Knowledge Representation for Language Engineering

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short presentation for:
Computer Linguistics II, Miriam Butt

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0. Plan

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1. $\mathcal{W}$hat
2. $\mathcal{W}$hy
3. $\mathcal{H}$ow
4. $\mathcal{W}$hom
5. $\mathcal{H}$ow
6. $\not{\mathcal{W}}$ $\mathcal{Q}$uestions

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1. What?

1. What?

Def. **Knowledge Representation**: *the enterprise of specifying information about the* **world** *for use in* **computer** *systems*
p. 299

use

- conceptual results
- mathematical results
- computational results

. . . with the goal to **systematize** information.

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2. Why?

(1) I would like coffee.

as an answer to one of the questions

(2) Would you like a drink with dessert?

(3)
a. which of these flavors do you want?
b. What will you have to drink tomorrow morning?
c. Will you program for Team Coke or for Team Coffee?

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Division

Semantics $\longleftrightarrow$ pragmatics

$\downarrow$ $\downarrow$

interpretation $\longleftrightarrow$ meaning

. . .

3. How?

3. How?

3 levels:

- knowledge level
- representations and algorithms
- implementation level

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what the levels are responsible for:

	interpretation	⇒	meaning
knowledge level	words and phrases annotated with things they describe	links	Categories of Interpretation
interpretation / algo level	symbols	algos	predicates, operators
implementation level	...		...

3.1 Knowledge Level

- pre-formal
- use knowledge from Semantics, Pragmatics, CogSci

Interpretation:

- words and phrases annotated with things they describe
- use ontology, develop a domain representation
- organize relationships

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Meaning:

- **generalizations** from utterances to range of utterances
- Semantic knowledge as constraints (see (4), p. 311)
- use abstract concepts to accomodate different interpretations
- combination on knowledge level
- satisfy constraints

3.2 Representations and Algorithms Level

- Def: **Representation**s are formal structures that we can use to define computational operations but that we can also view as encoding information about the world.
- intended interpretation
- **algorithm**s: abstract but explicit and mechanical descriptions of the operations that the implementation will carry out.
- together: a formal specification
- this intermediate level **mediates** between knowledge and inplementaion level

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Interpretation

- symbols

  main challenge: consistency

- words 'build' a sentence: syntax

- make info explicit

Meaning

- use of variables, instantiation
- interpretation: vars $\longrightarrow$ values
- ex: a CSP solver (in implementation level notation)

```
solve([]).
solve([C|Cs]) :-
  clause(C,true),
  solve(Cs).
```

3.3 Implementation Level

- Def: **implementation**: how proposed representations and algorithms are to be realized in physical systems.
- Ex: PROLOG
- level translation not too difficult . . .

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4. Whom?

Elements of interpretation

- objects . . .
- whole categories . . .
- events
- space: place and path
- abstract objects

5. How?

5. How?

- **Description logic**: concepts and roles . . .
- **First Order Logic (FOL)**: terms, variables vs. predicates; sentences make claims.
- **Modal logic**: FOL '+' modal operators

6. conclusion

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. . . in the end, you will have to collaborate with humans. Who has to learn, who has to adapt, . . . ?

THE END

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