



Pointing: From reference to attention and back

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Bochum Language Colloquium, 03 May 2022

Ways of pointing¹

→ *demonstrating*



“then the house is like this”

→ *indicating*



“Can you jump over this spout?”

¹H. H. Clark (1996). *Using Language*. Cambridge: Cambridge University Press.

Uses of Demonstratives

Exophoric (deictic, perceptual)²

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⁴ W. V. O. Quine (1968). “Ontological Relativity”. In: *The Journal of Philosophy* 65.7, pp. 185–212; G. Nunberg (1993). “Indexicality and Deixis”. In: *Linguistics and Philosophy* 16.1, pp. 1–43.

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Endophoric (anaphoric, cataphoric)³

Städel has a new painting_i. *This painting_i* is by Chagall.

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This painting [nodding towards a canvas] is by Chagall.

Endophoric (anaphoric, cataphoric)³

Städel has a new painting_i. *This painting_i* is by Chagall.

Deferred reference⁴

This painter [nodding towards a canvas] is the most expensive one.

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Unified Semantics⁵

- ▶ Configuration: $[\text{DemNP}[[\text{that } i]R]\text{NP}]$
 - ▶ i : contextually given index, $g(i)$.
 - ▶ R : salient relation (eventually bridging between $g(i)$ and $[\text{NP}]$, defaults to identity).
 - ▶ The relation variable R can be *bound*, capturing endophoric uses.

⁵P. Elbourne (2008). “Demonstratives as Individual Concepts”. In: *Linguistics and Philosophy* 31.4, pp. 409–466.

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 - ▶ The relation variable R can be *bound*, capturing endophoric uses.
- ▶ **Problems:**
 - ▶ **No index** in case of endophoric uses.
 - ▶ **Directly referential** assignment $g(i)$ is too simplistic.
 - ▶ No representation of **demonstration act**.

⁵P. Elbourne (2008). “Demonstratives as Individual Concepts”. In: *Linguistics and Philosophy* 31.4, pp. 409–466.

Claims

- ▶ Real word referents and discourse referents have *different identification conditions*.
- ▶ This difference becomes effective in *indirect reference (bridging vs. deference)* and *clarification*.
- ▶ Simple unified theories of demonstratives make incomplete or false predictions wrt. such cases.
- ▶ TODO: provide better account (→ DemNPs as processing instructions).

Outline

1. Bridging demonstratives, clarifying indices
2. Pointing and deferred reference
3. DemNPs as processing instructions



Bridging demonstratives, clarifying
indices

Indirect reference

- ▶ Indirect reference happens iff index \neq referent.
- ▶ Endophoric indirect reference is known as *bridging*⁶, exophoric indirect reference is known as *deferred reference*⁷.
- ▶ If unified approaches are correct, then endophorically and exophorically used demonstratives should behave similar.

⁶ H. H. Clark (1975). “Bridging”. In: *Proceedings of the 1975 Workshop on Theoretical Issues in Natural Language Processing*. TINLAP ’75. Cambridge, Massachusetts: Association for Computational Linguistics, pp. 169–174.

⁷ W. V. O. Quine (1968). “Ontological Relativity”. In: *The Journal of Philosophy* 65.7, pp. 185–212; G. Nunberg (1993). “Indexicality and Deixis”. In: *Linguistics and Philosophy* 16.1, pp. 1–43.

Asymmetry in indirect reference

- ▶ Deferring from painting to painter:
 - (1) That[ : *demonstrating a painting*] painter is my favorite one.
- ▶ Corresponding bridging is not possible, however:
 - (2) I saw a beautiful *painting* in the museum.
 - a. *?That painter* is my favorite one.
 - b. That painting is my favorite one.
 - c. The painter is my favorite one.

Contrast

- ▶ Demonstrative bridging is possible if a contrast is exploited, as is argued by Wolter⁸ by example of the following sentences:
- (3) a. A car drove by. The horn was honking. Then another car drove by. *That horn* was honking even louder.
- b. A car drove by. The horn was honking. Then another car drove by. *?The horn* was honking even louder.
- c. *?A car* drove by. *That horn* was honking.

⁸L. Wolter (Jan. 2006). *Bridging Demonstratives at the Semantics-Pragmatics Interface*. Talk presented at the LSA Annual Meeting.

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- b. A car drove by. The horn was honking. Then another car drove by. *?The horn* was honking even louder. [not unique]
- c. *?A car* drove by. *That horn* was honking. [no contrast]

⁸L. Wolter (Jan. 2006). *Bridging Demonstratives at the Semantics-Pragmatics Interface*. Talk presented at the LSA Annual Meeting.

No problem for deference

- (3) [Context: *One car is driving by.*] *That*[] *horn* is honking.

This also works for the contrastive set of two cars:

- (4) [Context: *Two cars are driving by.*] *That*[] *horn* is honking.

Rephrasing

- ▶ Indirect reference is licensed by a formula like *the X of that Y*, where *X* is the inferred referent and *Y* the demonstratum.
 - ▶ Rephrasing the examples according to that matrix:
- (5) a. A car drove by. The engine stuttered. Then another car drove by. The engine of that/?the car stuttered, too.
- b. A car drove by. The engine of that/the car stuttered. [no contrast needed any more!]
- c. [Context: *A car is driving by.*] The engine of that[] car stutters.

Identification by repetition

- (8) a. A car drove by. The engine stuttered. Then another car drove by. The engine of that car stuttered, too.
- b. A car drove by. The engine of that car stuttered.
-
- ▶ Commonality: *re-use* of expression: “car”.
 - ▶ Clue to identification requirement of demonstratives?

Identification by repetition

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Identification by repetition

Discourse referents are identified by a *repetition* of the linguistic material associated with them.

Uptake of bridge

- ▶ Reconsidering bridging with “identification by repetition”-view.
 - ▶ Bridging is licensed only if the bridging demonstrative takes up a canonical bridge:
- (6) a. A car drove by. **The engine** stuttered. Then another car drove by. *That engine* stuttered, too.
- b. A car drove by. **The engine** stuttered. Then another car drove by. **?That horn** was honking.

Inferential base

- ▶ The “inferential bases” have to be sufficient similar even in case of an uptake of the canonical bridge:
- (7) a. A *car* drove by. The horn was honking. Then a **gnu** walked by. ?That horn was scuffed.
- b. A *car* drove by. The horn was honking. Then a **motorbike** drove by. That horn was honking, too.

Free base for deferring

► No uptake of bridge required:

- (8) a. [Context: *A car is driving by.*] *That*[] engine stutters.
b. [Context: *Another car is driving by.*] *That*[] horn is honking.

► No similar inference base required:

- (9) a. [Context: *A car is driving by.*] *That*[] horn is honking.
b. [Context: *Then a gnu is walking by.*] *That*[] horn is scuffed.

Semantic parallelism

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Bridging demonstratives require a *canonical bridge* from *similar antecedents*.

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Bridging demonstratives require a *canonical bridge* from *similar antecedents*.

- ▶ Deferrals do not underlie semantic parallelism.
- ▶ If this view is broadly correct, then bridging demonstratives involve a kind of co-text look-up for finding matching expressions.
- ▶ This is as expected in light of the “identification by repetition” constraint.

Summary

Identification by repetition

Discourse referents are identified by a *repetition* of the linguistic material associated with them. (*Modulo* hypernyms.)

Semantic parallelism

Bridging demonstratives require a *canonical bridge* from *similar antecedents*.

Identity conditions

- ▶ Discourse referents are distinguished *numerically*, they can be identified by sameness of description or counting.
- ▶ Real world referents are identified *perceptually*, they allow for a plurality of classifications (any classification which is perceptually grounded).

Reprise Content Hypothesis

Reprise Content Hypothesis (strong version; Purver & Ginzburg 2004⁹)

A nominal fragment reprise question queries exactly the standard semantic content of the fragment being reprised.

⁹ M. Purver and J. Ginzburg (2004). “Clarifying Noun Phrase Semantics”. In: *Journal of Semantics* 21.3, pp. 283–339.

Clarification potential of exophoric DemNPs

(10) A. This[] painting is by Chagall.

B. This[] painting?

~ *The object over there?*

~ ?? *What do you mean ‘painting’?*

~ ?? *Which one?*

A. Right, this painting. / No, the one to the left.

?? Well, maybe it’s a drawing.

- ▶ *Ceteris paribus (intonation!), the reprise fragment DemNPs is restricted to the identity of the index.*

Skipping CN

(11) A. This[] painting is by Chagall.

B. This[] painting?

This[] one?

This[]?

- ▶ The head noun can be skipped, emphasizing the index-related clarifying potential of exophoric DemNPs.

Clarifying deferrals

Likewise, the clarification potential of deferred reference concerns only the index:

- (12) [Context: *A and B are looking at some painting.*]

- A. This[] painter died at an early age.
- B. This[] painter?
 - ~ ?? *What do you mean 'painter'?* (CN)
 - ~ ?? *Wouldn't be 'drawer' a better classification?* (bridge)
 - ~ *The painter of this painting?* (index)
 - ~ ?? *Which one?* (index or referent)
 - ~ ?? *There is no painter, there is just a painting* (referent)
- A. ?? Well, the painter of this painting.
?? Well, this drawer.
Yes, this one. / No, that one.

No index reachable for endophoric DemNPs ...

In case of anaphoric uses, requesting an index seems not to be feasible:

- (13) A. I saw a painting yesterday. This painting was shocking.
- B. This painting?
- ~ *Which one?*
- ~ ?? *The object over there?*
- ~ ?? *What do you mean ‘painting’?*
- A. The painting I saw yesterday. / The painting I just mentioned.
 ?? This one.

...and bridging demonstratives

(14) A. Mary talked to no senator before that senator was lobbied.

B. That senator?

~ *Which senator?*

~ ?? *What do you mean ‘senator’?*

A. (i) (?) The group of senators Mary talked to.

(ii) The one from the (group of) senators Mary talked to.

- ▶ Note that A's first answer (i) corresponds to the “Elbourne index” for bound DemNPs, which does not seem to provide a smooth answer to the request.

Even no skipping

- (15) A. I saw a painting yesterday. This painting was shocking.
- B. This painting?
- ?? This one?
- ?? This?

Conclusion

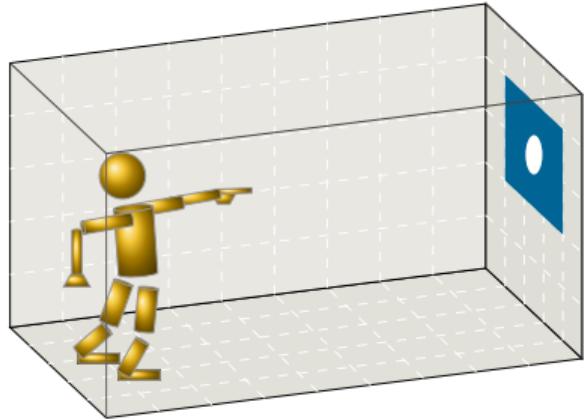
- ▶ Exophoric DemNPs are identified with reference to their (perceptual) indices.
- ▶ Endophoric DemNPs involve just an abstract discourse referent, which is not accessible as demonstratum.
- ▶ Unified approaches resting on “discourse deixis” makes false predictions with regard to this differences. (No unification possible *via* index.)

Pointing and deferred reference

Deferred reference

“This painter is great!”

^aG. Nunberg (1993). “Indexicality and Deixis”. In:
Linguistics and Philosophy 16.1, pp. 1–43.

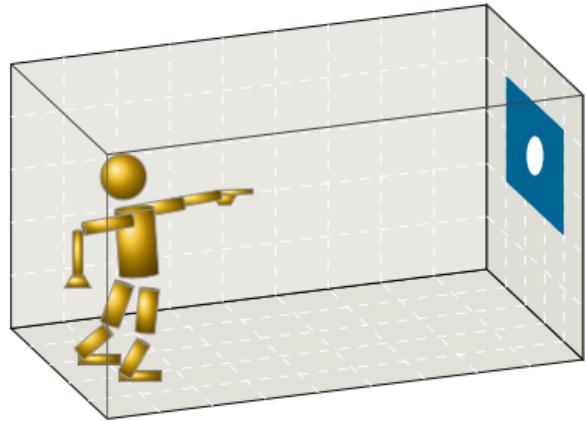


Deferred reference

“This painter is great!”

- ▶ index \neq referent
- ▶ Two stage process:^a
 1. Identify index
 2. Identify referent by means of a *salient relation*

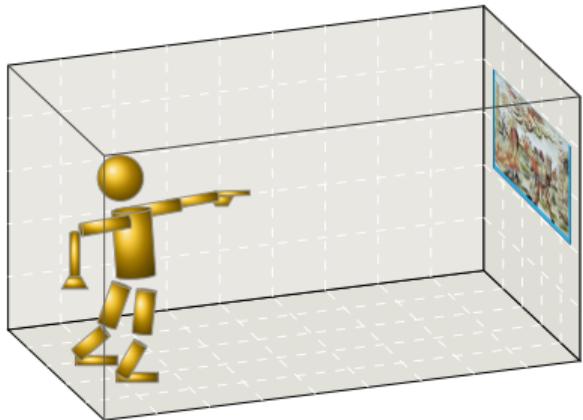
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Double deference

- ▶ “This era was a dark one.”

Image source: *Wikimedia Commons*, drawing from the Wickiana, a collection of news reports from the 16th century

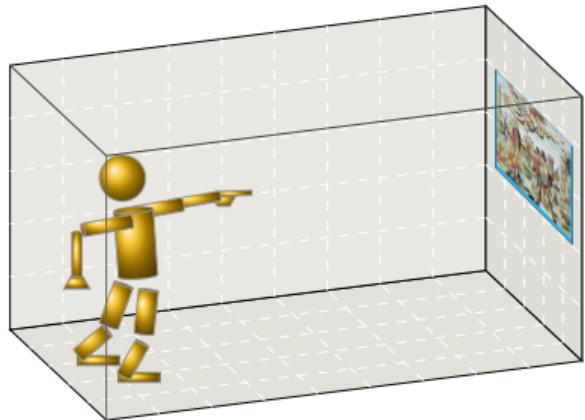


Double deference

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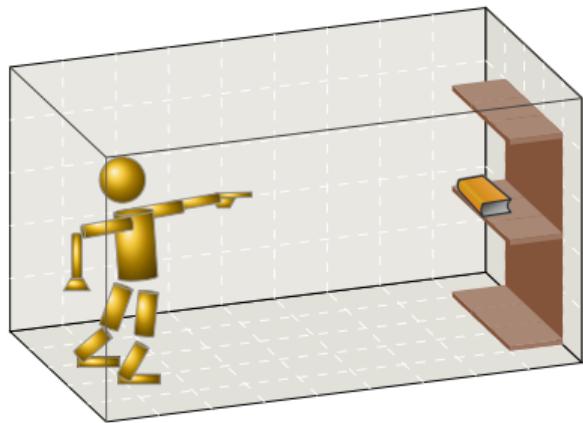
Image source: *Wikimedia Commons*, drawing from the Wickiana, a collection of news reports from the 16th century

- ▶ Three stage process:
 1. Identify index
 2. Identify intermediate referent (subject)
 3. Identify referent by means of a *salient relation* (historic epoch of subject)



At home with George¹⁰

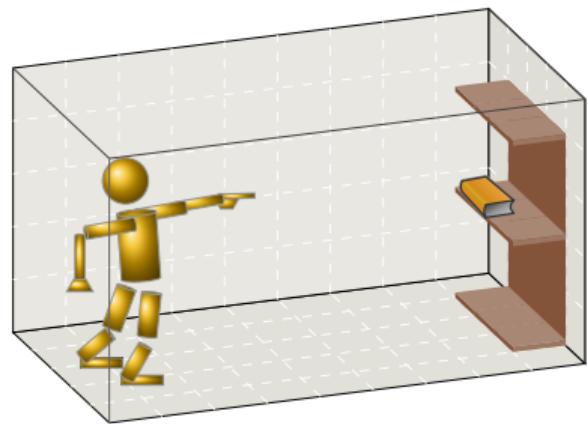
- ▶ George pointing at a copy of Wallace Stegner's novel *Angle of Repose* which lies on a bookshelf
- ▶ Assumption: index = book



¹⁰H. H. Clark (1996). *Using Language*. Cambridge: Cambridge University Press.

At home with George¹⁰

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concrete deixis

“That book is mine.”

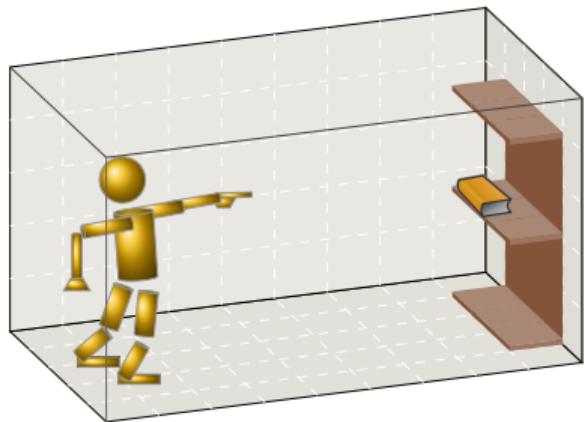
deferred reference

“That publisher is a good one.”

¹⁰ H. H. Clark (1996). *Using Language*. Cambridge: Cambridge University Press.

At home with George

- ▶ George pointing at a copy of Wallace Stegner's novel *Angle of Repose* which lies on a bookshelf
- ▶ **Assumption: index = book**



not: concrete deixis

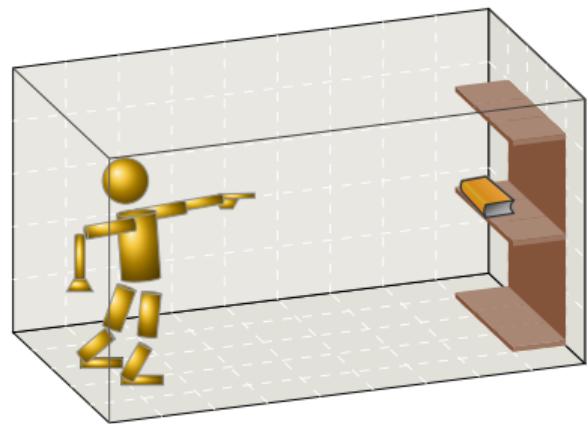
“That shelf is mine.”

not: deferred reference

“That craftsman is a good one.”

At home with George

- ▶ George pointing at a copy of Wallace Stegner's novel *Angle of Repose* which lies on a bookshelf
- ▶ **Assumption: index = book**



deferred reference

“That shelf is mine.”

double deferred

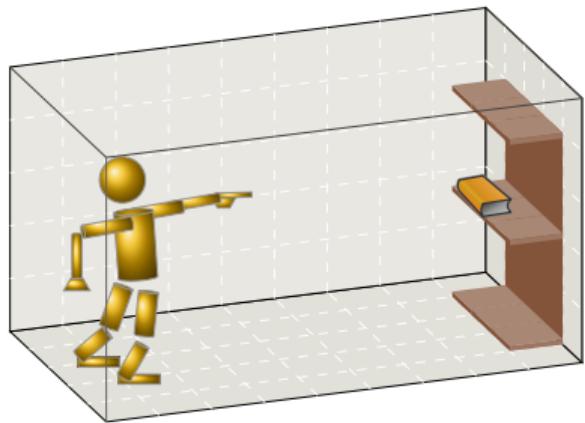
“That craftsman is a good one.”

“salient functional relation”:

1. factual *lies-on* relation.
2. 1. + *producer* relation.

At home with George

- ▶ George pointing at a copy of Wallace Stegner's novel *Angle of Repose* which lies on a bookshelf
- ▶ Analogous for index = bookshelf

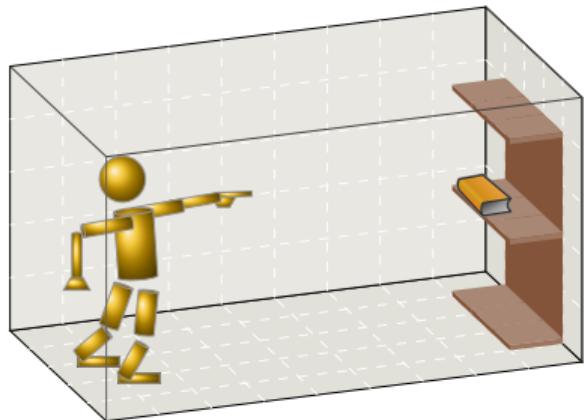


At home with George



- Contra-intuitive
- Four meanings (two deferrals, two double deferrals) more than necessary: violation of a variant of *Modified Occam's Razor*^a: **Do not multiply deferrals beyond necessity!**

^aH. P. Grice (1978). "Further Notes on Logic and Conversation". In: *Pragmatics*. Ed. by P. Cole. Syntax and Semantics 9. New York, San Francisco, and London: Academic Press, pp. 113–127.



Underlying assumptions

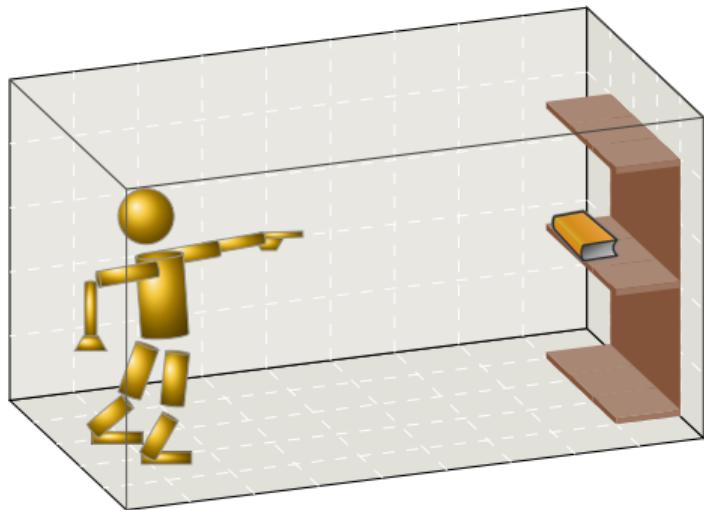
1. A pointing gesture is **referential** in the sense that it picks out an object.
2. A pointing gesture is **autonomous** in the sense that it demonstrates its index independently from accompanying speech (Kaplanian autonomy of demonstrations).
3. The **index need not be the referent**.

Underlying assumptions

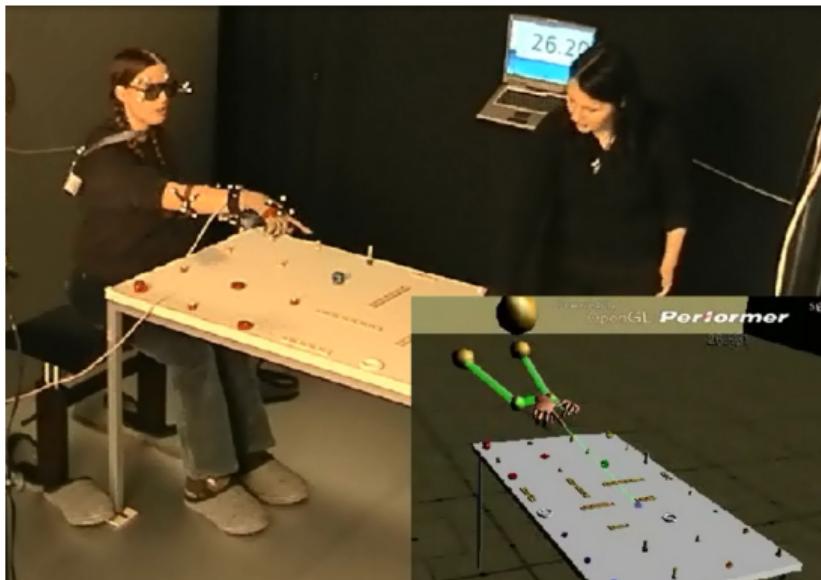
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Re-analysis

- ▶ Depending on George saying
 - ▶ “That book”
 - ▶ “That shelf”
- the index is understood to be the book or the bookshelf, respectively.
- ▶ Contradicting the autonomy of demonstration.
- ▶ Empirical support: Pointing cone studies speak against direct reference.



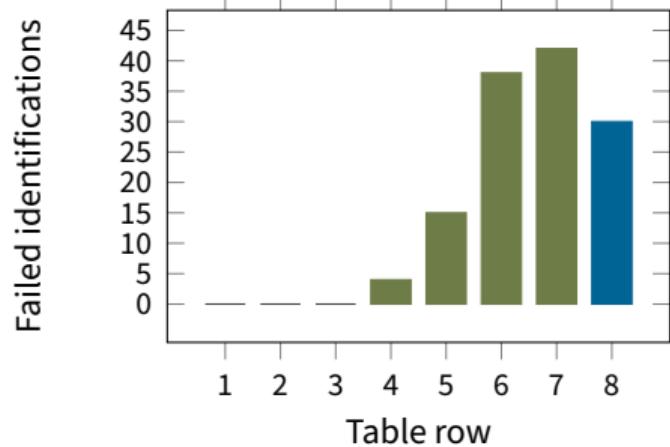
Direct Reference?¹¹



- ▶ *Experimental pragmatics* study.
- ▶ *Tracking of pointer*: simulate and “measure” pointing.

¹¹ A. Lücking, T. Pfeiffer, and H. Rieser (2015). “Pointing and Reference Reconsidered”. In: *Journal of Pragmatics* 77, pp. 56–79.

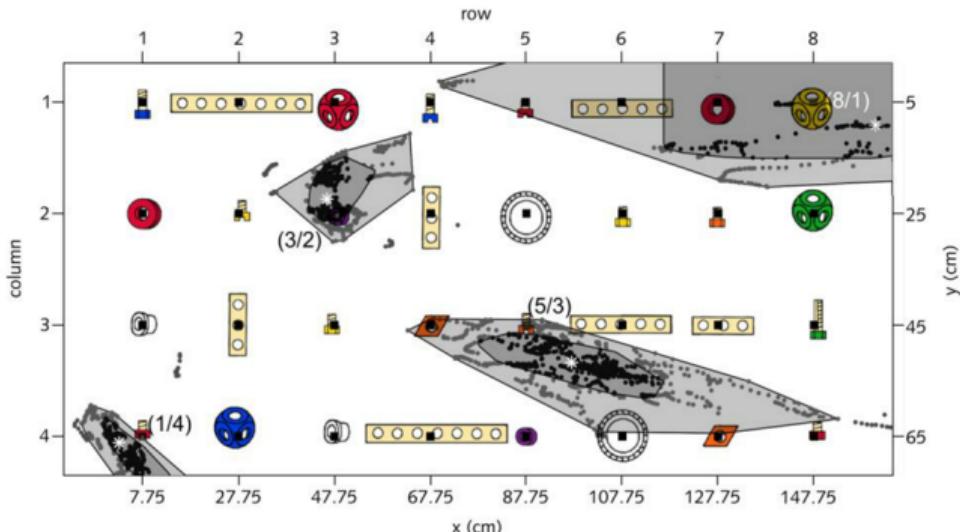
Identification Failures¹²



- ▶ For the addressee, the identifying force of pointings ceases in distal area.
- ▶ Note: decrease in row 8 due to “gestural hyperbole”.

¹² A. Lücking, T. Pfeiffer, and H. Rieser (2015). “Pointing and Reference Reconsidered”. In: *Journal of Pragmatics* 77, pp. 56–79.

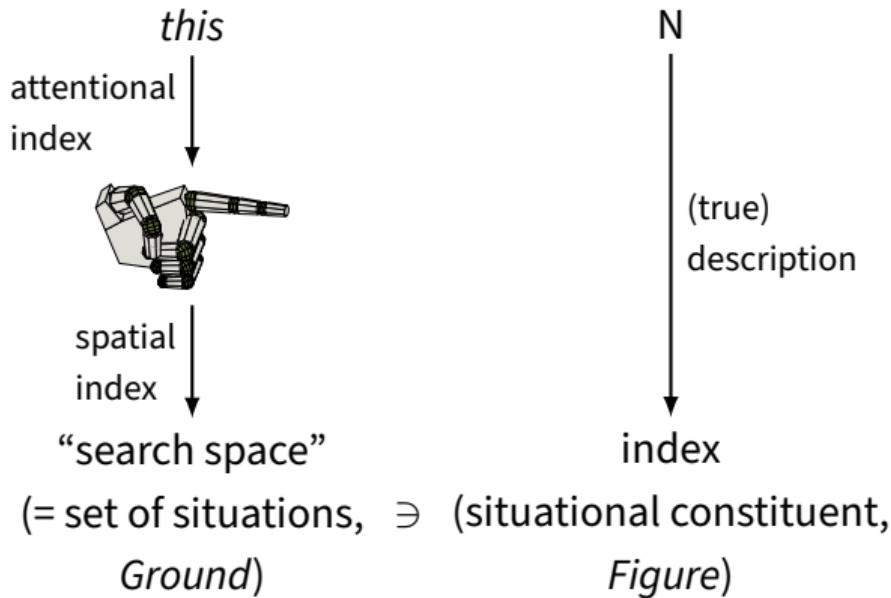
Pointing Cone¹³



- ▶ Even in proximal area pointings do not hit their targets.
- ▶ Demonstrative reference rests on a *pre-semantic pragmatic inference*.

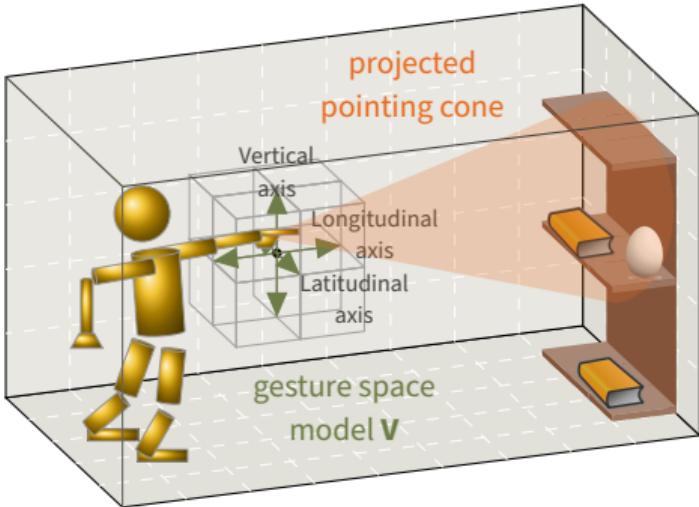
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New proposal: figure-ground model



Spatial Semantics

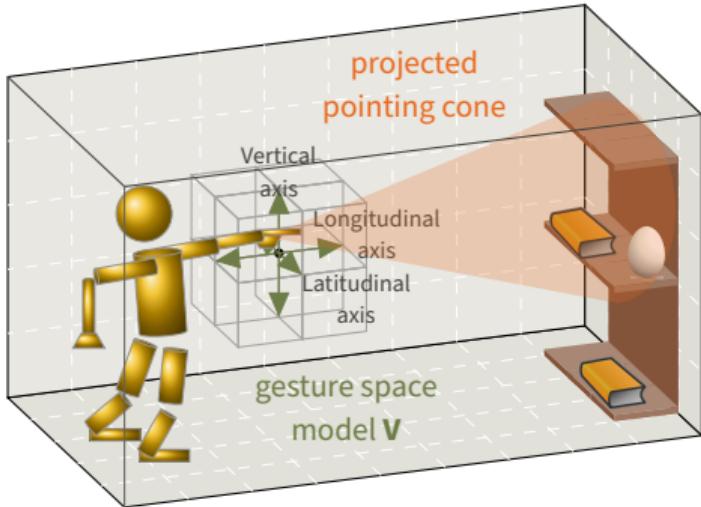
(Lücking, still not published...)



Spatial Semantics:
Demonstrations *constrain*
situation variables.

Spatial Semantics

(Lücking, still not published...)

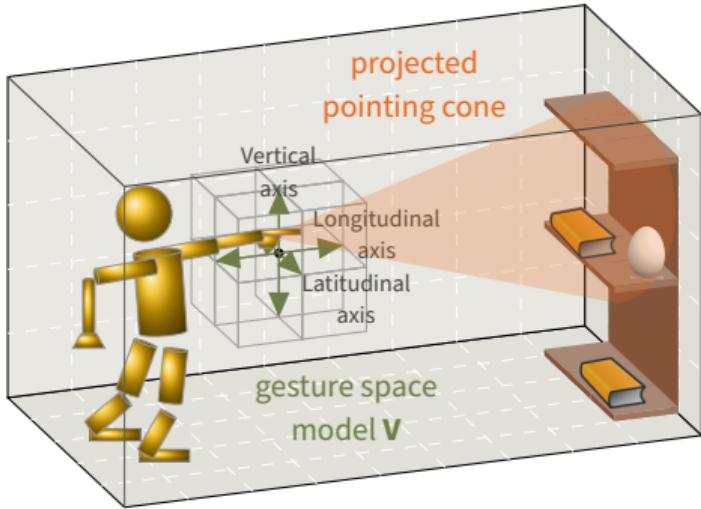


Spatial Semantics:
Demonstrations constrain
situation variables.

- ▶ Pointing's character at u : $\llbracket \text{pointing} \rrbracket^u = \lambda s. \text{region}(s) \cap \text{cone}(\text{pointing})(u) \mapsto \text{relmax}$
In short: $\text{pointing}(s) \mapsto \max_i$

Spatial Semantics

(Lücking, still not published...)



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Demonstrations constrain
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- ▶ Pointing's character at u : $\llbracket \text{pointing} \rrbracket^u = \lambda s. \text{region}(s) \cap \text{cone}(\text{pointing})(u) \mapsto \text{relmax}$
In short: $\text{pointing}(s) \mapsto \text{max}_i$
- ▶ This pointing book is great: $\lambda s. \text{book}(s) \wedge \text{pointing}(s) \mapsto \text{great}_i$ is great in s .
using Elbourne's situation semantics system

DemNPs as processing instructions

Processing semantics of DemNPs

The dynamic semantics of DemNPs in dialog is governed by the following three-fold processing rule: “Where to find the referent?”

Processing instructions for DemNPs

1. If there is a demonstration act, then the DemNP contributes to dgb-params and is witness-loaded in the focus of attention (*via* pointing cone).
2. If there is no demonstration, but a repetition of a constituent, the DemNP is interpreted anaphorically (also in dgb-params).
3. Otherwise, the DemNP contributes to q-params (but not to FoA).

TTR

Type Theory with Records—a cognitively construable formalism grounded in set theory¹⁴

- ▶ *Basic types* (*BType*; 0-place; *Ind*, *Loc*, *Time*, ...);
- ▶ *Predicate types* (*PType*; *n*-place; *lion(x)*, *carry(x,y)*, ...), constructed out of a predicate and objects which are arguments of the predicate;
- ▶ *Set and list types* (*Set(T)* and *List(T)*).
- ▶ *Function types*. ($T_1 \mapsto T_2$) is the type of functions from type T_1 to type T_2 ;
- ▶ *Records*: entities corresponding to **situations**,
- ▶ *Record types*: structured representations classifying records, **situation types**;

¹⁴ R. Cooper (2021). *From perception to communication: An analysis of meaning and action using a theory of types with records (TTR)*. <https://github.com/robincooper/ttl>. Unpublished book draft.

TTR

- ▶ A key notion in TTR is a *judgement*, a classification that object o is of type T , notated as $o : T$.
- ▶ If the judgement is true, than the extension $[^\vee T]$ of T is non-empty
- ▶ Judgements between records and record types, that is classifications such that a record r being of a record type RT , $r : RT$, give rise to **witnessing** between situations and situation types.

$$r = \begin{bmatrix} x = a \\ c_{\text{lion}} = e1 \end{bmatrix} \quad T_{\text{lion}} = \begin{bmatrix} x : \text{Ind} \\ c_{\text{lion}} : \text{lion}(x) \end{bmatrix} \quad r : T_{\text{lion}} \text{ just in case } a : \text{Ind} \text{ and } e1 : \text{lion}(a)$$

Propositions

Following Austin (1950) and Barwise & Etchemendy (1987), propositions are individuated in terms of a situation and a situation type:¹⁵

- ▶ $Prop := \begin{bmatrix} sit & : Rec \\ sit\text{-type} & : RecType \end{bmatrix}$
- ▶ A proposition $p = \begin{bmatrix} sit & = s_0 \\ sit\text{-type} & = ST_0 \end{bmatrix}$ is true iff $s_0 : ST_0$

¹⁵ J. L. Austin (1950). “Truth”. In: *Proceedings of the Aristotelian Society. Supplementary*. Vol. xxiv. Reprinted in John L. Austin: *Philosophical Papers*. 2. ed. Oxford: Clarendon Press, 1970., pp. 111–128; J. Barwise and J. Etchemendy (1987). *The Liar: An Essay on Truth and Circularity*. Oxford: Oxford University Press.

Locutionary and illocutionary propositions¹⁶

► *Sign* :=

phon	: List(Phonform)
cat	: [head : PoS]
dgb-params	: RecType
q-params	: RecType
cont	: SemObj

(grammatical type in HPSG_{TTR}, with
interface to context)

► *LocProp* := $\left[\begin{array}{l} \text{sit} : \text{Rec} \\ \text{sit-type} : \text{Sign} \end{array} \right]$

(grammatical type classifying speech event via phon)

► *IllocProp* := $\left[\begin{array}{l} \text{sit} : \text{Rec} \\ \text{x} : \text{Ind} \\ \text{y} : \text{Ind} \\ \text{a} : \text{Prop} \vee \text{Question} \vee \text{Outcome} \\ \text{R} : \text{IllocRel} \end{array} \right]$

$\text{sit-type} = \left[\text{c1} : \text{R(x,y,a)} \right] : \text{RecType}$

(dialogue move)

¹⁶ J. Ginzburg (2012). *The Interactive Stance: Meaning for Conversation*. Oxford, UK: Oxford University Press.

Context for signs: dialogue gameboards¹⁷

DGBTType :=

spkr	: <i>Ind</i>
addr	: <i>Ind</i>
utt-time	: <i>Time</i>
c-utt	: addressing(spkr,addr,utt-time)
facts	: <i>Set(Prop)</i>
vis-sit	= $\left[\text{foa} : \text{Ind} \vee \text{Rec} \right] : \text{RecType}$
pending	: <i>List(LocProp)</i>
moves	: <i>List(IllLocProp)</i>
qud	: <i>poset(Question)</i>
mood	: <i>Appraisal</i>

- ▶ *facts* represents shared assumptions
- ▶ *vis-sit* represents the visual situation of an agent
- ▶ dialogue moves that are in the process of being grounded or under clarification are the elements of the *pending* list
- ▶ grounded moves make up the *moves* list.
- ▶ *qud*: the current question under discussion
- ▶ *mood*: a participant's public display of emotion

¹⁷ J. Ginzburg (2012). *The Interactive Stance: Meaning for Conversation*. Oxford, UK: Oxford University Press.

Evolution of context in interaction

- ▶ *Conversational rules* regiment dialogue progress: given a dialogue gameboard (DGB) that satisfies *pre*(conditions), the DGB can be updated by *effects*.
- ▶ Example: *Assert QUD-incrementation*: given a proposition p and $\text{Assert}(A, B, p)$ being the LatestMove, QUD is updated with $p?$ as MaxQUD.

$$\begin{aligned} \text{pre} : & \left[\begin{array}{l} p \\ \text{LatestMove} = \text{Assert}(\text{spkr}, \text{addr}, p) : \text{IllocProp} \end{array} \right] \\ \text{effects} : & \left[\begin{array}{l} \text{QUD} = \langle p?, \text{pre.QUD} \rangle : \text{poset}(\text{Question}) \end{array} \right] \end{aligned}$$

- ▶ DGB structures might seem like an overly rich notion for interlocutors to keep track of, but they can be mapped to memory structures¹⁸

¹⁸ J. Ginzburg and A. Lücking (2020). “On Laughter and Forgetting and Reversing: A neurologically-inspired model of conversational context”. In: *Proceedings of the 24th Workshop on the Semantics and Pragmatics of Dialogue*. SemDial/WatchDial. Brandeis University, Waltham, New Jersey (Online).

Lexical resource for pointing

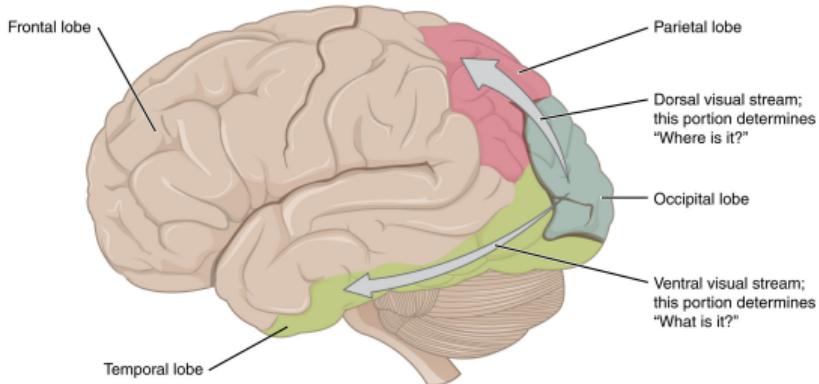
The pointing device gives rise to a direction vector which indicates the direction into which the addressee of the pointing should turn its attention.

(16)
$$\begin{aligned} & \left[\begin{aligned} & \text{shape:pointing} \\ & \text{dir=Vector(shape)} : \text{Direction} \end{aligned} \right] \\ & \text{dgb-params:} \left[\begin{aligned} & \text{spkr} : \text{Ind} \\ & \text{addr} : \text{Ind} \\ & \text{utt-time} : \text{Time} \\ & \text{c-utt} : \text{addressing(spkr,addr,utt-time,shape)} \end{aligned} \right] \\ & \left[\begin{aligned} & \text{content = Instruct(skpr,addr,turn(addr.e}_{\text{gaze}},\text{dir})) : \text{IllocProp} \end{aligned} \right] \end{aligned}$$

Two processing streams

- ▶ Vision proceeds along a dorsal “where” and a ventral “what” processing stream^a.
- ▶ Broadly, the dorsal pathway runs from the occipital lobe to the parietal lobe, the ventral one from the occipital lobe to the temporal lobe.

^a M. Mishkin, L. G. Ungerleider, and K. A. Macko (1983). “Object vision and spatial vision: Two cortical pathways”. In: *Trends in Neurosciences* 6, pp. 414–417; D. A. Westwood and M. A. Goodale (2011). “Converging evidence for diverging pathways: Neuropsychology and psychophysics tell the same story”. In: *Vision Research* 51.8. Perception and Action: Part II.



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Subsystems

- ▶ The dorsal “where” stream may be differentiated into two pathways, a “Grasp” and a “Use” system¹⁹.
- ▶ The “Grasp” system is responsible for prehensile actions to be executed at currently-viewed objects; the “Use” system is a long-term storage for action patterns associated with familiar objects.

¹⁹ F. Binkofski and L. J. Buxbaum (2013). “Two action systems in the human brain”. In: *Brain and Language* 127.2, pp. 222–229.

Pointing and visual processing

- ▶ On the spatial view unfolded in this section, pointing (as demonstration acts in general) is a “dorsal mechanism”: it contributes *where* information.
- ▶ But this leaves the follow-up question of how to account for the intuitively strong impression that we are pointing *at something*?
- ▶ The *what*, that is, the object to be indicated is contributed by vision—strongly mediated by the descriptive information from speech.
- ▶ The object in the visual field is provided by visual object perception, which among others rests on visual salience²⁰—which in semantics and pragmatics is captured in terms of pointing cones and *pre-semantic pragmatic inference*

²⁰C. O’Callaghan (2008). “Object Perception: Vision and Audition”. In: *Philosophy Compass* 3.4, pp. 803–829.

From attention to reference

- ▶ Establishing pragmatic reference—that is filling the value of *foa* within the addressee's vis-sit—is brought about by combining the ventral and dorsal processing streams²¹ such that an object becomes the unit of attention²².
- ▶ We conjecture that **the mechanism for deictic reference** is to be deduced from shared attention—not the other way round.
- ▶ Computationally, deictic reference is modeled in terms of a spatial semantics; procedurally, it employs two pathways of visual processing.

²¹ C. E. Connor and J. J. Knierim (2017). "Integration of objects and space in perception and memory". In: *Nature Neuroscience* 20.11, pp. 1493–1503.

²² B. J. Scholl (2001). "Objects and Attention: The State of the Art". In: *Cognition* 80.1-2, pp. 1–46.

Not: From reference to attention

In *Conversation Analysis* (CA) attention is derived from reference:

- ▶ “[...] a speaker introduces a new object by pointing at it and establishes the joint attention of the co-participants towards it” (Mondada 2014:95²³)
- ▶ “In perhaps its barest form, referring consists of literally pointing to something in order for two people to share attention on that thing [...]” (Enfield 2013:433²⁴)

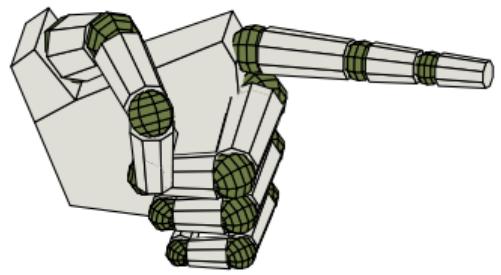
²³ L. Mondada (2014). “Pointing, talk, and the bodies. Essays in honor of Adam Kendon”. In: *From gesture in conversation to visible action as utterance*. Ed. by M. Seyfeddinipur and M. Gullberg. Amsterdam and Philadelphia: John Benjamins, pp. 95–124.

²⁴ N. J. Enfield (2013). “Reference in Conversation”. In: ed. by J. Sidnell and T. Stivers, pp. 433–454.

Conclusions

Take-home message

A proper understanding of deictic reference needs a cooperation of theoretical linguistics and cognitive science.



Encores

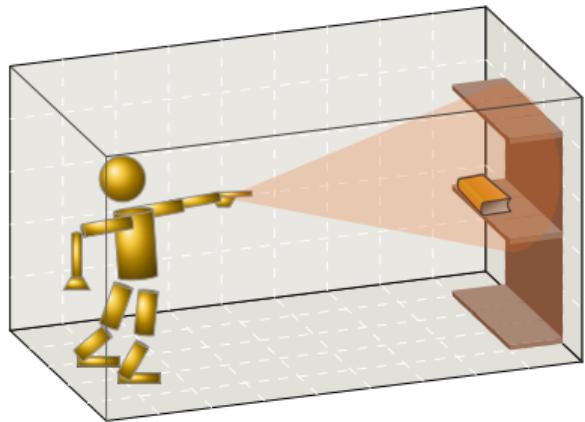
Tiger Woods

Discourse pointing

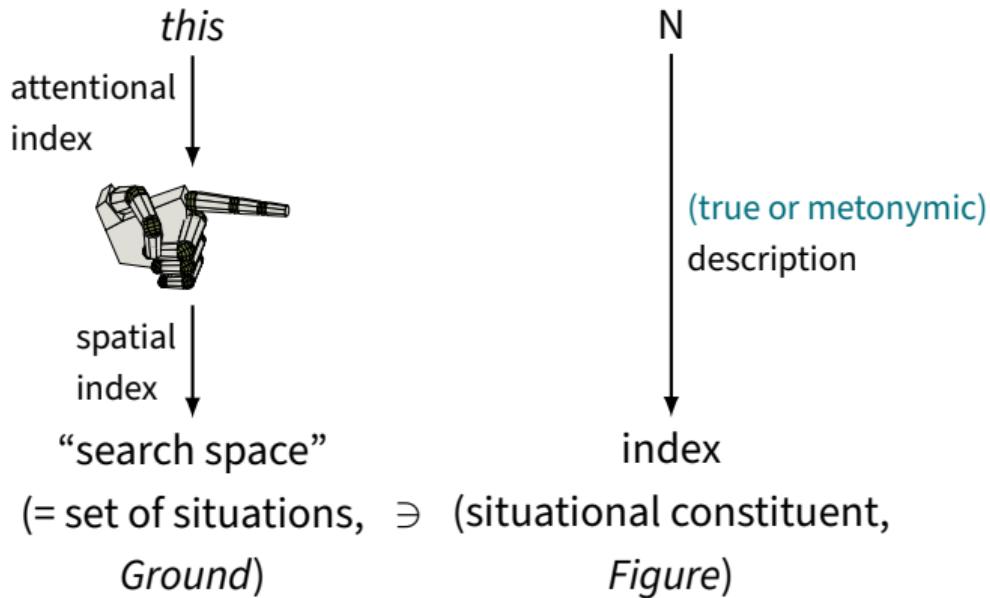
Tiger Woods

Reconsidering the re-analysis

- ▶ Depending on George saying
 - ▶ “That book/**publisher**”
 - ▶ “That shelf/**craftsman**”
- the **index** is understood to be the book or the bookshelf, respectively.
- ▶ Contradicting the true description requirement of Figure-Ground model.

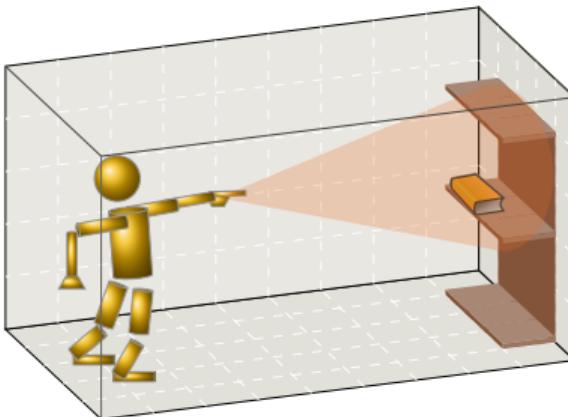


New proposal: figure-ground model, modified



Frames (<http://framenet.icsi.berkeley.edu>)

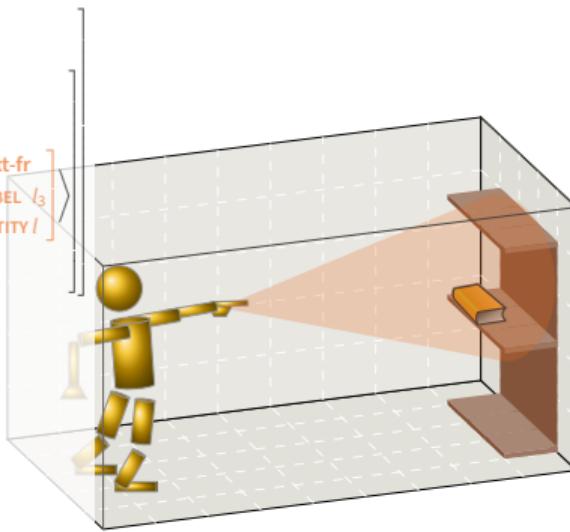
- ▶ “This author is a genius.”
- ▶ Co-determination: s is such that $s \in \text{cone}(\text{author})$ and s supports $\text{author}(x)$.
- ▶ Making it work with frame knowledge (excerpt):



Frames (<http://framenet.icsi.berkeley.edu>)

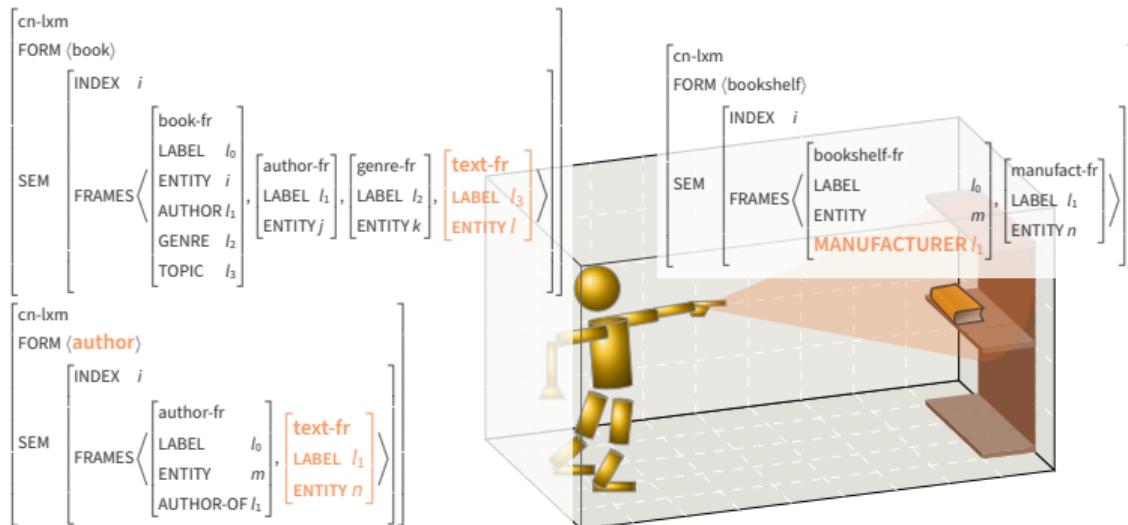
- ▶ “This author is a genius.”
- ▶ Co-determination: s is such that $s \in \text{cone}(\text{author})$ and s supports $\text{author}(x)$.
- ▶ Making it work with frame knowledge (excerpt):

cn-lxm	FORM (book)
	INDEX i
SEM	FRAMES \langle book-fr, LABEL l_0 , ENTITY i , AUTHOR l_1 , GENRE l_2 , TOPIC l_3 \rangle
cn-lxm	FORM (author)
	INDEX i
SEM	FRAMES \langle author-fr, LABEL l_0 , ENTITY m , AUTHOR-OF l_1 , LABEL l_1 , ENTITY n \rangle



Frames (<http://framenet.icsi.berkeley.edu>)

- ▶ “This author is a genius.”
- ▶ Co-determination: s is such that $s \in \text{cone}(s)$ and s supports $\text{author}(x)$.
- ▶ Making it work with frame knowledge (excerpt):



Extended judgments

- ▶ Let $Fr(\phi)$ be the frame elements of a type ϕ .
- ▶ A situation s extendedly exemplifies a type T , $s :: T$, iff
 - ▶ $s : T$, or
 - ▶ there is a type T' such that $Fr(T) \cap Fr(T') \neq \emptyset$ and $s : T'$ (indirect classification).

Wrong prediction for anaphoric uses?

Nunberg²⁵ argues that metonymic uses of demonstratives do not extend to discourse.

Nunberg's example

I can point at Tiger Woods and say (25):

- (25) That's what I want to take lessons in.

But this use of the demonstrative doesn't have a parallel in (26):

- (26) ?Whenever Mary sees Tiger Woods on TV, she wants to take lessons in that.

²⁵ G. Nunberg (2004). "Descriptive Indexicals and Indexical Descriptions". In: *Descriptions and Beyond*. Ed. by M. Reimer and A. Bezuidenhout. Oxford: Clarendon Press. Chap. 6, pp. 261–279, p. 271.

Tiger Woods (internet image search results, no permission!)

Example

I can point at Tiger Woods and say
“That’s what I want to take lessons in.”

Tiger Woods (internet image search results, no permission!)

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Tiger Woods (internet image search results, no permission!)

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Tiger Woods (internet image search results, no permission!)

Example

I can point at Tiger Woods and say
“That’s what I want to take lessons in.”



Tiger Woods (internet image search results, no permission!)

What Nunberg probably means:

Example

I can point at Tiger Woods **playing golf** and say
“That’s what I want to take lessons in.”



Tiger Woods (internet image search results, no permission!)

What Nunberg probably means:

Example

I can point at Tiger Woods **playing golf** and say
“That’s what I want to take lessons in.”



But this perfectly extends to discourse:

- (26) Whenever Mary sees Tiger Woods
on TV **playing golf**, she wants to
take lessons in that.

Thin or thick Tiger Woods ([internet image search results, no permission!](#))

Example

Can I point at Tiger Woods [neutral](#) and say
“That’s what I want to take lessons in.” [\[?\]](#)



Thin or thick Tiger Woods ([internet image search results, no permission!](#))

Example

Can I point at Tiger Woods [neutral](#) and say
“That’s what I want to take lessons in.” [\[?\]](#)



Upshot

Exophoric reference differs from endophoric reference: the former provides [thick particulars](#) while discourse referents are [thin particulars](#).

Discourse pointing

Uses of pointing gestures: spatial proxy



“then you do not exit here [index finger downwards] (but there).”

(taken from SaGA V9, 6:56^a)

^a A. Lücking, K. Bergmann, et al. (2010). “The Bielefeld Speech and Gesture Alignment Corpus

also called *abstract deixis*^a; projection from gesture space into described situation (cf. function \vec{v} of^b)

^a D. McNeill, J. Cassell, and E. T. Levy (1993). “Abstract deixis”. In: *Semiotica* 95.1-2, pp. 5–19.

^b A. Lascarides and M. Stone (2009). “A Formal Semantic Analysis of Gesture”. In: *Journal of Semantics* 28.1, pp. 3–34.

Pointing at addressee

(context: *F [on the right] recaps route direction, hesitates*)

F: da steht die (.) die / T: there is
the the

R: die SKULptur ((pointing at F)) / T:
the sculpture



F: die skulptur drauf / T: the sculpture
on top

(SaGA V5, 13:58)

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(context: *F [on the right] recaps route direction, hesitates*)

F: da steht die (.) die / T: there is
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R: die SKULptur ((pointing at F)) / T:
the sculpture



F: die skulptur drauf / T: the sculpture
on top

R is **pointing at the addressee** (F),
but:

- ▶ not locating addressee *F*
- ▶ no metonymic relation between *F* and the sculpture
- ▶ no spatial projection from *F*
- what to do with the pointing gesture?

(SaGA V5, 13:58)

Rude pointing

As the proverb has it...

“Man zeigt nicht mit nacktem Finger auf angezogene Leute!”

(It is bad manners to point at dressed people with naked fingers!)

Informal analysis

Context of example:

- ▶ *F* recaps a route direction he got from *R*
- ▶ *F* has difficulties to recall a certain landmark
- ▶ *R* jumps in and supplies the landmark (i.e. “sculpture”)
- the gesture emphasizes known material

Shared information gestures ...

“[...] mark material that the addressee probably already knows—information that is part of their common ground. They mean, essentially, ‘As you know.’” (Bavelas, Chovil, Lawrie & Wade 1992:397)²⁶

cf.: marker of common ground²⁷

²⁶ J. B. Bavelas et al. (1992). “Interactive Gestures”. In: *Discourse Processes* 15.4, pp. 469–489.

²⁷ J. Holler (2010). “Speakers’ Use of Interactive Gestures as Markers of Common Ground”. In: *Proceedings of*

Representing shared information

- ▶ Needed: notion of addressee and known material
- ▶ Systematic framework: KoS²⁸, formal dialogue semantics

²⁸J. Ginzburg (2012). *The Interactive Stance: Meaning for Conversation*. Oxford, UK: Oxford University Press.

Lexicalizing CG pointing

Using KoS, the informal analysis of *common ground pointing* or *shared information gesture* can be made more precise in the following way:

Preconds :	$\begin{bmatrix} \text{Pending : LocProp} \\ \text{u : sign} \\ \text{c1 : In(u, Pending.constits)} \end{bmatrix}$	allows for <i>compositional multimodal integration</i>
Effects :	$\begin{bmatrix} \text{R : Rel} \\ \text{p = R(c) : Prop} \\ \text{c = Preconds.u.cont} \\ \text{c1 : In(FACTS, p)} \end{bmatrix}$	

Note that CG pointing is lexicalized on the dialogical level, relating PENDING and FACTS.

Further examples

F: ok_nochmal beim anfang
dieses <>pointing at R> mit
den säulen scheint ja
irgendwie was komplizierter
zu sein ja? (-)>



ok back to the start, the thing (*CG pointing*) with the pillars seems to be a bit more complicated, isn't it?
(SaGA V2, 9:16)

F: auf jeden fall (.) DANN
((pointing at R)) muss ich
in den park gehen?



anyhow, then (*CG pointing*) I have to go into the park?

(SaGA V4, 9:43)

Corpus survey

Survey of six SaGA dialogues: 13 instances of CG pointing.

But also other classes:

- ▶ UTT (*utterance anaphora*), 20
- ▶ SCTM (*something's coming to mind*), 9
- ▶ GrabTurn, 2

UTT

Utt (utterance anaphora)

indicating a DR of the actual utterance (difference to CG, which relates to grounded DR); occurs with topic (DR) introduction, affirmation of utterance of the other interlocutor, request clarification, or corrections; formally pointing at R/F, or index finger raising

R: °hh und dann kommen halt äh (-) die ((pointing at F)) BÄUME / and then there will just eh be the (*UTT pointing*) trees



(SaGA V2, 7:30)

SCTM

SCTM (something's coming to mind)

pointing gesture associated with having an idea or recollection (in this case it is also CG); usually affiliated to expressives

R: da gehst du rein (-) °h da kommt n SEE: / there you enter, and there is a lake

R: ah gut ((pointing at F)) (.) ich glaub



es kam doch erst der park
well (*SCTM pointing*) I guess there was the park first

(SaGA V4, 5:23)

SCTM discourse meaning

Preconds :	$\left[\begin{array}{l} \text{spkr : } \textit{Ind} \\ \text{addr : } \textit{Ind} \\ \text{Pending.cont : } \textit{IllocProp} \\ \text{q : } \textit{Question} \\ \text{c1 : About(Pending.cont,q)} \end{array} \right]$
Effects :	$\left[\begin{array}{l} \text{spkr = pre.spkr : } \textit{Ind} \\ \text{addr = pre.addr : } \textit{Ind} \\ \text{Pending.cont : } \textit{IllocProp} \\ \text{c2: } \neg \text{About(Pending.cont,Preconds.q)} \end{array} \right]$

≈ “actual utterance
pertains to a different
question than the previous
one”

GrabTurn

Grab turn

usually index finger raising; affiliated to turn-taking expressions

- R: du bleibst auf jeden fall auf der straße wo du bist und gehst geradeaus
°h / in any case you stay on the street where you are and go straight ahead
- F: <<index raised, repeated>ich frage nochmal kurz was nach> (.) also ähm
/ I have a brief clarification request ehm



(SaGA V4, 4:28)

GrabTurn discourse meaning

Preconds : $\begin{bmatrix} \text{spkr} : \text{Ind} \\ \text{addr} : \text{Ind} \end{bmatrix}$

Effects : $\begin{bmatrix} \text{spkr} = \text{pre.addr} : \text{Ind} \\ \text{addr} = \text{pre.spkr} : \text{Ind} \end{bmatrix}$

- ▶ speaker change
- ▶ can be realised by finger-raising instead of addressee pointing