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# Multimodal Propositions? From Semiotic to Semantic Considerations in the Case of Gestural Deictics



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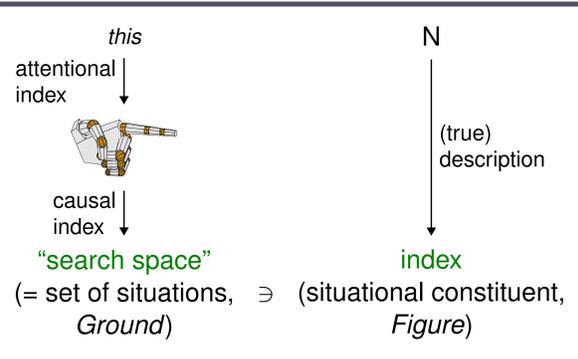
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## Multimodality

Utterances that comprise elements that are perceived by different sense modalities and are coded according to a non-linguistic code are **multimodal utterances** (cf. FRICKE 2012). An example for non-linguistically coded signs are indexicals like pointing gestures, which, according to PEIRCE, bear some **nomological**, **causal** or **attentional** relation to their objects (CP 1.372, 2.248, 2.285). How is this difference in interpretation of nonlinguistic elements treated in semantic theories?

[Integrated view on pointing]



## Comparison

### Semiotics

- affectedness
- non-symbolic code
- focusing attention

### Semantics

- form-based interpretation
- perspectivity
- token-reflexivity

## Index vs. Referent

The entity (object, property, situation, ...) pointed at is called the **index** and does not need to coincide with the entity talked about, the **referent** (terminology from KÜHNLEIN 1999) – see example 2 below.

## Example

1. “This egg” + is good in  $s_1$  but not in  $s_2$  or  $s_0$
2. “This hen” + is good in  $s_1$  but not in  $s_2$  or  $s_0$
3. “The left egg” is good in  $s_0$

Contribution of deictic gesture

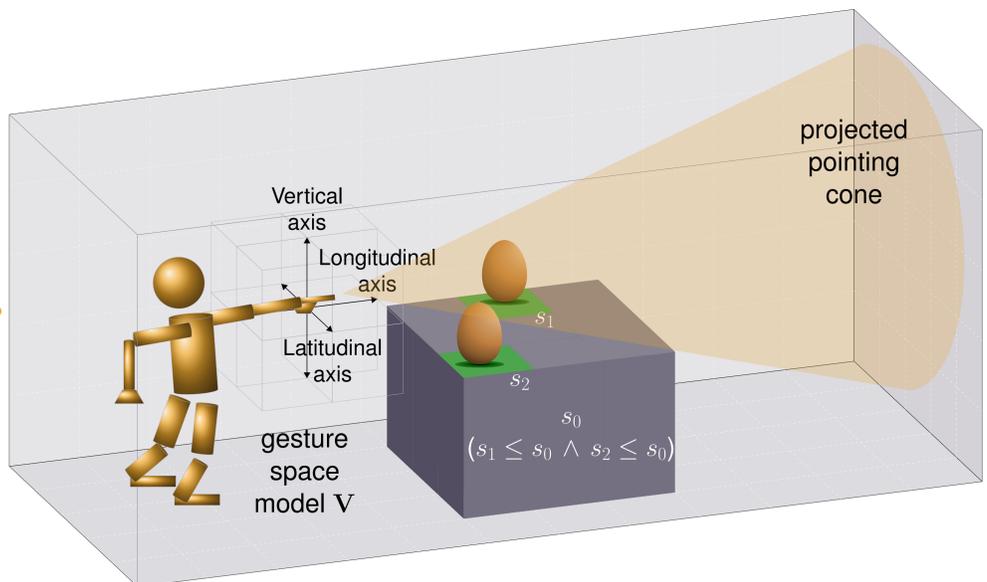
## Spatial Extension of Pointings

The extension of a pointing gesture  $G$  is specified in terms of the set of situations whose regions intersect with the **pointing cone**  $r(G)$  (cf. KRANSTEDT ET AL. 2006):

$$[[\text{pointing hand}]]^M = \{e \mid \text{region}(e) \cap r(G) \rightsquigarrow \max_i\}$$

' $\rightsquigarrow \max_i$ ' picks out the  $i$  situations that have the largest overlap with the pointing cone.

relates to



is given by

## Reconstructing the pointing cone

The region encircled by a gesture  $G$  is determined by the set of vectors emanating in gesture space  $V$  in the direction of the pointing hand/finger. The corresponding cone covers the following subspace  $r(G) \in R \subset V$ :  $r(G) = \{\mathbf{v} \mid \text{proj}_{\text{LONG}} \mathbf{v} < \text{proj}_{\text{VERT}} \mathbf{v} \wedge \text{proj}_{\text{LONG}} \mathbf{v} < \text{proj}_{\text{LAT}} \mathbf{v}\}$  (where  $\text{proj}_y \mathbf{u}$  is the orthogonal projection from vector  $\mathbf{u}$  onto line  $y$ ).

provides shared resource

## Model

A model  $M$  for gestural deictics is an octuplet of the form  $\langle S, D, \leq, L, \triangleleft, R, \mathbf{V}^*, V \rangle$ , where the ingredients are as follows:

- ▶  $S$  is a set of situations;
  - ▶  $D$  is a domain of individuals;
  - ▶  $\leq$  is a partial function over  $S$ . For all  $s \in S$  there is exactly one  $s' \in S$  such that  $s \leq s'$ , and for all  $s'' \in S$ , if  $s \leq s''$ , then  $s' = s''$ ;
  - ▶  $L$  is set of locations  $\{l \mid l \in \mathbb{R}^3\}$  (time is treated according to a separate timeline, which is of no impact here);
  - ▶  $\triangleleft$  is a complete order over  $L$ , namely the order of spatial vicinity;
  - ▶  $R$  is a set of regions, where any region  $r$  is a  $\triangleleft$ -connected subset of  $\text{Pow}(L)$ ;
  - ▶  $\mathbf{V}^*$  is a set of vector spaces;
  - ▶  $V$  is a valuation function for interpreting constants.
- The ingredients are interrelated in the following way:
- ▶ a function  $\text{cons} \subseteq D^n \times S$  assigns situations their constituents;
  - ▶ a function  $\text{region} \subseteq R \times S$  assigns every situation its spatial extension;
  - ▶ a function  $\text{place} \subseteq L \times D$  locates individuals. for all  $d \in D$  and  $s \in S$ :  $\text{place}(d) \in \text{region}(s) \leftrightarrow d \in \text{cons}(s)$ ;
  - ▶ a function  $\text{space} \subseteq D \times \mathbf{V}^*$  assigns a vector space  $\mathbf{V} \in \mathbf{V}^*$  to each individual  $d \in D$ . The origin of the vector space  $d$ ,  $O(\mathbf{V}_d)$  is at  $\text{place}(d)$  by default;
  - ▶ a function  $\text{speaker} \subseteq S \times D$  defines the speaker in a situation (a speaker is a constituent of  $s$  with the property of speaking in  $s$ ).

## Semantic Integration: Figure-Ground Model

- ▶ Demonstrative descriptions like “This egg” carry the **presupposition** that interlocutors are attended to a shared resource (represented as an open variable for a situation,  $\dot{S}$ ; the **Ground**) for finding the index (i.e., the **Figure**) (CLARK & MARSHALL 1981; ROBERTS 1993; POESIO 1993).
- ▶ Example: “This egg” +
  - “This egg”  $\rightsquigarrow (\dot{S} \models \text{rx}[\text{EGG}(x)]) \wedge \text{ATT}(\text{spkr}, \text{hearer}, \dot{S})$
  - $\rightsquigarrow \dot{S} \in \{e \mid \text{region}(e) \cap r(G) \rightsquigarrow \max_i\}$
- ▶ The Figure-Ground model of gestural deictics differs from previous accounts to pointing (e.g., RIESER 2004; LASCARIDES & STONE 2009) in that
  - the gesture contributes in providing the **circumstance** against which the demonstrative description is evaluated;
  - the oriented gesture space in addition to the spatial model provides an **explicit** representation for the spatial meaning of pointing;
  - semiotic properties like **focusing attention** are reflected.

is evaluated in



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