

# Nonindexical Context-Dependence and the Interpretation as Abduction Approach

Erich Rast

[erich@snafu.de](mailto:erich@snafu.de)

IFL, Universidade Nova de Lisboa

PhiLang 2011, 13. 5. 2011



Instituto de  
Filosofia da Linguagem  
FCSH / UNL

# Overview

Interpretation as Abduction

Examples

Technical Remarks

Conclusions

## Interpretation as Abduction (IA)

This approach goes back to Hobbs et. al. (1993) but since then has barely been elaborated. It can be used for modeling *nonindexical linguistic context-dependence*.

### Examples of Context-Dependence

- (1) John is ready.
- (2) Every beer is in the fridge.
- (3) Fire!
- (4) I'm parked back there.
- (5) John went to the bank.

Thesis: IA is well-suited for cases like (1)-(3), less appropriate for (4)-(5).

# The Setting

## Intensions

- ▶ In the article, intensions as sets of possible worlds are used – i.e. predicates of type  $ct$  in HOL, where  $c$  is a type for states (possible worlds or more fine-grained entities; situations in a partial logic (Muskens 1995, 2005)).
- ▶ IA can also be generalized to a two-dimensional semantics but the details can be tricky (Rast 2010).

## Inclusive Context-Dependence

- ▶ Let  $P_i$  be possible interpretations of  $Q$ . If in general  $\forall s. P_i s \rightarrow Q s$ , i.e.  $P_i \subseteq Q$  in set-theoretic terms, then the context-dependence is *inclusive*. Otherwise let us call it *non-inclusive*.
- ▶ If a context-dependence is inclusive, an (agent-relative) abductive inference can be used to model the interpretation of semantically incomplete content.

# Abduction

## Problem Formulation

For a given intension  $Q$  and agent  $a$  in a given base situation  $u$ , find the  $P_j$  among the  $P_i$ 's such that  $\forall s. P_i s \rightarrow Q s$  that is most plausible for the agent  $a$  in  $u$  (in comparison to all other  $P_i$ 's).

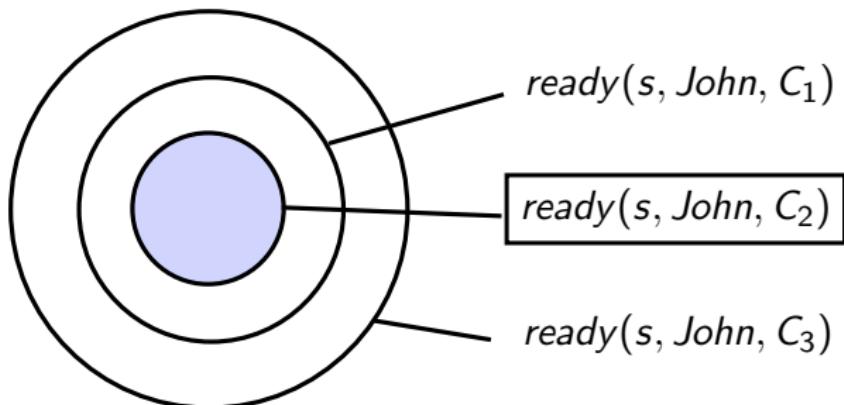
- ▶ The states play the role of doxastic alternatives in this approach.
- ▶ Can be implemented directly on the basis of *subjective plausibility* understood as a preorder relation over the set of states.

## Example: John is ready

$$\lambda s. \exists X [\text{ready}(s, \text{John}, X)] \quad (1)$$

Consider existential particularizations  $\text{ready}(s, \text{John}, C_i)$  for constants  $C_i$ . Each of these implies (1), hence abduction is applicable:

$$\text{ready}(s, \text{John}, C_i) \rightarrow \exists X. \text{ready}(s, \text{John}, X)$$



## Open Argument Places

Many cases of nonindexical context-dependence can be modeled by existentially quantifying over open argument places:

- ▶ John is ready.

$$\lambda s \exists X. ready(s, John, X) \rightsquigarrow \lambda s. ready(s, John, C)$$

- ▶ Every beer is in the fridge.

$$\begin{aligned} \lambda s \exists X Y. \forall x [(&Beer(s, x) \wedge X(s, x)) \rightarrow \\ &located(x, \iota y [Fridge(s, y) \wedge Y(s, y)]))] \\ \rightsquigarrow \lambda s. \forall x [(&Beer(s, x) \wedge C_1(s, x)) \rightarrow \\ &located(x, \iota y [Fridge(s, y) \wedge C_2(s, y)]))] \end{aligned}$$

- ▶ Fire!

$$\lambda s. \exists x [burn(s, x)] \rightsquigarrow \lambda s. burn(s, c)$$

(These representations are just examples and not intended to be fully adequate.)

# Ambiguities and Semantic Transfer

## Problem with Ambiguity

(5) John went to the bank.

(5')  $\lambda s. Past(s) \wedge$

$(go[s, John, \lambda x. bank_1(s, x)] \vee go[s, John, \lambda x. bank_2(s, x)])$

Applying the interpretation as abduction view to ambiguities requires literal semantic content that represents a huge disjunction of all possible interpretations. Such content is not readily available.

## Problem with Semantic Transfer

(4) I'm parked back there.

These cases require other mechanisms (e.g. Gricean ones) in order to arrive at some interpretable contents in the first place. Their literal meaning is not the basis for abductive inference, if there is one.

## Notes on the Implementation

☞ The details are in the article.

- ▶ Based on work on preference logic by van Benthem/Liu (2005), Liu (2008), Lang/van der Torre (2008), Baltag/Smets (2006, 2010) and my own work.
- ▶ Introduce a preorder  $\leq$  over states (reflexive, transitive) that also depends on an agent and a base state, reflecting an agent's ability to compare two scenarios according to their subjective plausibility at a given time.
- ▶ You also need a well-ordering axiom to ensure that every non-empty intension has a  $\leq$ -minimum.
- ▶ For the dynamics you can encode well-known preference update operations directly in HOL, e.g. the article uses *lexicographic update*. **Without dynamics the approach becomes a case of 'vacuous modeling'!**
- ▶ One form of abduction is then based on the  $\leq$ -minimum of  $\lambda s. \forall t [Rst \rightarrow Pt]$  for an agent in a given base state.
- ▶ "the most plausible states in the  $R$ -relation to those in  $P$ "

# Abduction

## Minimum

Relative to an agent  $x$ , base state  $u$ , plausibility relation  $C$  and intension  $P$ :

$$\text{MIN} := \lambda CxuP. \iota Q \forall s [(Ps \wedge \neg \exists t [Pt \wedge Cxuts \wedge \neg Cxust]) \equiv Qs]$$

## General Abduction

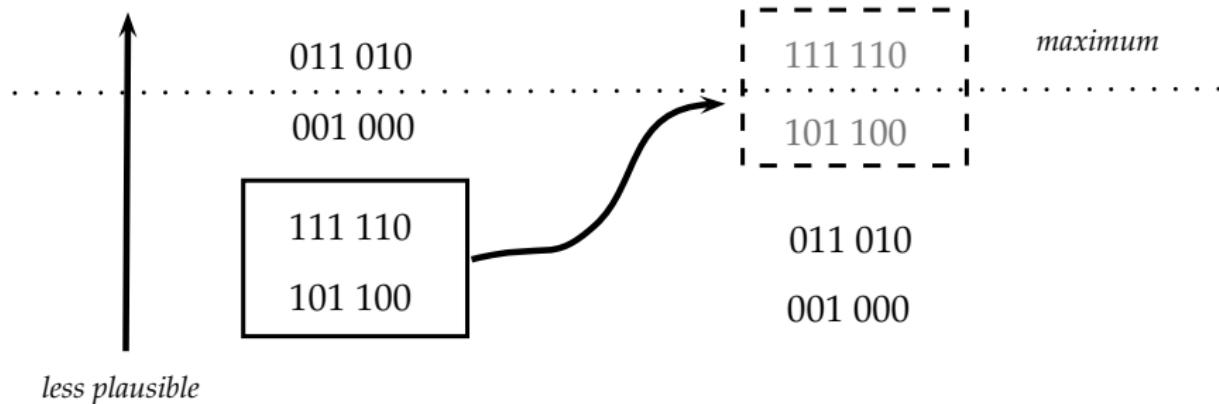
Relative to an agent  $x$ , a base state  $u$ , and intension  $P$ :

$$\downarrow := \lambda CxuP. \text{MIN}_C xu \lambda s. \forall t [Rst \rightarrow Pt]$$

☞  $R$  is a sort of ‘accessibility relation’ that can be used to implement different forms of abductive reasoning. For example,  $Rst$  could be read as  $s$  is a cause of  $t$ .

## Lexicographic Update

Lexicographic upgrade: To revise an ordering relation by  $P$ , shift all  $P$ -states on top of the non- $P$ -states in the new relation.  
*more plausible*



van Benthem/Liu (2005), Liu (2008), Lang/van der Torre (2008),  
Baltag/Smets (2006, 2010).

## Summary and Conclusions

- ▶ Inclusive context-dependence is very common.
- ▶ Many cases of linguistic context-dependence can be modeled on the basis of the interpretation as abduction view.
- ▶ Not much is gained by attempting to apply the interpretation as abduction method to non-inclusive context-dependence.
- ▶ General forms of abduction can be implemented on the basis of subjective plausibility.
- ▶ **Danger of vacuous modeling:** To avoid it, a way to rationally revise the plausibility relation in light of new evidence is needed.
- ▶ Future goals:
  - ▶ Use more methods from formal epistemology for theorizing about the semantics/pragmatics interface.
  - ▶ Combine plausibility with default reasoning.