Compositionality and Ontological Commitment

Thomas Ede Zimmermann, Goethe University, Frankfurt

SPE 5, University of Turin, July 25-27, 2012

0. Intro
1. The compositional enterprise
2. External extensions
3. Internal Extensions
4. Intensions and Fregean compositionality
5. Outro

0. Intro

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To be is to be the value of a (bound) variable.

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To be is to be the value of a (bound) variable.

Quine (1961)

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Ontological overkill:

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Every man loves a woman.

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$(\forall x)\ [M(x) \rightarrow (\exists y)\ [W(y)\ \&\ L(x,y)]]$

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ranging over…

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individuals

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ranging over…

Compositional analysis (indirect interpretation)

$(\lambda Y.\, \lambda X.\, Y \subseteq X)(M)(\lambda x.\, (\lambda Y.\, \lambda X.\, Y \between X)\ (W)\ (\{y|\ xLy\}))$

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sets of individuals

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To be is to be the referent of a term.

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set of worlds (proposition)

denoting …

sets of individuals

Compositional analysis (indirect interpretation)

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function from worlds to sets of sets of individuals

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$(\lambda Y.\,\lambda X.\,Y \subseteq X)(M)(\lambda x.\,S(x,\hat{}(\lambda Y.\,\lambda X.\,Y \between X)(W)))$

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1. The compositional enterprise

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START

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EXPRESSIONS

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EXPRESSIONS have

semantic values ⟨X⟩ , ⟪X⟫ ,...

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semantic values ⟨X⟩ , ⟪X⟫ ,...

corresponding to their (communicative,...) functions:
reference (potential), informational content,...

1. The compositional enterprise

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Some

EXPRESSIONS have

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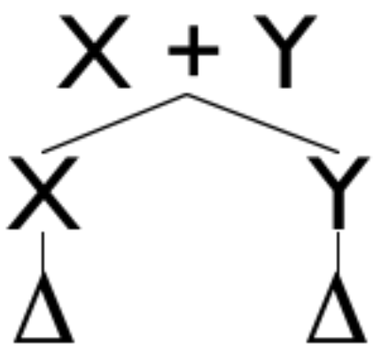

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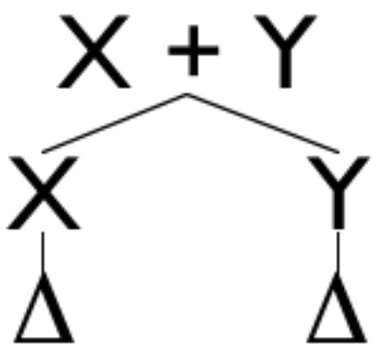

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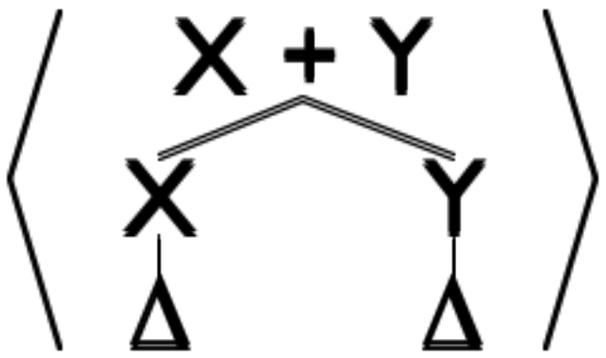

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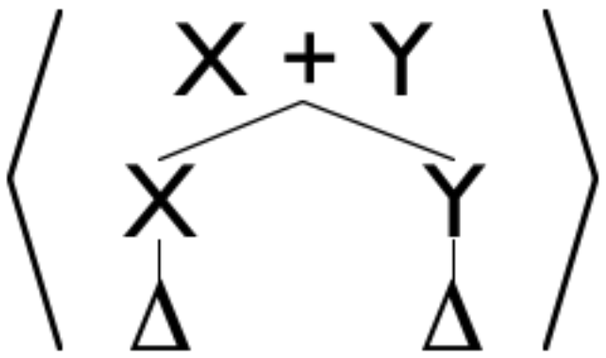

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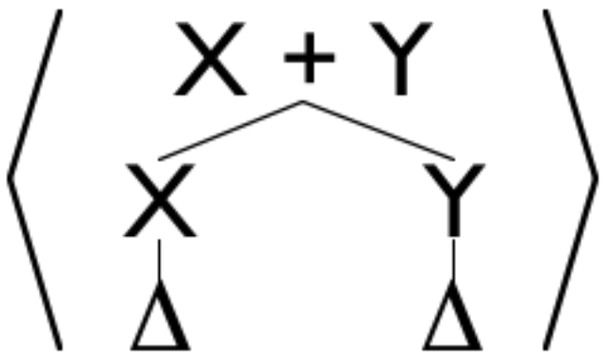

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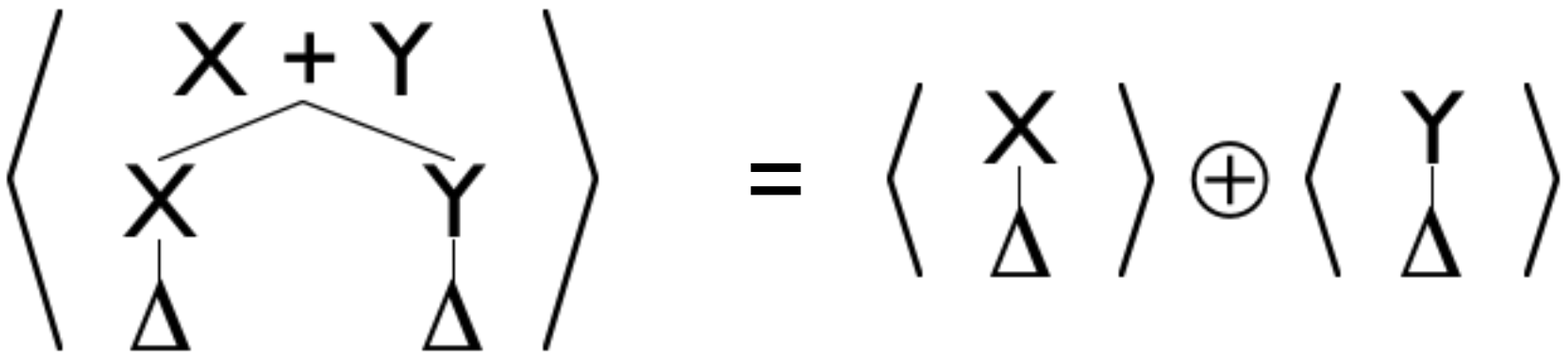

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2. External extensions

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1st approach

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Frege (1892)

2. External extensions

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Frege (1892)

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2. External extensions

1st approach

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2. External extensions

1st approach

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Frege (1892)

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REFERENTIAL

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2. External extensions

1st approach

Frege (1892)

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REFERENTIAL

EXPRESSIONS get their **referents** as

external semantic values ⟨X⟩

corresponding to their **referential** function

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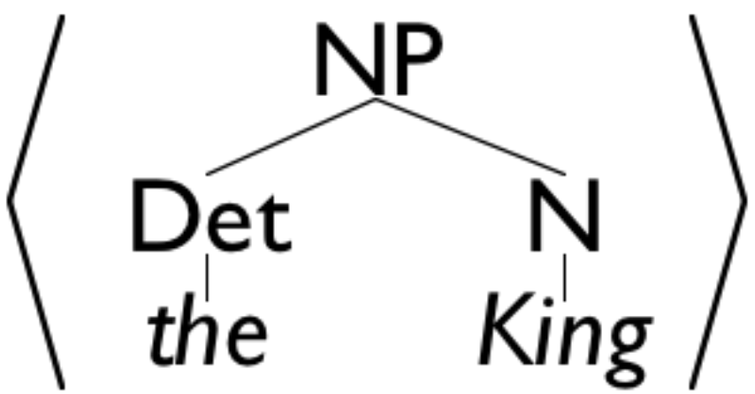

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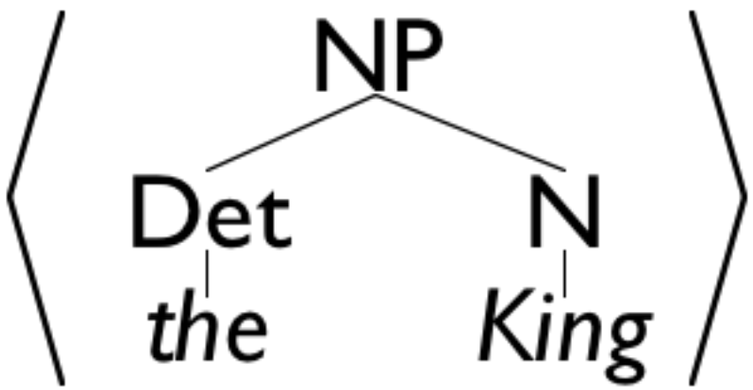

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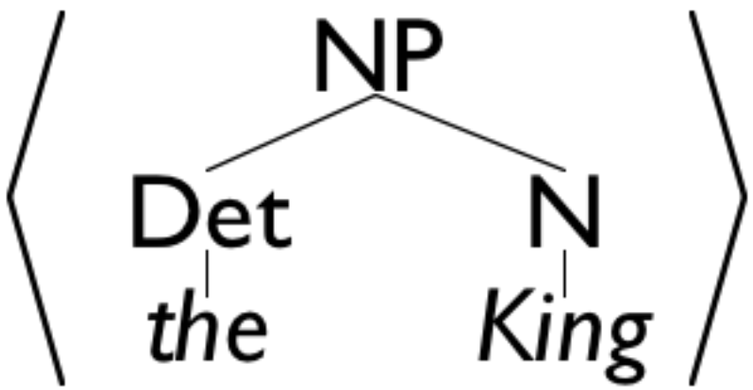

= Elvis

2. External extensions

1st approach

Frege (1892)

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REFERENTIAL

EXPRESSIONS get their **referents** as

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corresponding to their **referential** function

$$\left\langle \begin{array}{c} \text{NP} \\ \textit{Elvis} \end{array} \right\rangle = \text{Elvis}$$

2. External extensions

1st approach

Frege (1892)

START

REFERENTIAL

EXPRESSIONS get their **referents** as

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⟨ NP *Elvis* ⟩ = Elvis

+ (somewhat mysteriously)

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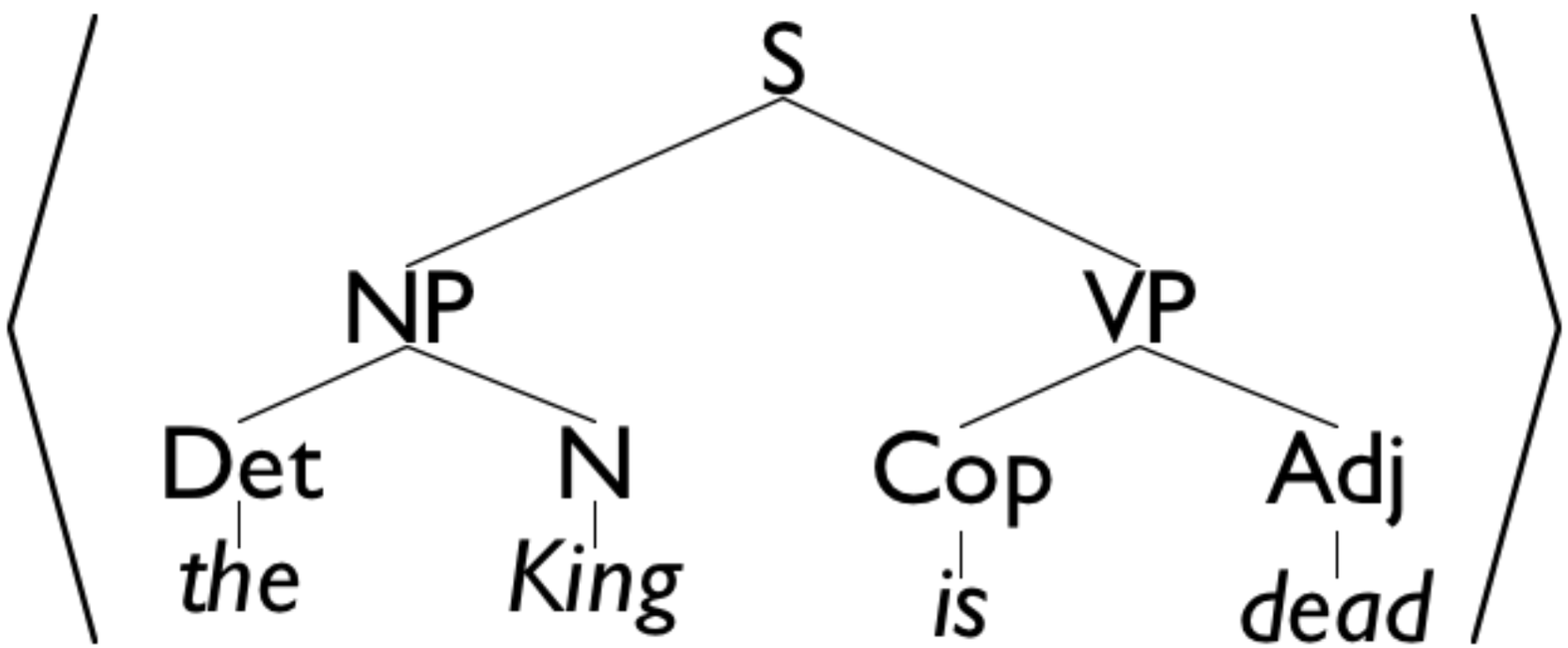

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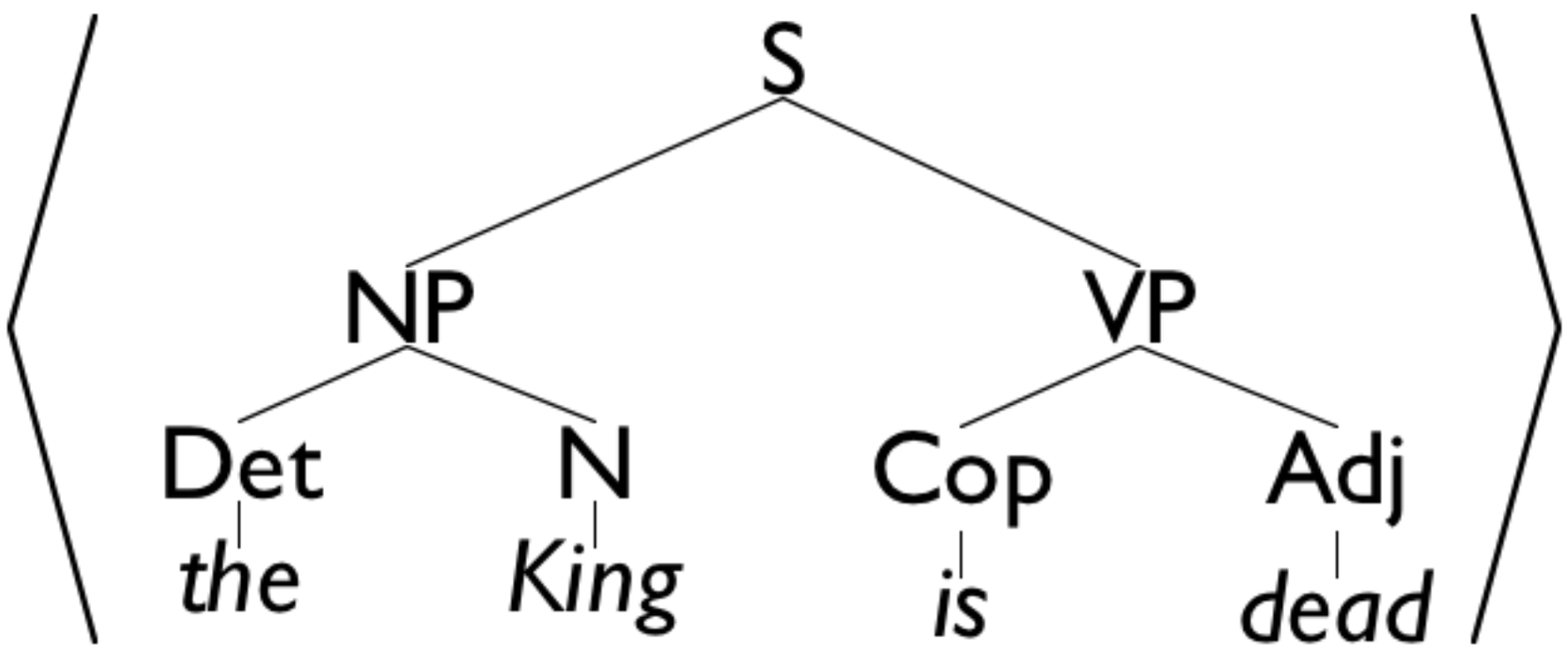

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2. External extensions

2nd approach — Carnap (1947)

START

TERMS (= Names + Descriptions): as before

PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference**

. . .

2. External extensions

2nd approach — Carnap (1947)

START

TERMS (= Names + Descriptions): as before

PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference**

⟨*is dead*⟩

...

2. External extensions

2nd approach

Carnap (1947)

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TERMS (= Names + Descriptions): as before

PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference**

⟨*is dead*⟩ = {(x)| x is dead}

...

2. External extensions

2nd approach

Carnap (1947)

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⟨*is dead*⟩ = {(x)| x is dead}

⟨*is watching*⟩

...

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2nd approach

Carnap (1947)

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⟨*is dead*⟩ = {(x)| x is dead}
⟨*is watching*⟩ = {(x,y)| x is watching y}

...

2. External extensions

2nd approach

Carnap (1947)

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PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference**

⟨*is dead*⟩ = {(x)| x is dead}

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⟨*is showing*⟩

…

2. External extensions

2nd approach — Carnap (1947)

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PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference**

⟨*is dead*⟩ = {(x)| x is dead}
⟨*is watching*⟩ = {(x,y)| x is watching y}
⟨*is showing*⟩ = {(x,y,z)| x is showing y to z}
…

2. External extensions

2nd approach Carnap (1947)

START

TERMS (= Names + Descriptions): as before

PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference** valency

1	⟨*is dead*⟩	= {(x)| x is dead}
2	⟨*is watching*⟩	= {(x,y)| x is watching y}
3	⟨*is showing*⟩	= {(x,y,z)| x is showing y to z}
…	…	

2. External extensions

2nd approach — Carnap (1947)

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TERMS (= Names + Descriptions): as before

PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference** valency =

1	⟨*is dead*⟩	= {(x)| x is dead}
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3	⟨*is showing*⟩	= {(x,y,z)| x is showing y to z}
…	…	

2. External extensions

2nd approach — Carnap (1947)

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TERMS (= Names + Descriptions): as before

PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference** valency =

1	⟨*is dead*⟩	= {(x)| x is dead}	1
2	⟨*is watching*⟩	= {(x,y)| x is watching y}	2
3	⟨*is showing*⟩	= {(x,y,z)| x is showing y to z}	3
…	…		…

-arity

2. External extensions

2nd approach — Carnap (1947)

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TERMS (= Names + Descriptions): as before

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-arity

	⟨*Elvis is dead*⟩		
1	⟨*is dead*⟩	= {(x)| x is dead}	1
2	⟨*is watching*⟩	= {(x,y)| x is watching y}	2
3	⟨*is showing*⟩	= {(x,y,z)| x is showing y to z}	3
…	…		…

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2nd approach — Carnap (1947)

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PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference**

valency =		-arity
0	⟨*Elvis is dead*⟩	
1	⟨*is dead*⟩ = {(x)| x is dead}	1
2	⟨*is watching*⟩ = {(x,y)| x is watching y}	2
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…	…	…

2. External extensions

2nd approach — Carnap (1947)

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PREDICATES get their **satisfiers** as external semantic values ⟨P⟩ corresponding to their **multiple reference**

valency		=	-arity
0	⟨*Elvis is dead*⟩	= {( )| Elvis is dead}	0
1	⟨*is dead*⟩	= {(x)| x is dead}	1
2	⟨*is watching*⟩	= {(x,y)| x is watching y}	2
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…	…		…

2. External extensions

Comparison

2. External extensions

Comparison

Names

Descriptions

Nouns

Verbs

Sentences

Determiners

…

2. External extensions

Comparison

	Frege	Carnap
Names		
Descriptions		
Nouns		
Verbs		
Sentences		
Determiners		
…		

2. External extensions

Comparison

	Frege	Carnap
Names	individuals	individuals
Descriptions	individuals	individuals
Nouns	–	sets
Verbs	–	relations
Sentences	truth values	truth values
Determiners	–	–
…	–	–

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GOAL

All

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external (or internal) semantic values ⟨X⟩ , ⟪X⟫ ,…

corresponding to (the contributions they make to)
the functions of expressions in which they occur

3. Internal extensions

GOAL

All

EXPRESSIONS have

external **or internal extensions** ⟨X⟩ corresponding to the **contributions they make to** the external extensions of expressions in which they occur

3. Internal extensions

3. Internal extensions

Construction of internal extensions: standard method

3. Internal extensions

Construction of internal extensions: standard method

Frege (1891)

3. Internal extensions

Construction of internal extensions: standard method

Frege (1891)

Cofinality assumption

Every expression occurs in some sentence.

3. Internal extensions

Construction of internal extensions: standard method

Frege (1891)

Cofinality assumption

Hodges (2001)

Every expression occurs in some sentence.

3. Internal extensions

Construction of internal extensions: standard method

Frege (1891)

Cofinality assumption

Hodges (2001)

Every expression occurs in some sentence.

Strategy

To extend the evaluation to a class X of (valueless) expressions, choose a *suitable* construction +:

- + is *completed* by X

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… i.e.: all values $\langle X_i + Y_j \rangle$ and $\langle Y_j \rangle$ have already been determined (externally, by previous applications of the standard method, or otherwise).

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… i.e.: whenever $\langle Y_j \rangle = \langle Y_k \rangle$, then:

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… i.e.: whenever $\langle X_i + Y_k \rangle = \langle X_j + Y_k \rangle$, *for all* Y_k, then:

$\langle Z[X_i] = Z[X_i] \rangle$, for all Z[_] already evaluated.

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$\langle X_i \rangle := \lambda \langle Y_j \rangle . \langle X_i + Y_j \rangle$ … and $\oplus$ is functional application.

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Construction of internal extensions: standard method

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Example 1 *(based on 1st approach to external extensions)*

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$\langle$ *is dead*$\rangle$ = λ $\langle$NP$\rangle$. $\langle$NP + *is dead*$\rangle$

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(characteristic function of) set of individuals

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$\langle$ *everybody*$\rangle$ = λ $\langle$VP$\rangle$. $\langle$*everybody* + VP$\rangle$

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bound set variable!

3. Internal extensions

4 problems with standard method of constructing extensions

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Problem 1: Indeterminacy

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Solution: Zimmermann (forthcoming)

Isomorphic theories should be declared notational variants of one another – provided they agree on the external extensions (and their 'interpretation').

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Problem 2: Laziness

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Solution: Background theory for characterizations of functional values.

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$\langle V + everybody \rangle$ = ???

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Solution: No principled compositionality problems can arise (due to representativity of +); however standards for specifying (functional) values are needed.

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Problem 4: No suitable + exists

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Problem 4: No suitable + exists

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Attitude verbs V; e.g. no $\oplus$ can satisfy:

$$\langle V + S \rangle \neq \langle V \rangle \oplus \langle S \rangle$$

because + is not compositional in V.

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Solution strategy *(for Problem 4)****: Local repair***

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$$\langle X_i \rangle := \lambda \langle\!\langle Y_j \rangle\!\rangle \; . \; \langle X_i + Y_j \rangle$$

Attitude reports:

$$\langle \textit{believe} \rangle := \lambda \langle\!\langle S_j \rangle\!\rangle \; . \; \langle \textit{believe} + S_j \rangle$$

… where (e.g.) ⟪S⟫ is the intension of S

4. Intensions and Fregean compositionality

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External intensions

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Identify informational content with **sets of possible worlds** ('regions in Logical Space'), thereby obtaining intensions of (declarative sentences).

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(!) $\langle\!\langle S \rangle\!\rangle \cong \lambda w. \langle S \rangle_w$

where $\langle S \rangle_w$ is the extension of S according to w.

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Generalize (!) from S to arbitrary expressions.

4. Intensions and Fregean compositionality

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Remark

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However

Relational analyses of referentially opaque transitive verbs are not the result of Fregean Laziness.

The compositional analysis

$(\lambda Y.\lambda X.Y \subseteq X)(M)(\lambda x.\, S(x,\hat{}(\lambda Y.\lambda X.Y \between X)(W)))$

of *Every man seeks a woman.*

can be obtained from the non-compositional modal paraphrase:

$(\forall x)\,[M(x) \rightarrow \boxdot_x (\exists y)\,[W(y) \,\&\, L(x,y)]]$

by the standard method of constructing extensions.

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Thank you for your attention!

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