

Facts as proofs

Carla Umbach

Institute of Cognitive Science, University of Osnabrück
carla.umbach@uos.de

Workshop on Abstract Objects, Barcelona, March 2008

Declarative complement clauses

Attitude verbs like *glauben* (believe), *wissen* (know), *bedauern* (regret) ...
combine with a declarative complement clause

(a) *Marie glaubt, dass Hans heute Abend kommt.*

Marie believes that Hans will come tonight.

(b) *Marie weiß, dass Hans heute Abend kommt.*

Marie knows that Hans will come tonight.

What is the semantic type of the declarative clause?

glauben (believe): non-factive, → proposition

wissen (know): factive, → true proposition, or fact ?

2

True proposition or fact?

Question:

- Are facts distinct from true propositions?
- If so, how does a fact differ from a true proposition?

Asher (1993), Ginzburg/Sag (2000):

Facts are distinct from propositions (and from true propositions)

'Natural Language Ontology' point of view:

Which types of entities must be distinguished from a linguistic point of view?

3

Overview

In this talk, I will

- adopt a 'Natural Language Ontology' point of view,
- argue that facts are distinct from (true) propositions,
- not follow Ginzburg/Sag's central argument in favor of facts,
- instead, exploit the grammatical distribution of German *wissen* vs *kennen* (*know*),
- suggest to view facts as proof objects in the sense of Martin-Löf's Type Theory (Martin-Löf 1987, 1996)

4

Substitutivity test (1)

Ginzburg & Sag (2000):

- A predicate treats a nominal 'purely referential' if it passes the substitution test below.
- If a nominal is treated 'purely referential' by a predicate, it indicates the semantic type of the argument.

(a) *There is the claim that Hans doesn't have any money.
Marie believes that claim.*
==> *Marie believes that Hans doesn't have any money.*

→ *believe* treats proposition denoting arguments fully referential, therefore, *believe* selects for propositions

5

Substitutivity test (2)

(b) *It is a fact is that Hans doesn't have any money.
Marie knows that fact.*
==> *Marie knows that Hans doesn't have any money.*

→ *know* treats fact denoting arguments fully referential therefore, *know* selects for facts

(c) *There is the claim that Hans doesn't have any money.* (assumed to be true)
Marie knows that claim.
= / => *Marie knows that Hans doesn't have any money.*

→ *know* does not treat proposition denoting arguments fully referential therefore, *know* does not select for facts (even if true)

Ginzburg & Sag:

- Failure of substitutivity shows that factive verbs select for arguments denoting facts, but not for arguments denoting (true) propositions.
- Therefore, facts are distinct from (true) propositions.

6

Substitutivity – German data

(b) *It is a fact is that Hans doesn't have any money.* (repeated)
Marie knows that fact.
==> *Marie knows that Hans doesn't have any money.*

→ *know* treats fact denoting arguments fully referential

German version (Tatsache – fact, wissen / kennen – know)

(d) *Es ist eine Tatsache, dass Hans kein Geld hat.*
*Marie *weiß / kennt diese Tatsache.*
==> *Marie *kennt / weiß, dass Hans kein Geld hat.*

?? → *wissen* treats fact denoting arguments fully referential

The paradigm case of a factive verb -- *wissen* -- does not take the paradigm case of a fact denoting nominal – *Tatsache* – as an argument!

7

wissen vs. kennen (1)

wissen

– declarative complement clauses

M. weiß, dass er kommt.

M. knows that he will come.

– interrogative complement clauses

M. weiß, ob er / wer kommt.

M. knows whether he / who will come.

– von-PPs

M. weiß von dem Plan / Überfall.

M. knows about the plan / robbery.

– direct object NPs (very rare!)

M. weiß den Weg / die Lösung.

M. knows the way / solution.

kennen

– direct object NPs

M. kennt Hans / die Gesetze / seine Meinung / diese Tatsache.

M. knows Hans / the laws / her opinion / the fact.

8

wissen vs. kennen (2)

- (a) *M. weiß den Weg.* ==> M. knows how to get to some place.
(b) *M. kennt den Weg.* ==> M. took that way / route before.
M. knows the way.
description vs. acquaintance ??
- (c) *M. weiß von dem Plan.* ==> M. knows that there is a particular plan.
(d) *M. kennt den Plan.* ==> M. is familiar with the details of the plan.
M. knows (about) the plan.
- (e) *M. weiß von seiner Behauptung.* ==> M. knows that he made a certain claim.
(f) *M. kennt seine Behauptung.* ==> M. knows the content of his claim.
M. knows (about) his claim.'
existence vs. acquaintance ??

9

wissen vs. kennen (3)

wissen does not combine with *Tatsache* while *kennen* does:

- (a) *Marie weiß, dass ...* *Marie knows that ...*
(b) * *Marie weiß die Tatsache, dass ...* ? *Marie knows the fact that ...*
(c) *Marie kennt die Tatsache, dass ...* *Marie is aware of the fact that ...*

→ *wissen* and *kennen* select for different types of arguments

- (d) *Marie weiß, dass φ* ==> *Marie kennt die Tatsache, dass φ.*

→ the arguments of *wissen* and *kennen* are systematically related to each other

Hypothesis: *kennen* selects for facts (among other things)
wissen selects for true propositions

(since facts are truth-makers, systematically related to true propositions)

10

Facts are proofs of a proposition

One prominent usage of *Tatsache*:

Diese Tatsache ist ein Beweis dafür, dass ... *This fact is a proof that ...*

- Classical logic: propositions are either true or false
Possible world semantics: propositions are set of worlds
(i.e. the set of worlds where the proposition is true)
- Type theory: propositions are sets of proofs
– a proposition is true iff non-empty
- proofs are part of the object language
judgement that A is true $a : A$
(Martin-Löf 1987, 1996)

→ a fact is a proof of a proposition – a true proposition is one that has a proof

11

Preliminary representation

suppose: *wissen* selects for true propositions, *kennen* selects for facts – proofs

Marie glaubt, dass Hans in Berlin ist. *M. believes that Hans is in Berlin*
glauben (m, H-in-Bln) (H-in-Bln : prop)

Marie weiß, dass Hans in Berlin ist. *M. knows that ...*
wissen (m, H-in-Bln) ($x : H-in-Bln$, H-in-Bln : prop)

Marie kennt die Tatsache, dass Hans in Berlin ist. *M. is familiar with the fact that ...*
kennen (m, x) ($x : H-in-Bln$, H-in-Bln : prop)

assertion: *Hans ist in Berlin.* $x : H-in-Bln$ (H-in-Bln : prop) ?
hBln : H-in-Bln (...)

12

"Justified true belief"

Recall: *Marie weiß, dass p* ==> *Marie kennt die Tatsache, dass p*

knowledge as justified true belief:

Marie weiß / knows, dass p iff (i) Hans glaubt/believes, dass **p**
(ii) **p** is true
(iii) Hans is justified in believing that **p**

assuming that facts are proofs: (i) ...
(ii') there is a proof of **p**
(iii') Hans kennt / is familiar with this proof of **p**

(immune to the Gettier problem)

13

Are facts/proofs similar to events?

Ranta (1994) Type Theoretical Grammar, p. 54:

"... rudiments of the propositions-as-types principle occur in various theories of truth-makers. A well-known example is Davidson's ontology of events."

Davidsonian events make an event sentence true:

"There is an event *e* which is a stabbing of Caesar by Brutus"
Brutus stabbed Caesar. $\exists e. \text{stab}(\text{Brutus}, \text{Caesar}, e)$

Events \neq facts

- facts lack spatial-temporal properties, facts don't *happen*, ...
- *Ereignis* cannot be combined with *kennen*

* *Marie kennt dieses Ereignis.* *M. is familiar with that event.*

* *Marie weiß dieses Ereignis* *M. knows that event.*
Marie weiß von diesem Ereignis. *M. knows about that event. (?)*

14

Situation Semantics

Kratzer (2002)

- possible situations are parts of possible worlds
- possible situations are partially ordered ("part-of")
- propositions are sets of possible situations
- a possible situation **s** is a fact exemplifying a proposition p iff for all subsituations **s'** in which **p** is not true there is a subsituation **s''** such that $s' \leq s'' \leq s$, and **s''** is a minimal situation in which **p** is true. (A minimal situation in which **p** is true is a situation that has no proper parts in which **p** is true).

S knows **p** iff (i) There is a fact **f** that exemplifies **p**,
(ii) S believes **p** *de re* of **f**, and
(iii) S can rule out relevant possible alternatives of **f** that do not exemplify **p**.

15

Type Theory with Records

Cooper (2006):

draws a parallel between Type Theory and Situation Semantics

Type Theory: propositions are sets of proofs
Austinian Truth: statements are true of something

$a : A$ a is a proof of A – A is true
 $s \models \sigma$ situation s supports $\text{infor } \sigma$ – s is of type σ

- Type Theory is encoded by using records
- Situations are regarded as contexts in type theory, and represented as records (belonging to record types)
- Record types represent the object of attitudes

(see also Ginzburg 2005)

16

Conclusion

Initial question:

Are facts distinct from true propositions? If so, how does a fact differ from a true proposition?

The semantic difference between *wissen* and *kennen* exemplifies the difference between propositions and facts:

- *wissen* combines with a truth-bearer, a true proposition
- *kennen* combines with a truth-maker, a fact

In Type Theory, true propositions invariably come with a proof,

→ truth-maker and truth-bearer exist simultaneously

Some open questions:

- What do factive verbs like *bedauern* (*regret*), *vergessen* (*forget*) select for? (suggestion: ambiguous, depending on the syntactic type of the argument)
- How to analyse NP/PP arguments of *wissen* ?
- How do facts relate to events?

17

References

- Asher, N. (1993) Reference to Abstract Objects in Discourse, Dordrecht: Kluwer Academic Publishers.
- Barwise, J. & J. Perry (1983) Situations and Attitudes, MIT Press.
- Cooper, Robin (2006) Austinian truth, attitudes and type theory. *Research on Language and Computation*, Vol. 3 (2005), pp. 333-362
- Davidson, D. (1967) 'The Logical Form of Action Sentences', in N. Rescher (ed.), *The Logic of Decision and Action*, Pittsburgh: University of Pittsburgh Press, pp. 81-95;
- Ginzburg, J. & I. Sag (2000) Interrogative Investigations. CSLI Lecture Notes 123.
- Ginzburg, J. (2005) Situation Semantics: The Ontological Balance Sheet. *Research on Language and Computation*, Vol. 3 (2005), pp. 363-389
- Kratzer, A. (2002) Facts: Particulars or Information Units? *Linguistics & Philosophy* 25, 655-670.
- Martin-Löf, P. (1987) Truth of a proposition, evidence of a judgement, validity of a proof. *Synthese* 73, 407-420.
- Martin-Löf, P. (1996) On the meanings of the logical constants and the justifications of the logical laws. *Nordic Journal of Philosophical Logic*, Vol.1, No. 1, 11-60.
- Ranta, Aarne (1994) Type-Theoretical Grammar, Clarendon Press, Oxford.

18

19

20