Empirical observation suggests that language comprehension integrates information from linguistic utterances with information that is antecedently or concurrently available from other sources, as soon as the information becomes available to the processor.

The philosophical conception of sentence meanings that are constructed compositionally in the semantics, and are subsequently adjusted to contextual or background information is hard to fit to empirical observation about the incrementality of language comprehension.
The classic division of labour

**Compositional sentence contents**

*propositions (truth conditions)*

**Contexts → Utterance meanings**

**SEMANTICS**

**PRAGMATICS**

---

**Frege**

Wenn mit dem *Tempus praesens* eine Zeitangabe gemacht werden soll, muß man wissen, wann der Satz ausgesprochen worden ist, um den Gedanken richtig zu erfassen. Dann ist also die Zeit des Sprechens Teil des Gedankenausdrucks.

(Der Gedanke, 1918)

Did he mean that, in order to capture the proposition, we must use knowledge from the utterance context?
David Kaplan integrates contextual information into the semantics

Character: Contexts → Contents

sentence meaning

Content: Worlds → {0,1}

proposition

This accounts for contextual saturation of explicit variables - typically for indexicals, like I, you, here, now, etc.

… but there's more to context dependence (→ Graham Katz's talk yesterday)

Immediate context influence

Suppose we apply Kaplan's conception not to sentence meanings, but to meanings of smaller constituents - ultimately lexical items - as they become available consecutively during sentence processing.

We would then not any longer compute sentence meanings from lexical meanings, but sentence denotations from denotations of constituents

and context dependence is taken into account not at sentence level, but immediately, during processing.

Evidence from sentence processing would seem to support such a conception.
Klicken Sie auf die blaue Rakete.

*click on ... [followed by a def. determiner, adjective, and noun]*

**Visual world (1)**

default NPs:
- die Giraffe
- die Rakete
- der Stern
- das Hufeisen

**Visual world (2)**

condition: colour and gender of default noun of target object are shared with one other object
subjects decide about reference as soon as they have enough information

condition: target object singled out by gender of default noun

Heute ist Markt im Dorf. Die Marktfrau streitet sich mit dem Arbeiter. Sie sagt jetzt gerade, dass er ihr nun das neue Fahrrad zurückgeben soll, das er sich geliehen hat.

It's market day in the village. The market woman is qibbling with the worker. She's just saying that he should give the new bike back that he das borrowed.
Immediate evaluation

The experimental evidence shows that visual and linguistic input are processed simultaneously: Referential expressions are resolved to the utterance context immediately - before sentence meanings are computed.

Should this not also be the case for unsaturated expressions, like VP, V, etc.?

Anticipation effects, as in the Karabanov e.a. experiment, seem to suggest this.
Immediate evaluation

The experimental evidence shows that visual and linguistic input are processed simultaneously: Referential expressions are resolved to the utterance context immediately - before sentence meanings are computed.

Should this not also be the case for unsaturated expressions, like VP, V, etc.?

Are there contextual denotations of unsaturated expressions, like VPs?

And do they behave like this?

Consider VP anaphora
VP anaphora

*Peter is working, and so is Fred.*

*Peter is working, and Fred ____ too.*

*Peter is working, and Fred is ____ too.*

What are the relevant identity conditions between source and target?

In what terms are they defined?

- surface expressions?
- meanings?
- LF-expressions?

Could it be denotations?

---

What are the contextual denotations of VPs?

*Where is Fred?*

(1) *He's working.*

\[ \text{WORK}_i(\text{fred}) \rightarrow \phi (\text{LOCATION}(\text{fred})) \]

*How can Fred afford these expensive holidays?*

(2) *He's working.*

\[ \text{WORK}_k(\text{fred}) \rightarrow \psi (\text{WEALTH}(\text{fred})) \]

The lexical meaning or lexical denotation of *work* is clearly insufficient.
The variation is inferentially and hence *truth-conditionally relevant*.

Nothing follows about Fred's *location* when

Fred is working

is an answer to

*How can Fred afford these expensive holidays?*

The variation is *stable within the utterance context*.

Fred is working *and so is* Pete.

cannot be interpreted as, e.g.,

Fred is in his office and Pete can afford expensive holidays.
What is this variation a variation of?

- not of lexical meanings (characters) 
  (because the variation is productive and correlates with variation in the context)

- but of semantic values (contents)

I call these contextual values of predicate expressions

*Contextual Concepts* (CCs)

Cf. Frege's idea that the values of "predicates" are concepts.

---

What is this variation a variation of?

CCs are the contextual denotations of predicate expressions

They are truth functions that are defined for all arguments in the intended context.

CCs are linguistically real.

They define the required notion of identity in

- VP anaphora, coordination, question-answer coherence
- they define units of counting
VP anaphora, VP ellipsis, Coordination

Fred is working and so is Pete.
Fred is working, and Pete too.
Fred is working and Pete is working.

(talking of Fred, Pete, and a few others):
I wonder how many of them are working?

This is NOT identity of meaning, but identity of semantic value:
Fred is working for her, and so is Pete.

the referent of her must be the same for Pete and Fred and forms part of the specification of the CC ascribed to both Pete and Fred.

Multiple VP anaphora

[… Fred…]

John revised his paper before the teacher did, and so did Bill
### Denotations of the VP "revised his paper"

[...Fred...]  

John revised his paper.

<table>
<thead>
<tr>
<th>Denotations</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda x. [\text{rev}](x, <a href="y">\text{p_of}</a>) (\text{[f]}))$</td>
<td>(no additional reading)</td>
</tr>
<tr>
<td>$\lambda x. [\text{rev}](x, <a href="y">\text{p_of}</a>) (\text{[j]}))$</td>
<td>John revised Fred's paper</td>
</tr>
<tr>
<td>$\lambda x. [\text{rev}](x, <a href="%5Ctext%7Bx%7D">\text{p_of}</a>) (\text{[j]}))$</td>
<td>John revised his own paper</td>
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<tr>
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<td>John revised John's paper</td>
</tr>
</tbody>
</table>

**CC1, CC2, CC3 are sub-concepts of CC4**

- Value from context assigned to free variable y
- Free variable y bound by abstractor
- Contextual inference: if CC2 is true of j it follows that
- Value from context assigned to free variable y

### Denotations of the VP "revised his paper" & VP anaphora

[...Fred...]

John revised his paper before the teacher did.

<table>
<thead>
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<tr>
<td>$\lambda x. [\text{rev}](x, <a href="y">\text{p_of}</a>) (\text{[j]}))$</td>
<td>(completely identical to source)</td>
</tr>
<tr>
<td>$\lambda x. [\text{rev}](x, <a href="%5Ctext%7Bf%7D">\text{p_of}</a>) (\text{[j]}))$</td>
<td>to revise Fred's paper</td>
</tr>
<tr>
<td>$\lambda x. [\text{rev}](x, <a href="%5Ctext%7Bx%7D">\text{p_of}</a>) (\text{[j]}))$</td>
<td>to revise one's paper</td>
</tr>
<tr>
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<tr>
<td>$\lambda z. ([\text{bef}] (\lambda x. [\text{rev}](x, <a href="%5Ctext%7Bf%7D">\text{p_of}</a>)(z)), (\text{[f]}))) (\text{[i]}))$</td>
<td></td>
</tr>
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<td>$\lambda z. ([\text{bef}] (\lambda x. [\text{rev}](x, <a href="%5Ctext%7Bx%7D">\text{p_of}</a>)(z)), (\text{[x]}))) (\text{[i]}))$</td>
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<td></td>
</tr>
</tbody>
</table>

CC to be resumed
Denotations of the VP "revised his paper" & VP anaphora

[...Fred... ] John revised his paper before the teacher did.

Lexical compositional VP denotation

\( \lambda x.\text{[rev]}(x, \text{[p_of]}(y))(j) \)

CC1 to revise Fred's paper

\( \lambda x.\text{[rev]}(x, \text{[p_of]}(x))(j) \)

CC2 to revise one's paper

\( \lambda x.\text{[rev]}(x, \text{[p_of]}(j))(j) \)

CC3 to revise John's paper

\( \lambda z. (\text{[bef]} (\lambda x.\text{[rev]}(x, \text{[p_of]}(f))(z)), (\lambda x.\text{[rev]}(x, \text{[p_of]}(f))(t))(j)))(j) \)

CC to be resumed (completely identical to source)

\( \lambda z. (\text{[bef]} (\lambda x.\text{[rev]}(x, \text{[p_of]}(x))(z)), (\lambda x.\text{[rev]}(x, \text{[p_of]}(x))(t))(j)))(j) \)

\( \lambda z. (\text{[bef]} (\lambda x.\text{[rev]}(x, \text{[p_of]}(j))(z)), (\lambda x.\text{[rev]}(x, \text{[p_of]}(j))(t))(j)))(j) \)

y may now also be evaluated to \( t \):

\( \lambda z. (\text{[bef]} (\lambda x.\text{[rev]}(x, \text{[p_of]}(t))(z)), (\lambda x.\text{[rev]}(x, \text{[p_of]}(t))(t))(j)))(j) \)

y may be bound by higher abstractor:

\( \lambda z. (\text{[bef]} (\lambda x.\text{[rev]}(x, \text{[p_of]}(z))(z)), (\lambda x.\text{[rev]}(x, \text{[p_of]}(z))(t))(j)))(j) \)

\( \lambda z. (\text{[bef]} (\lambda x.\text{[rev]}(x, \text{[p_of]}(f))(z)), (\lambda x.\text{[rev]}(x, \text{[p_of]}(f))(t))(j)))(j) \)

\( \lambda z. (\text{[bef]} (\lambda x.\text{[rev]}(x, \text{[p_of]}(x))(z)), (\lambda x.\text{[rev]}(x, \text{[p_of]}(x))(t))(j)))(j) \)

\( \lambda z. (\text{[bef]} (\lambda x.\text{[rev]}(x, \text{[p_of]}(j))(z)), (\lambda x.\text{[rev]}(x, \text{[p_of]}(j))(t))(j)))(j) \)
### Denotations of the VP "revised his paper" & VP anaphora

**[...Fred...] John revised his paper before the teacher did.**

**Five CCs are now available for further VP anaphora:**

<table>
<thead>
<tr>
<th>CC</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCa</td>
<td>to revise T’s paper before T revised T’s paper</td>
<td></td>
</tr>
<tr>
<td>CCb</td>
<td>to revise one’s paper before T revised one’s paper</td>
<td></td>
</tr>
<tr>
<td>CCc</td>
<td>to revise F’s paper before T revised F’s paper</td>
<td></td>
</tr>
<tr>
<td>CCd</td>
<td>to revise one’s paper before T revised his paper</td>
<td></td>
</tr>
<tr>
<td>CCe</td>
<td>to revise J’s paper before T revised J’s paper</td>
<td></td>
</tr>
</tbody>
</table>

**What properties do our readings r1 - r5 ascribe to John?**

**Five CCs are now available for further VP anaphora:**

<table>
<thead>
<tr>
<th>CC</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCa</td>
<td></td>
</tr>
<tr>
<td>CCb</td>
<td></td>
</tr>
<tr>
<td>CCc</td>
<td></td>
</tr>
<tr>
<td>CCd</td>
<td></td>
</tr>
<tr>
<td>CCe</td>
<td></td>
</tr>
</tbody>
</table>
Denotations of the VP  "revised his paper" & VP anaphora

[...Fred...]  John revised his paper before the teacher did.

two of these CCs permit the derivation of two more CCs:

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]

**CCb** to revise one's own paper before T revised one's paper

if John has this property he also has this one (one variable contextually evaluated):

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]

**CCg** to revise one's own paper before T revised J's paper

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]

**CCd** to revise one's paper before T revised his paper

if John has this property he also has this one (two variables contextually evaluated):

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]

**CCf** to revise J's paper before T revised T's paper

Denotations of VPs  the full sentence

[...Fred...]  John revised his paper before the teacher did and so did Bill
all seven CCs that can be derived from the source are now in place.
The seven readings for the full sentence are arrived at by simple resumption of these CCs:

**CCa** to revise the teacher's paper before the teacher revised the teacher's paper

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]

**CCb** to revise one's paper before the teacher revised one's paper

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]

**CCc** to revise the teacher's paper before the teacher revised the teacher's paper

J revised T's paper before T revised T's paper

B revised T's paper before T revised T's paper

**CCd** to revise one's paper before T revised his paper

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]

**CCe** to revise T's paper before T revised T's paper

J revised his paper before T revised his paper

& B revised his paper before T revised his paper

**CCf** to revise J's paper before T revised T's paper

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]

**CCg** to revise one's paper before T revised J's paper

\[
\lambda z. (\text{bef} \circ (\lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))))(z), \lambda x. \text{rev} \circ (x, \text{p_of} \circ (z))(z)
\]
Denotations of VPs  the full sentence

[...Fred...] John revised his paper before the teacher did and so did Bill

CCc  to revise Fred's paper before the teacher revised Fred's paper

\[
\lambda z. (\text{bef} \ (\lambda x. [\text{rev}] (x, [\text{p_of}] (f))) (z)) \ (\text{[j]})
\]

Rd:JTBT

CCd  to revise one's paper before the teacher revised his paper

\[
\lambda z. (\text{bef} \ (\lambda x. [\text{rev}] (x, [\text{p_of}] (x))) (z)) \ (\text{[b]})
\]

Rd:FFFF

Denotations of VPs  the full sentence

[...Fred...] John revised his paper before the teacher did and so did Bill

CCe  to revise John's paper before the teacher revised John's paper

\[
\lambda z. (\text{bef} \ (\lambda x. [\text{rev}] (x, [\text{p_of}] (j))) (z)) \ (\text{[j]})
\]

Rd:JJJJ

CCf  to revise John's paper before the teacher revises the teacher's paper

\[
\lambda z. (\text{bef} \ (\lambda x. [\text{rev}] (x, [\text{p_of}] (j))) (z)) \ (\text{[b]})
\]

Rf:JTJT
### steps in the derivation

[...Fred...] John revised his paper before the teacher did and so did Bill

<table>
<thead>
<tr>
<th>binding</th>
<th>apply to j</th>
<th>reading source 1</th>
<th>apply to goal 1</th>
<th>reading source 2</th>
<th>apply to goal 1</th>
<th>infer CC</th>
<th>reading complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>lex</td>
<td></td>
<td>eval</td>
<td></td>
<td>1</td>
<td>CCa</td>
<td></td>
<td>TTTT</td>
</tr>
<tr>
<td>lex</td>
<td></td>
<td>bind</td>
<td></td>
<td>2</td>
<td>CCb</td>
<td></td>
<td>JJJBJ</td>
</tr>
<tr>
<td>lex</td>
<td></td>
<td></td>
<td>2</td>
<td>CCb</td>
<td>CCg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lex</td>
<td>eval</td>
<td>1</td>
<td>CC1</td>
<td>3</td>
<td>CCc</td>
<td></td>
<td>FFFF</td>
</tr>
<tr>
<td>lex</td>
<td>bind</td>
<td>2</td>
<td>CC2</td>
<td>4</td>
<td>CCd</td>
<td></td>
<td>JTBT</td>
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<tr>
<td>lex</td>
<td></td>
<td></td>
<td>4</td>
<td>CCd</td>
<td>CCf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lex</td>
<td>infer</td>
<td>3</td>
<td>CC3</td>
<td>5</td>
<td>CCe</td>
<td></td>
<td>JJJJ</td>
</tr>
</tbody>
</table>
CCs - a note on their ontological status

Ontologies represent *sorts* (types) of entities. These may be things (saturated) or properties (unsaturated).

Individual entities are *instances* of these sorts (tokens of these types). They can, in principle be named, like elements of a set.

*Representations of instances* may be incomplete: We may simply not know (or not be interested in) all the sorts, which an instance is an instance of or all its attributes.

*Representations of sorts* are always fully specified (their identity is given by their representation)

*Discourse referents are things: instances or sorts; Contextual Concepts are sorts.*

CCs in an ontological subsumption hierarchy

- phys.object
  - artefact
  - vehicle
    - commodity
    - car
      - Saab 900
      - VW Golf
  - commodity
  - vehicle
  - artefact
- accomplishment
  - \( \lambda x \, \text{[say]}(x, p) \)
  - \( \lambda x \, \text{[say]}(x, \text{[fool]}(y)) \)
  - \( \lambda x \, \text{[say]}(x, \text{[fool]}(\text{[Peter]})) \)
  - \( \lambda x \, \text{[last_night]}(\text{[say]}(x, \text{[fool]}(\text{[Peter]}))) \)

[indefinitely more subtypes, but no instances]
Summary (1)

• There is reasonable experimental evidence for immediate evaluation of referential expressions to the intended context.

• There are indications that immediate contextual evaluation may not be restricted to referential expressions, but that also unsaturated expressions are evaluated immediately.

• I am proposing Contextual Concepts as contextual semantic values of unsaturated expressions.

Summary (2)

• CCs are constructed compositionally from lexical denotations and the currently available context knowledge.

• CCs are the entities VP anaphora refers to - if you like the "discourse referents" for VPs.

• In VP anaphora, CCs as VP denotations in source and target are completely identical in all cases - no sloppy identity, similarity, higher order unification or discourse coherence accounts are required.