $\sqsubset u_1 \sqsupset$  and  $\sqsubset u_2 \sqsupset$ .

# What Does the Third Member Look Like?

The third member of the triple (i.e. the 'meaning') is a place holder in principle for whatever turns out to be the best theory of lexical meanings. I have made life easy for myself by simply expressing them in the lambda notation as partial descriptions over event arguments, but it is not intended to be a repetition of the linguistic form itself, but rather a non-linguistic mental representation.

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In the framework of Ramchand (2008) It is the syntactic information that structures this content into monadic and dyadic predications over events with participants.



# Hendersonian Deployment (The Case of Ideophones)

This is Henderson (2015)'s denotation for the quotation meaning. TH ( $d$ ) =  $u$  says that the 'theme' of  $d$  is the linguistic object  $u$ , and  $d$  'demonstrates' or has certain structural properties in common with  $e$ .

$$(1) \quad \text{QUOTE} : \lambda u \lambda d \lambda e [\text{TH}_\delta(d) = u \wedge \text{DEMO}(d, e) ]$$

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This reusable essential symbolic content is the equivalent of Henderson's ideophone. A symbol is a conventionalized ideophone, used to invoke and describe and event.

# Deployment, Generalized

## Deployment of the Symbolic Content at EvtP

- (2) I.  $E_{VT}P : \lambda d \lambda e [UTTERANCE(d) \wedge TH_{\delta}(d)=u \wedge CONVEY(d,e)]$

Property of of an utterance event  $d$  and event  $e$ , which has  $u$  as its theme, and where  $d$  deploys  $u$  ( $\in D_{\mu}$ ) to convey  $e$ .

II. In the case of purely conventional (i.e. non-depictive) LIs, uttered with sincerity and without metaphor or hyperbole,  
 $'TH_{\delta}(d)=u \wedge CONVEY(d,e)' \longrightarrow ' \llcorner u \lrcorner '(e)'$

# Using Expressions with Intrinsic Semantic Properties

This is a representational encoding of the intuition that reference involves a speaker and a context in addition to the symbol she is deploying. But it is not just a matter of a speaker  $X$  using the symbol  $Y$  to refer to the object  $Z$ , we need to leave room also for the contextual circumstances and mode of deployment of the symbol in question. Once again Chomsky (1995) puts it well,

*" More generally, person  $X$  uses expression  $E$  with its intrinsic semantic properties to talk about the world from certain intricate perspectives, focusing attention on specific aspects of its, under circumstances  $C$ , with the "locality of content" they induce (in Bilgrami's sense). "*  
*Chomsky (1995), p. 43*

# What is d in this system?

The utterance event *d* is reminiscent of the Kaplanian context, but is not exactly that. I assume it to be no different from a davidsonian eventuality variable corresponding to the utterance act. However, the comparison is apt because the compositional semantics proposed here also mirrors the original Kaplanian order of composition whereby 'character' (the linguistic symbols(s)) combines with 'context' (*d*) first to create 'content' (a relation between eventualities and speech events), and only subsequently has its reference established via world and time parameters (Kaplan 1989).  
(see also Schlenker 2011)



# Why Reify The Speech Event?

Semanticists understand very well the need for incorporating contextual information to build meanings that have actual truth conditions, so from a semantic point of view this is not new. But why put it in the representation in this literal fashion, instead of simply invoking it in the model or in the process of interpretation?

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Perceived intensities	zero crossings blobs, edges bars, ends virtual lines groups, curves boundaries	local surface orientation and discontinuities in depth and in surface orientation	3 D models hierarchically organised in terms of surface and volumetric primitives

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The move to the objectual, 'extensional' representation is crucially mediated by the folding in of information concerning the viewer's own position

# Quantificational Quotational Semantics: Three Layers of Meaning

Intuitively, we build up a representation of the proposition in three stages:

- (i) The putting together of lexical items which encode certain event properties. This stage needs to be productive and compositional, but with no reference to temporal or world parameters. (The Interior) (cf. Also Hinzen )
- (ii) The assertion by the speaker of the existence of an event with those properties. (Deployment)
- (iii) Addition of temporal and world properties to the event. (Referential/Instantiational domain)
- (iv) Anchoring of the worldly and temporal properties via the Origo (the speaker and her contextual coordinates).

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**Underwriting NL Generalizations:** Small steps in the direction of explaining broad level templatic facts/generalizations ( $V < T < C$ ).

# QQS in Action

# Applying QQS to Demonstrative Content

What happens if the `UTTERANCE` event comes with a particular intonation, co/speech gestures like eye rolls or hand movements? What if the nature of the sign deployed carries presuppositions telling us that the deployment event is iconically similar to the event being evoked?

The `CONVEY` predicate was chosen to be maximally general, but we could state principles which choose different flavours of 'conveying' depending on the nature of the symbol involved and how it is being deployed.

# The Boring Case

$$(3) \quad \text{EVT}_{\text{P}} : \lambda d \lambda e [\text{UTTERANCE}(d) \wedge \text{TH}_{\alpha}(d)=u \wedge \text{CONVEY}(d,e)]$$

Property of of an **UTTERANCE** event  $d$  and event  $e$ , which has  $u$  as its theme, and where  $d$  deploys  $u$  ( $\in D_{\mu}$ ) to convey  $e$ .

In the boring case (i) the **UTTERANCE** is straightforward and sincere and has no significant other properties and (ii) the symbol deployed carries straightforward conventionalized descriptive content and the formula plausibly reduces as follows.

$$(4) \quad \text{TH}_{\alpha}(d)=u \wedge \text{CONVEY}(d,e) \equiv \text{' } \perp \text{ } u \text{ } \lrcorner \text{ (e) (pure DESCRIPTION)}$$

# Where Does the Flexibility Lie?

We could propose a series of more fine grained predicates relating *d* and *e*, depending on the nature/modality of the similarity evoked.

- (5) DEMO (iconic/auditory): (the symbol used in *d*) demonstrates or has certain auditory properties in common with *e* (onomatopoeia).  
 DEMO(iconic/visual): (the symbol used in *d*) demonstrates or has certain structural properties in common with *e* (spatial iconicity).

However, degree of iconicity involved seems to be dependent more on the *lexical symbol itself* than on the speaker or general contextual or real world knowledge. I propose therefore that the best formal representation uses the general predicate CONVEY which is neutral between the division of labour between demonstration and depiction.

# Onomatopaeia

In fact, many instances of CONVEY *combine* different ways of representing the event in question.

(6) The water whooshed into the room.

$EVT_P : \lambda d \lambda e [\text{UTTERANCE}(d) \wedge \text{TH}_\alpha(d) = \text{whoosh} \wedge \text{'}\ulcorner \text{whoosh} \urcorner (e) \text{'} \wedge \text{'}\lrcorner \text{whoosh} \lrcorner \text{'}$  has properties in common with the sound of e']

(Where I use top corner brackets by convention to pick out the phonological part of the triple corresponding to a symbol of  $D_\mu$ .)

So, the claim here is that degree of iconicity is not built into the choice of predicate relating  $d$  and  $e$ , contra Henderson (2015), but to the presuppositional properties of the symbol deployed.

# Sarcasm

The second way in which the act of deployment can be enriched is when the **UTTERANCE** event  $d$ , is endowed with properties over and above the act of uttering the symbols. This encompasses a range of effects from intonation, to eye-rolling, to co-speech gestures.

(7) *Dialogue 1: Sarcasm*

Speaker A: What did you have for dinner yesterday?

Speaker B: I am trying to lose weight, so I had a huge bowl of kale with some lentils mixed in.

Speaker A: Ooh. That sounds **delicious**. (where red text indicates sarcasm alert intonation).

$$\text{EVT}_{\text{P}} : \lambda d \lambda e [\text{UTTERANCE}(d) \wedge \text{TH}_{\alpha}(d) = \text{sound delicious} \\ \wedge \text{SPEAKER-OF-D DOES NOT BELIEVE}(\ulcorner \text{sound delicious} \\ \urcorner (e)') ]$$

# Co-Speech Gesture

## (8) *Dialogue 2: Co-speech Gesture*

Speaker A: You won't believe what happened when my pipes burst on me last night!

Speaker B: OMG what was it like?!?

Speaker A: The water whooshed into the room. (with wave-like hand gesture simultaneous with pronunciation of verb)

$$\text{EVT}_{\text{P}} : \lambda d \lambda e [\text{UTTERANCE}(d) \wedge \text{TH}_{\text{gesture}}(d) = \Delta \wedge$$

$$\text{TH}_{\alpha}(d) = \text{whoosh} \wedge \text{' } \perp \text{ whoosh } \perp \text{ (e)'} \wedge \text{' } \lceil \text{ whoosh } \rceil \text{ has}$$

$$\text{properties in common with the sound of e'} \wedge \text{'The}$$

$$\text{performance of d has properties in common with the spatial}$$

$$\text{trajectory of e'} \text{ ]}$$

In the latter case, we can see that the deployment event  $d$  can in principle contain information in addition to the actual symbol being deployed.



# Deploying Across Modalities

(9)  $EV_{TP} : \lambda d \lambda e [\text{UTTERANCE}(d) \wedge \text{TH}_\delta(d)=u \wedge \text{CONVEY}(d,e)]$

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DESCRIBE (conventional): ' $\text{TH}_\delta(d)=u \wedge \text{'L } u \text{' } (e)$ '

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DESCRIBE (conventional): ' $\text{TH}_\delta(d)=u \wedge \text{'}\_L u \_J(e)\text{'}$ '

DEMONSTRATE (iconic/auditory): (the symbol used in )  $d$  demonstrates or has certain structural properties in common with  $e$  (onomatopeia).

DEMONSTRATE (iconic/visual): (the symbol used in )  $d$  demonstrates or has certain structural properties in common with  $e$  (spatial iconicity).

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(10) The water whooshed into the room.

$E_{VTP} : \lambda d \lambda e [\text{UTTERANCE}(d) \wedge \text{TH}_\delta(d) = \text{whoosh} \wedge \ulcorner \text{whoosh} \urcorner (e) \wedge \lceil \text{whoosh} \rceil \text{ has properties in common with the sound of } e \rceil]$

(Where I use top corner brackets by convention to pick out the phonological part of the triple corresponding to a symbol of  $D_{\mu \cdot}$ .)

# Languages in the Visual Modality

(11)

$EV_{TP} : \lambda d \lambda e [\text{UTTERANCE}(d) \wedge \text{TH}_\delta(d) = \Delta \wedge \text{'}\lrcorner \Delta \lrcorner \text{'}(e) \wedge$   
 'SHAPE( $\Delta$ ) has properties in common with the spatial trajectory  
 of e']

# Gesture in an Auditory Language

In both auditory and visual mode languages, gesture in a parallel dimension can be folded into the semantics by adding properties to the deployment event  $d$ .

- (12) The water whooshed into the room. (with wave-like hand gesture simultaneous with pronunciation of verb)
- $EV_{TP} : \lambda d \lambda e [UTTERANCE(d) \wedge TH_{\delta}(d) = \text{whoosh} \wedge \ulcorner \text{whoosh} \urcorner (e) \wedge \ulcorner \text{whoosh} \urcorner \text{ has properties in common with the sound of } e \wedge \ulcorner \text{The Visual Performance of } d \text{ has properties in common with the spatial trajectory of } e \urcorner ]$

In the latter case, we can see that the deployment event  $d$  can in principle contain information in addition to the actual symbol being deployed.



# How Quotational Semantics is Different

- By reifying the symbol and the deployment event, QQS allows the symbol to denote partial descriptions of eventive particulars, without committing to the existence of those particulars until the event is existentially closed at the vP level.
- QQS allows a zone of compositional concept building which leaves it open that the inputs to concept building can come from a variety of different sources, including iconic input (both auditory and gestural).

# How Quotational Semantics is Different

- By reifying the symbol qua symbol, QQS offers a better way of integrating iconic and gestural content into the formal semantic representation. (we don't need to relegate it into a post-linguistic pragmatic component).
- The deployment event is integrated early in concept formation, potentially predicting a more central conceptual role for deictic information. Essentially allowing the transition to an objectual representation with referential import, as in Marr's visual model.

# Conclusion

Symbolic self consciousness and the *reusability* of open class items is necessary for a generative meaning engine.

This is essentially a 'third factor' design aspect of language which does the work here. This is the crucial factor that motivated the quotational system in the first place, and implementing it with this quotational operator allowed us to begin to see how we can explain the cartographic generalizations.

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