



Introducing Dialogue Games

Day 3

Paul Piwek

The Open University, UK

Course Plan

- **Wednesday:**
 - Why study dialogue?
 - What is a dialogue game?
 - Historical overview – argumentative dialogue
- **Thursday:**
 - Historical overview – task-oriented/goal-directed dialogue
 - Goal-directed dialogue between software agents
 - Following rules in dialogue (Grice)
- **Today:**
 - Remainder : following rules in dialogue (Grice)
 - Final part of historical overview: logical/semantic games
 - Open issues/challenges
 - Demos

H.P. Grice (1913 - 1988)

- *Logic & Conversation* (1967, published in: 1975/1978/1989)
- **Shows** that “non-logical” meaning can be constructed systematically from “what is said” and a general principle of conversation.
- **Maxims of Cooperation:** quantity, quality, relation & manner.
- **Implicatures:** q is an implicature of uttering literal meaning p \Leftrightarrow S is assumed to be cooperative, and that requires q. S believes that the hearer can work out q (and ...).
- **Example:** A: I am out of petrol.
B: There is a gas station around the corner.

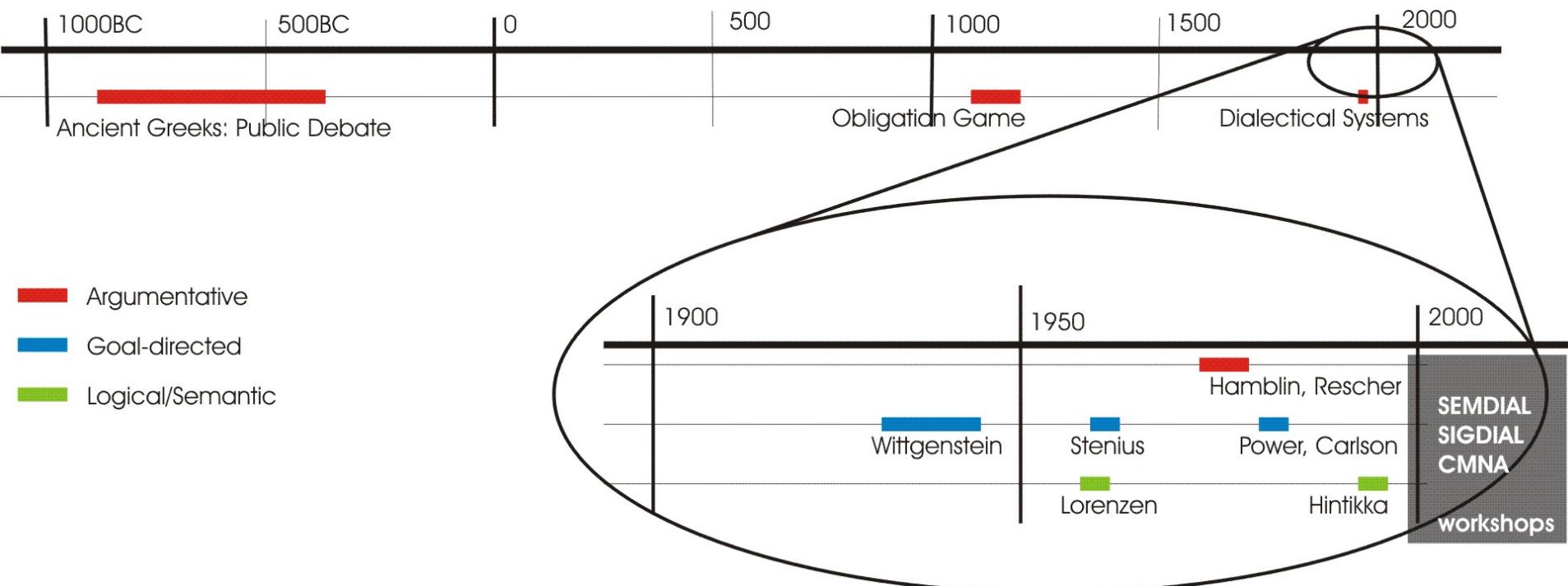
Properties of Conversational Implicatures

1. Can be cancelled (since it is possible to opt out).
2. Nondetachability. (try, attempt, endeavored).
3. Not part of the meaning (related to point 1).
4. The implicature is associated/triggered by the act of saying.
5. Multiple alternative implicatures are possible.

Implication for Dialogue Games

Given an utterance U in context C , if U at first sight doesn't conform with the "maxims of cooperation" (dialogue rules), the hearer can adjust C and the interpretation of U such that they do.

Dialogue Game - Chronology



Logical/Semantic Games

- Paul Lorenzen (1915 - 1994)
- Hintikka (1929 -)
- Alternative definitions of truth/falsity in a model and validity for formal logical systems.
- Use the game-theoretic notion of a winning strategy.

Propositional Logic

- Players: Eloise (defender) and Abelard (attacker)
- Model
- Moves:
- For P or Q: Eloise pick one of {P,Q}
- For P and Q: Abelard pick one of {P,Q}
- For Not P: swap roles
- For atomic(P): Eloise wins if P is true, Abelard wins if P is false
- There is a winning strategy for Eloise regardless of the model.

Some Challenges/Outlook

- Main venues:
 - SEMDIAL workshop
 - SIGDIAL (ACL) workshop
 - CMNA workshop

Some Challenges/Outlook

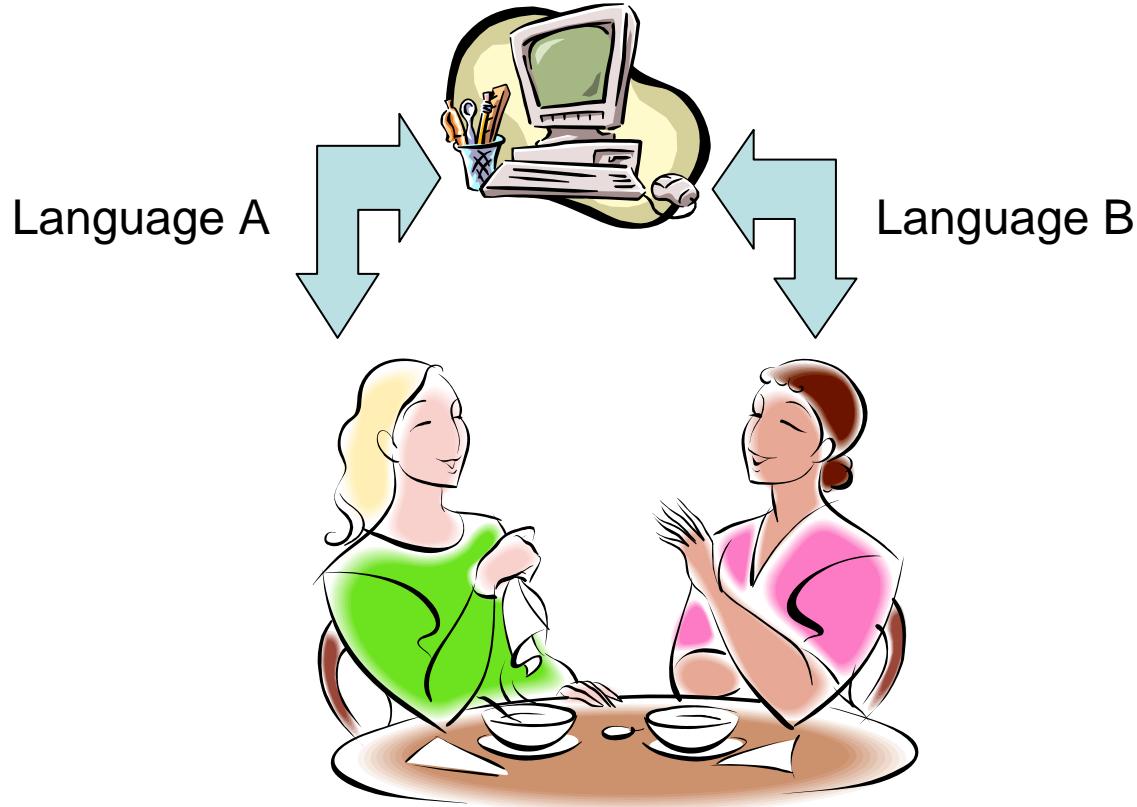
- Grounding problem
- Overlapping turns and simultaneous feedback
- Automatic alignment in dialogue (lexical, syntactic, situation model) (Pickering & Garrod, 2004) (BBS)
- Meaning in dialogue: coupling representations with sensory experience versus coordination of usage and sensory experience with other language users. (DeVault et al., 2006) (AAAI)

Demos/Applications

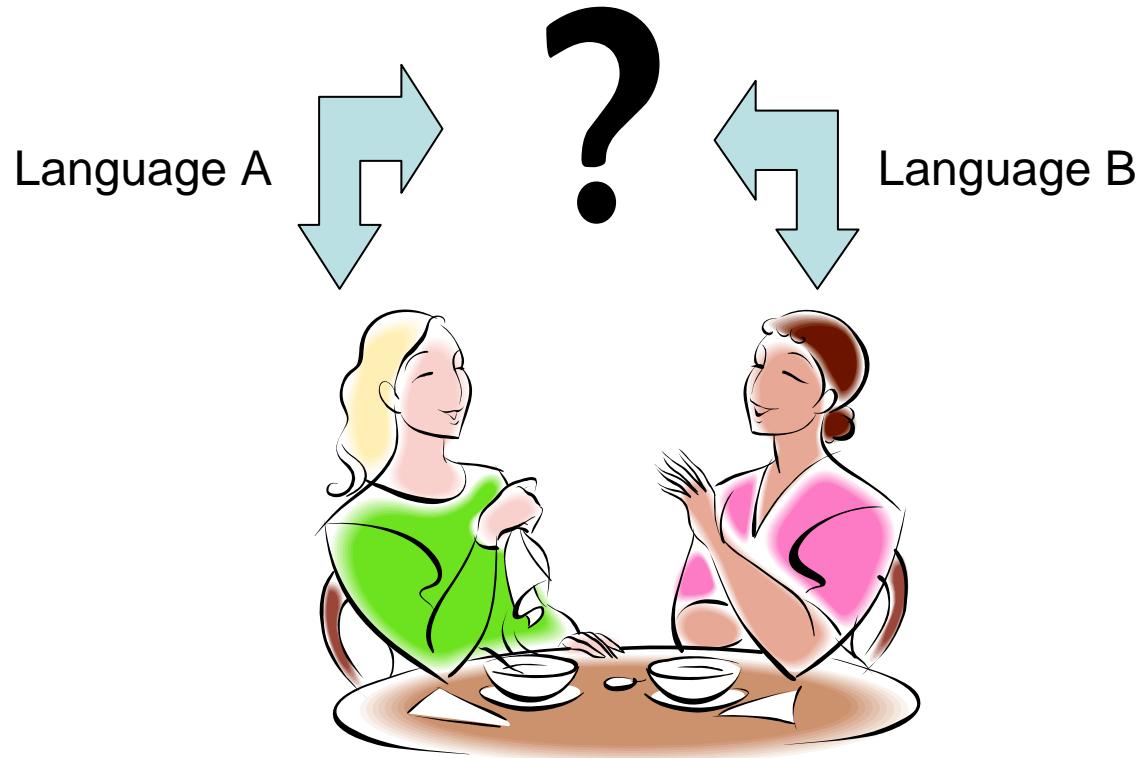
- **Dialogue Games for Crosslingual Communication** (Piwek, Hardcastle & Power, June 2007) (DECALOG)
- **Mapping text to Dialogue for computer-animated characters** (Piwek, Hernault, Prendinger & Ishizuka, September 2007) (IVA07)

Dialogue Games for Crosslingual Communication

Crosslingual computer-mediated dialogue



Crosslingual computer-mediated dialogue



Crosslingual computer-mediated dialogue

- Machine Translation
- Information extraction + language generation
- Template-based

Crosslingual computer-mediated dialogue

- Machine Translation
 - Some large scale projects (Verbmobil, Spoken Language Translator, ...), but no deployed system. Accuracy still quite low.
 - Typically sentence-by-sentence translation. No representation of the semantic content of the discourse.
- Information extraction + language generation
- Template-based

Machine Translation

- Source: ‘Daar achter staat een doos met appels. Kan ik daar een halve kilo van hebben?’
- Target: ‘Back there, there is a box with apples. Can I have half a kilo of those?’
- Babel Fish (<http://babelfish.altavista.com/tr> consulted on April 17, 2007): ‘There behind state a box with apples. Am I possible of it a half kilo have?’

Crosslingual computer-mediated dialogue

- Machine Translation
- Information extraction (named entity recognition, etc.) + language generation
- Template-based

What we say to dogs



what they hear



Crosslingual computer-mediated dialogue

- Machine Translation
- Information extraction + language generation
- Template-based

Crosslingual computer-mediated dialogue

- Machine Translation
- Information extraction + language generation
- Template-based
 - Allow user to fill in fixed templates: Systems have limited expressivity; But they can provide accurate and effective communication (e.g., Linguanet).

An alternative: Conceptual Authoring

- **Interpretation** from an input string/speech signal to a representation.
- **Conceptual Authoring:** direct manipulation of a representation (cut, paste, copy, drag & drop, insert, etc.)
 - Robust: no parsing, no syntax errors.
 - Problem: how to present the structures & editing operations to the user.

Conceptual Authoring

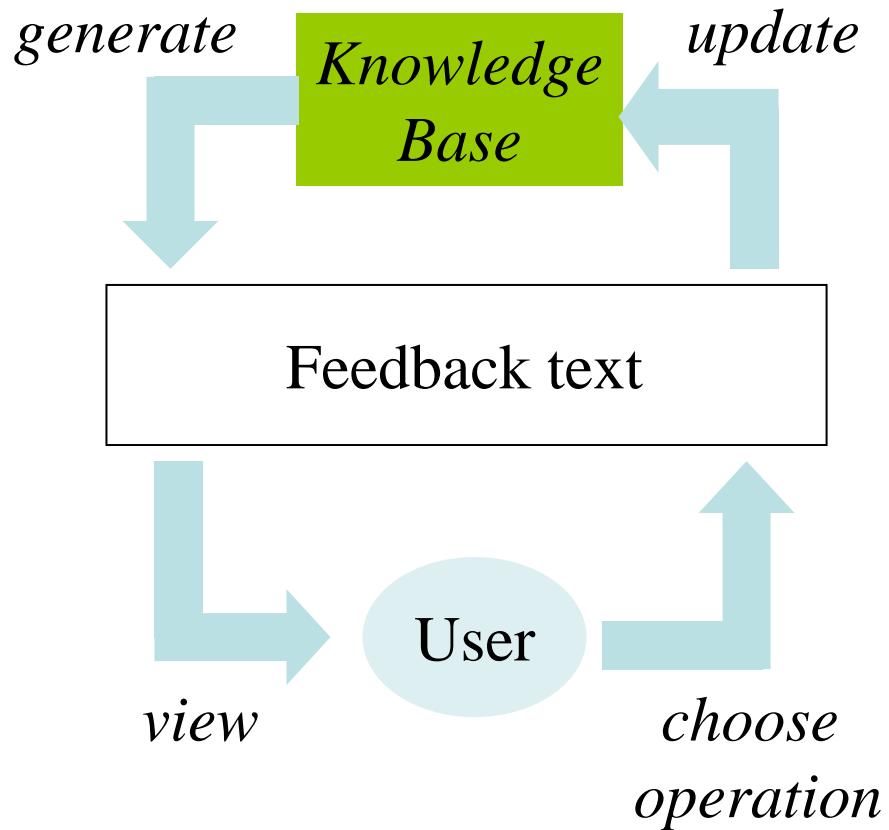
- Direct manipulation with graphical feedback



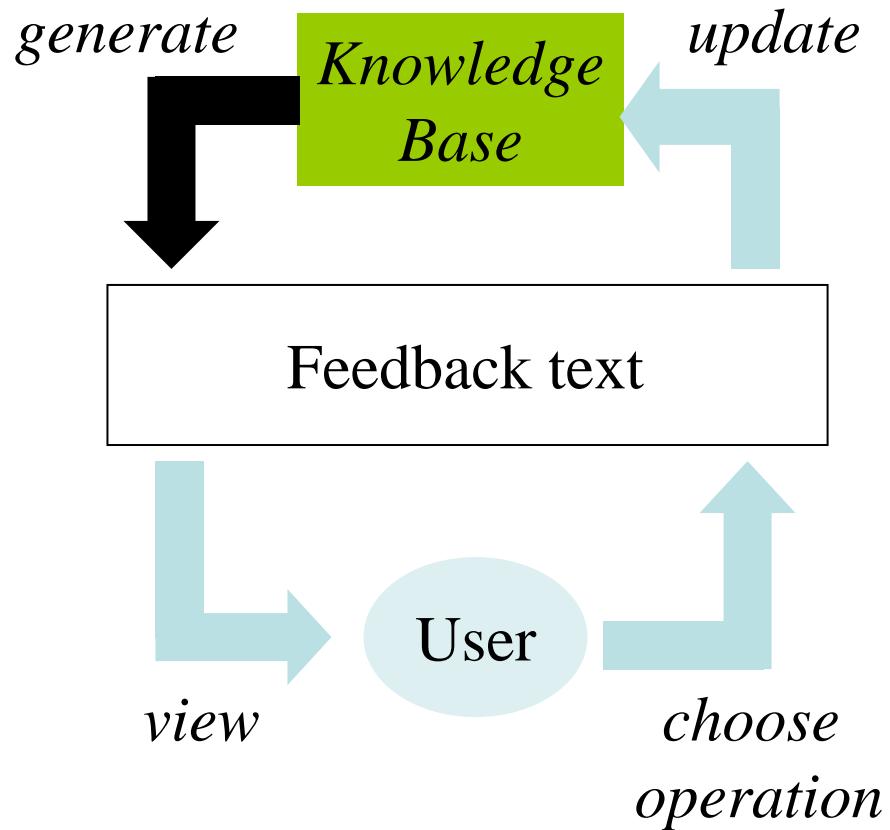
Conceptual Authoring

- Building a knowledge base by manipulating graphs, trees, diagrams, menus, etc. (e.g. Paley, 1996)
- Problem: Network representations can become very complex and hard and difficult to understand for ordinary users.

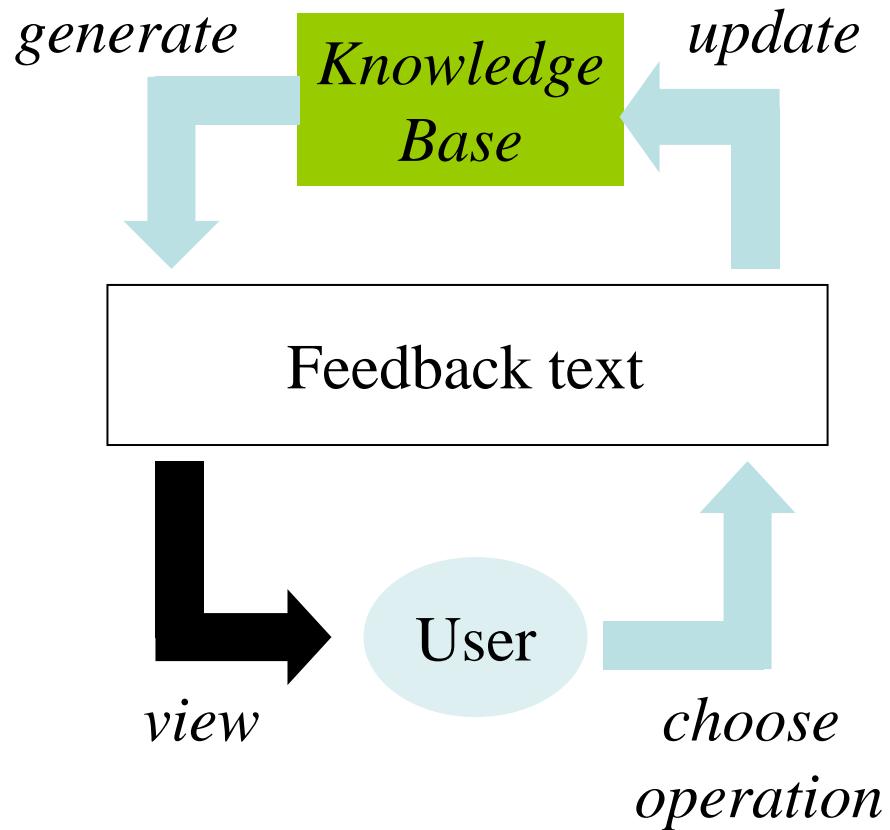
Conceptual Authoring



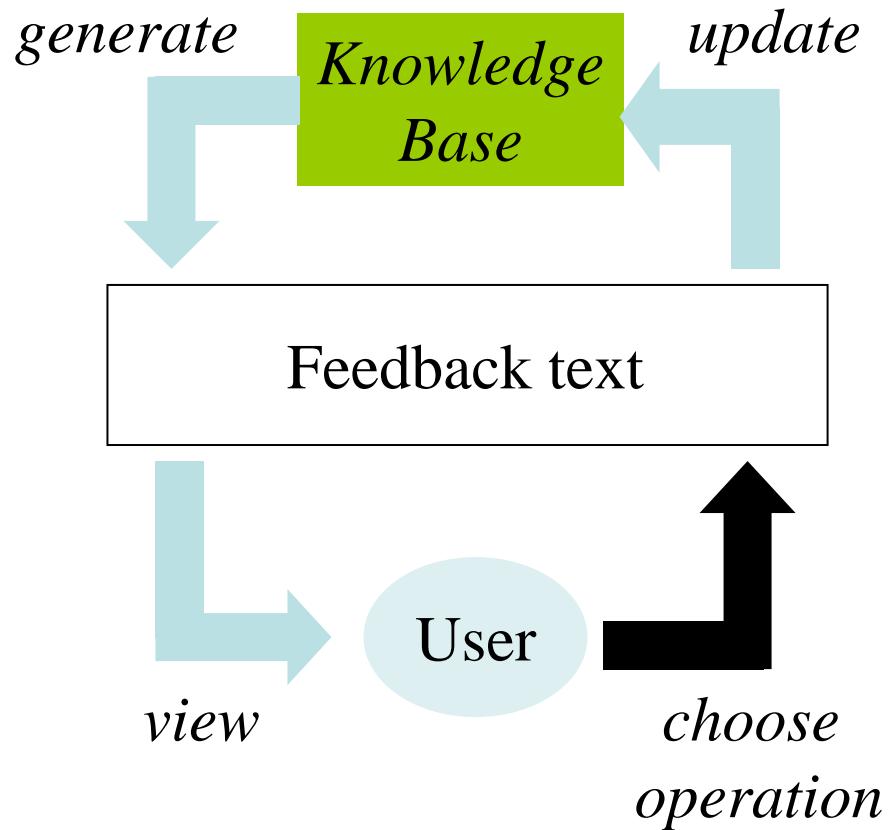
Conceptual Authoring



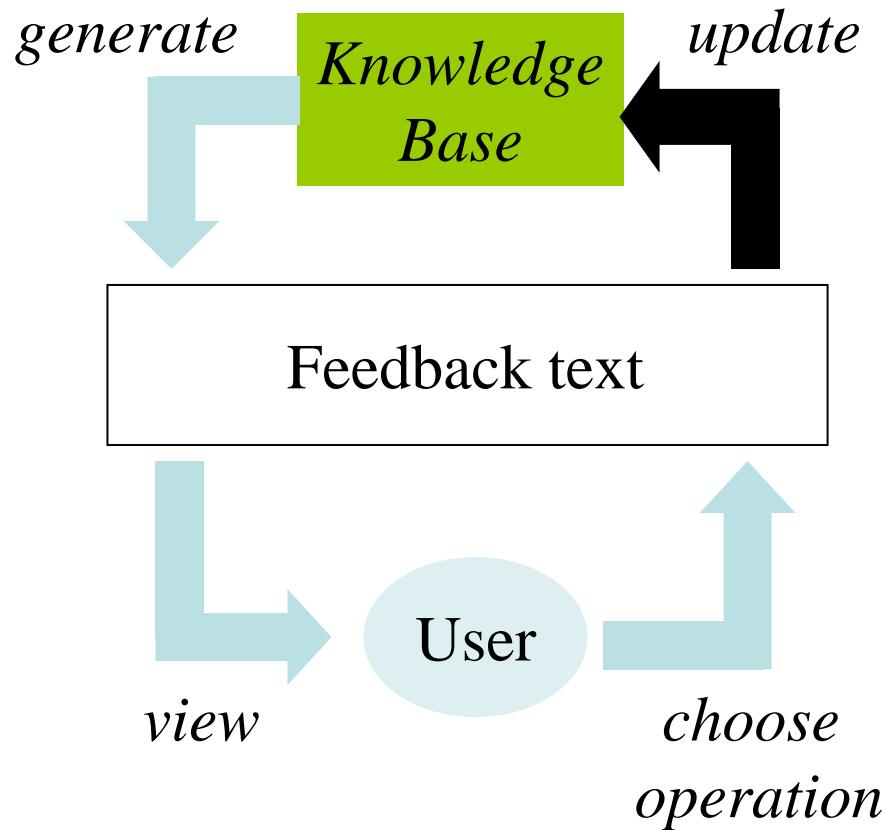
Conceptual Authoring



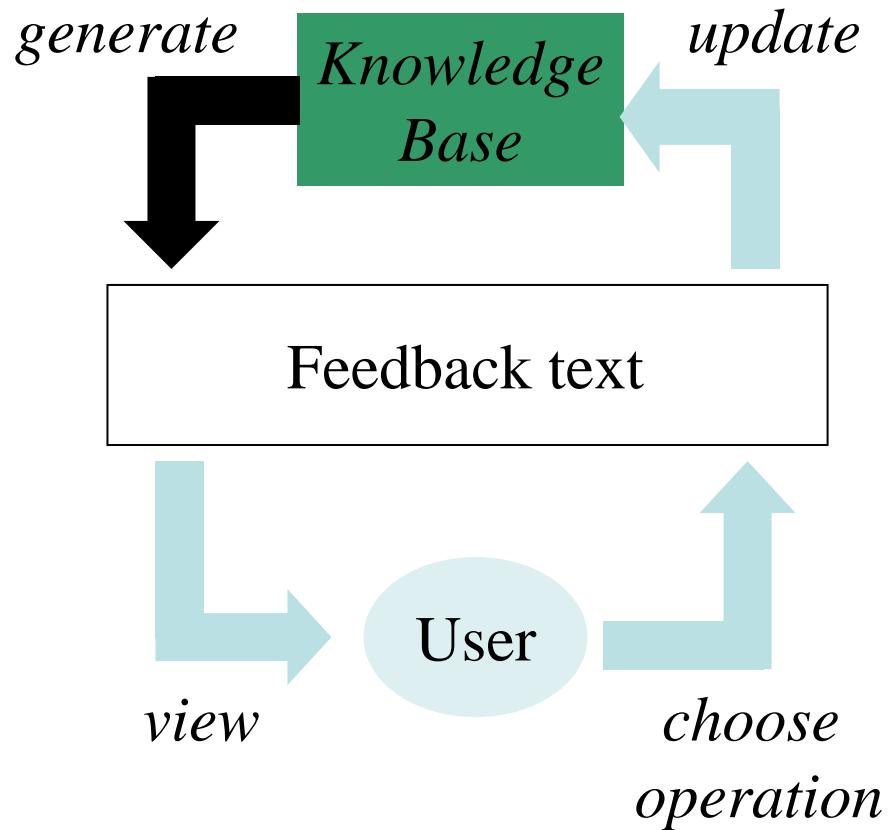
Conceptual Authoring



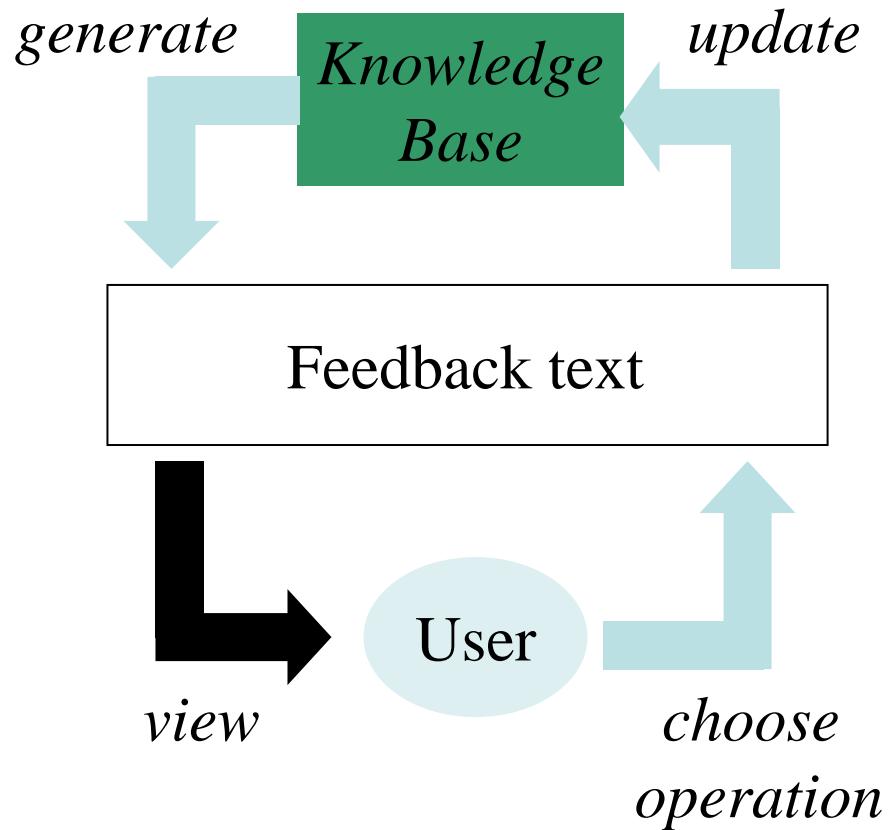
Conceptual Authoring



Conceptual Authoring

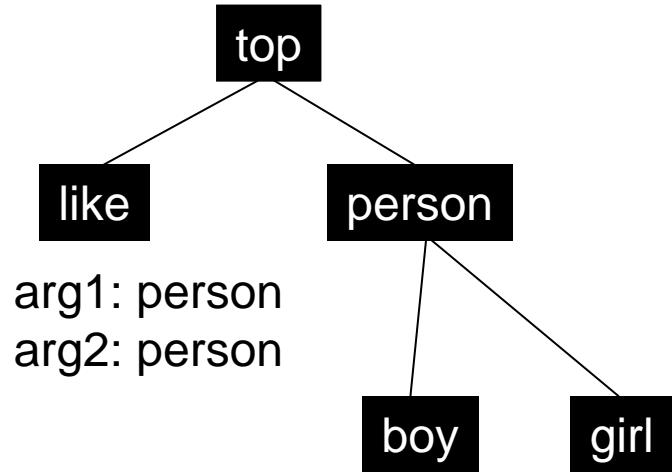


Conceptual Authoring



CA: Simple Example

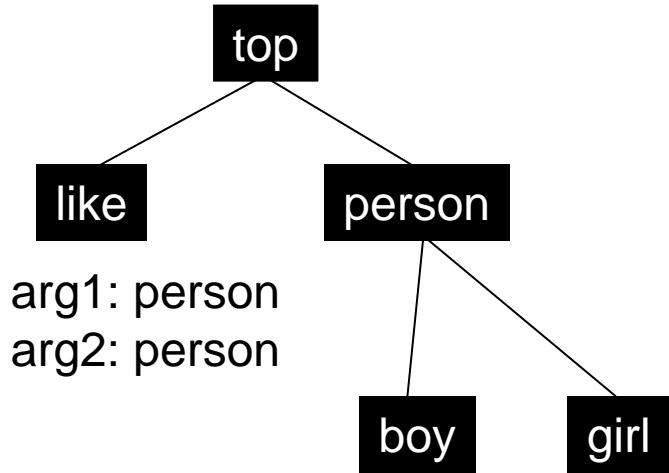
T-Box/Ontology



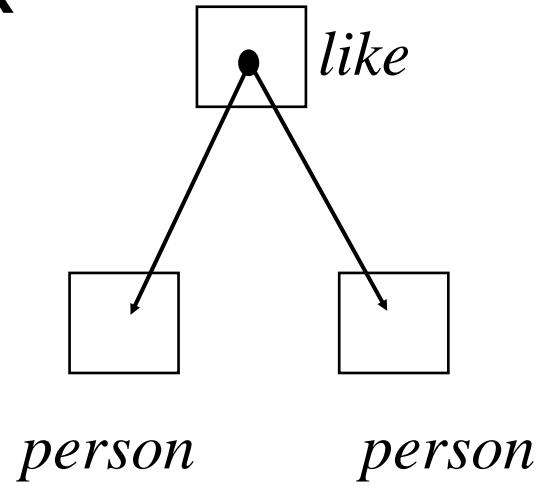
A-box

CA: Simple Example

T-Box

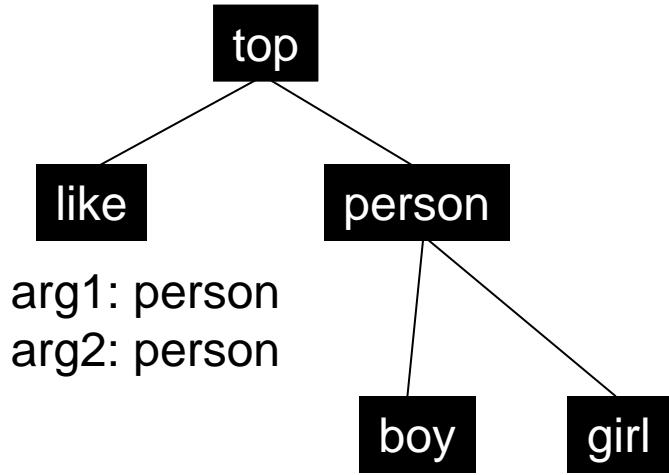


A-box

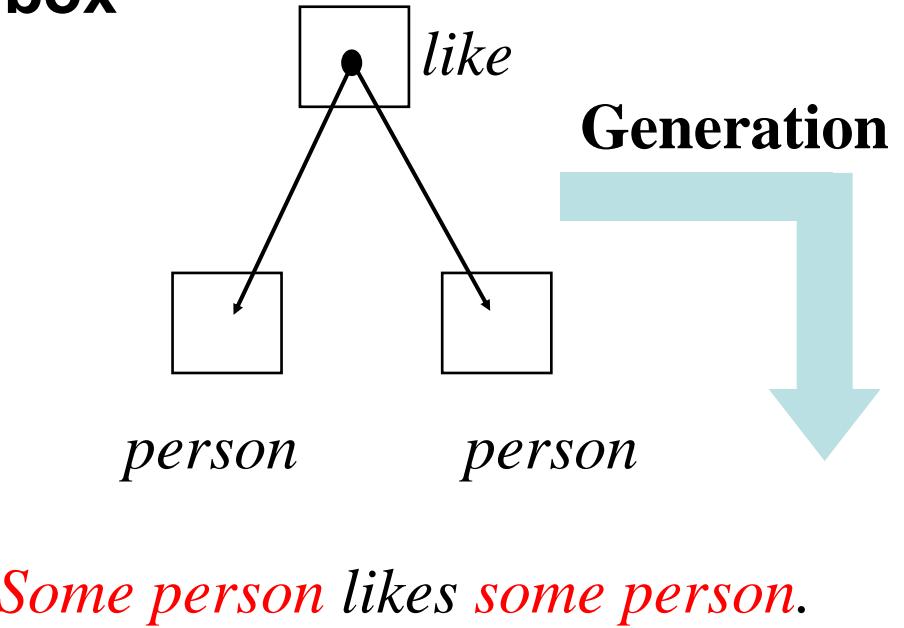


CA: Simple Example

T-Box

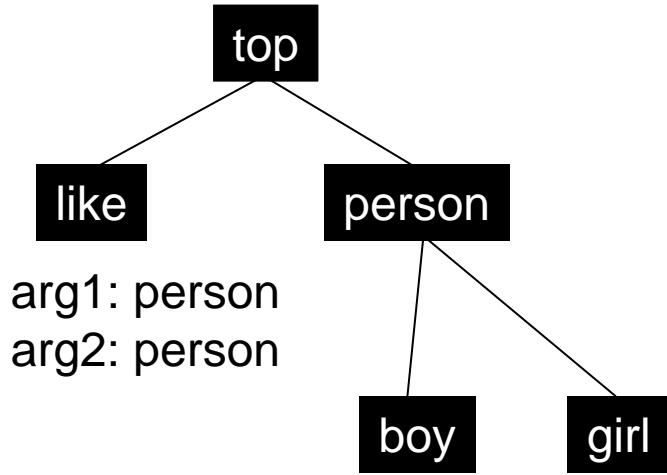


A-box

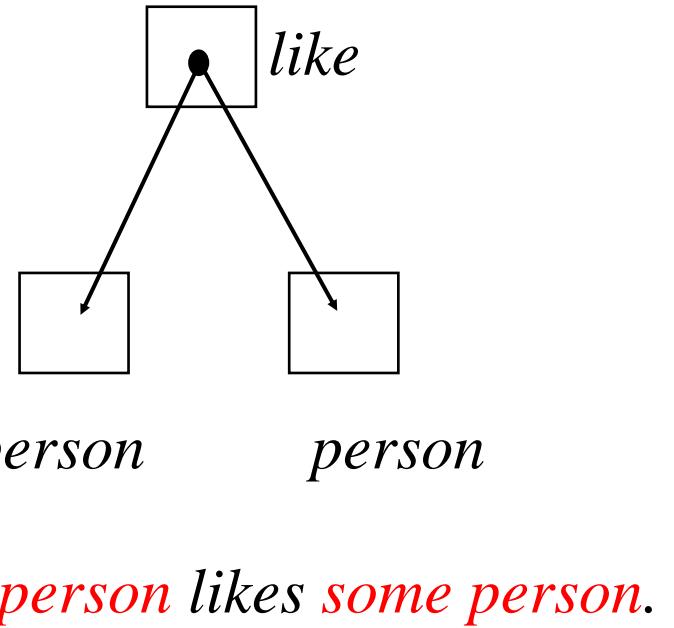


CA: Simple Example

T-Box

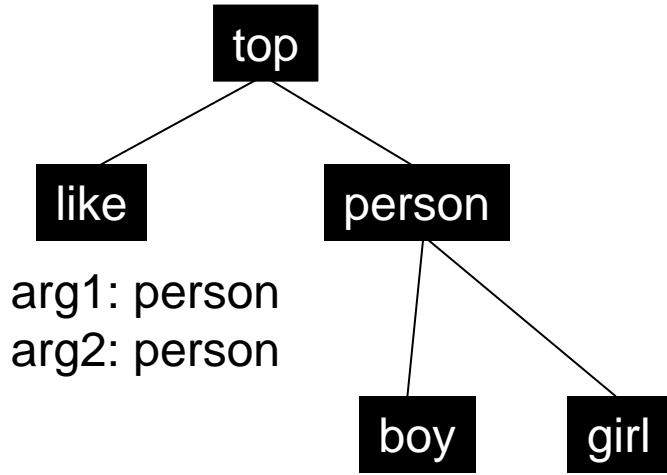


A-box

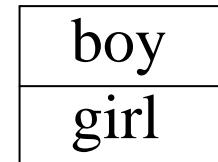
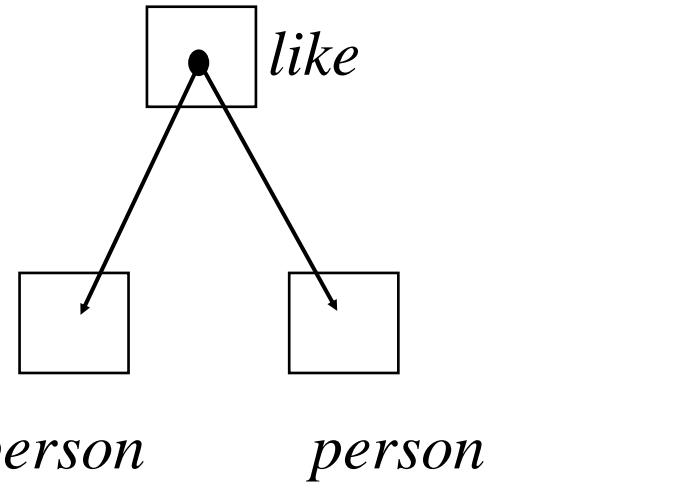


CA: Simple Example

T-Box

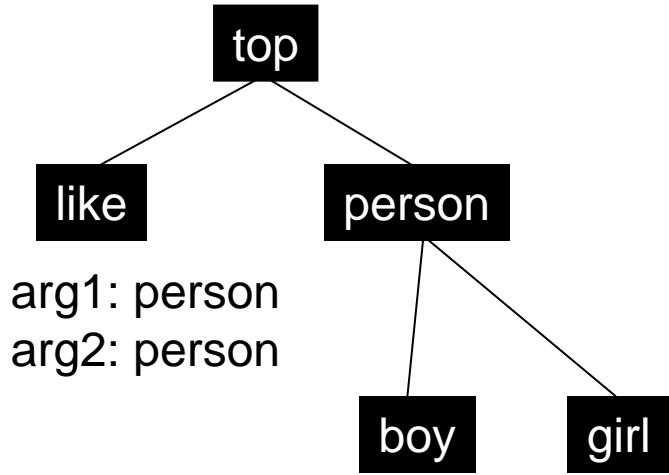


A-box

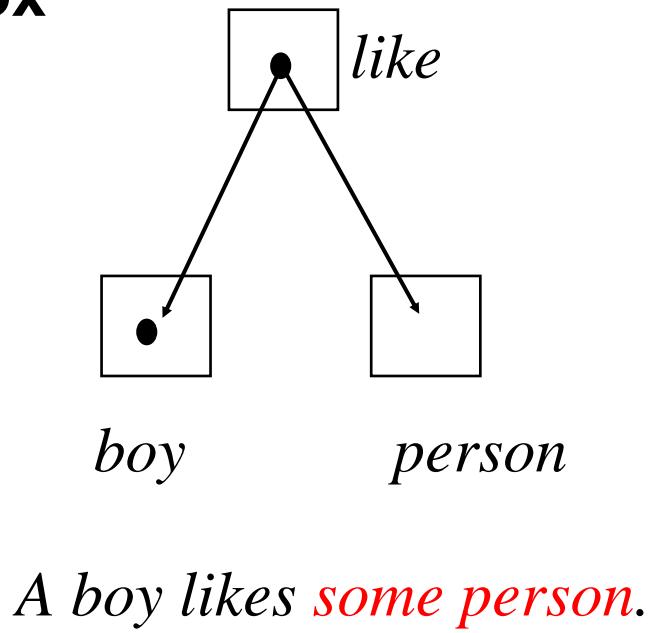


CA: Simple Example

T-Box

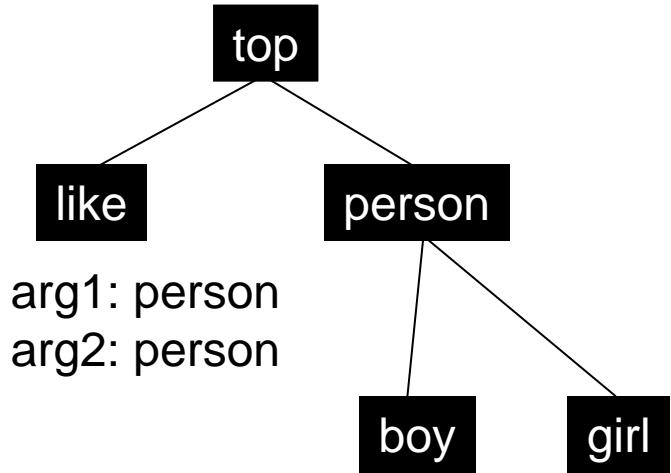


A-box

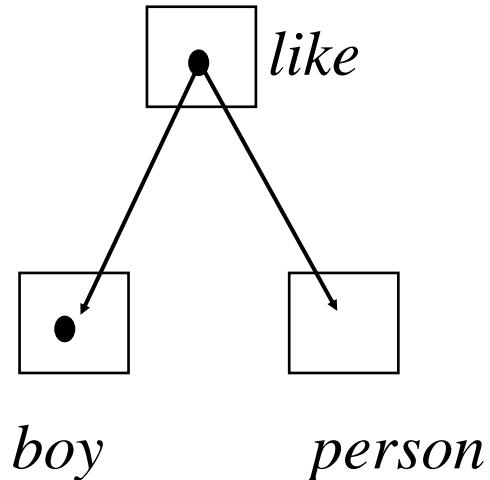


CA: Simple Example

T-Box



A-box

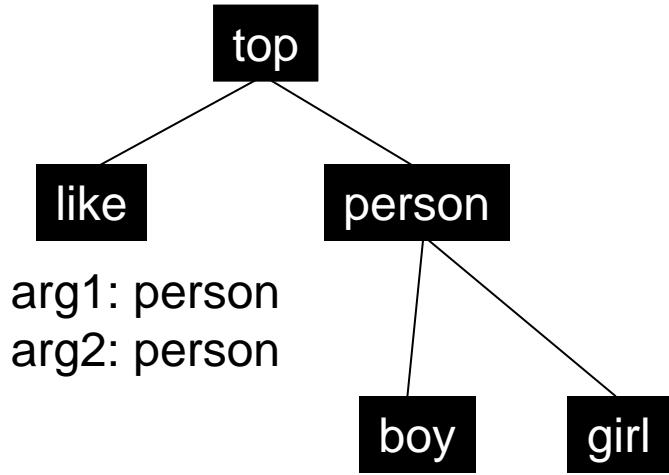


A boy likes some person.

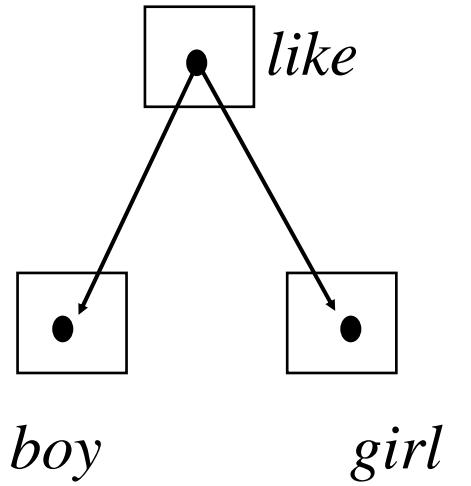
boy
girl

CA: Simple Example

T-Box



A-box

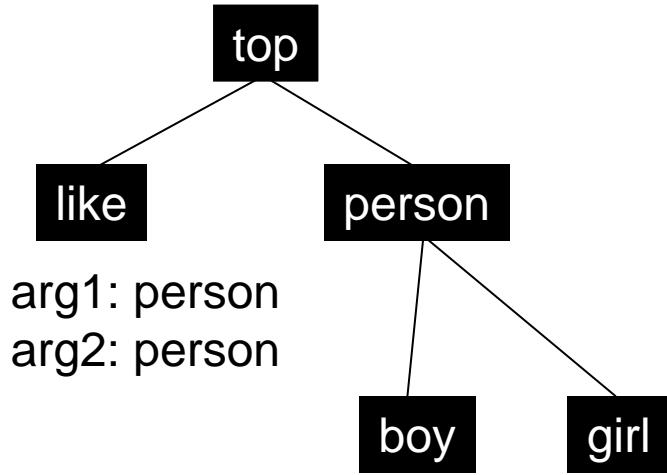


A boy likes a girl.

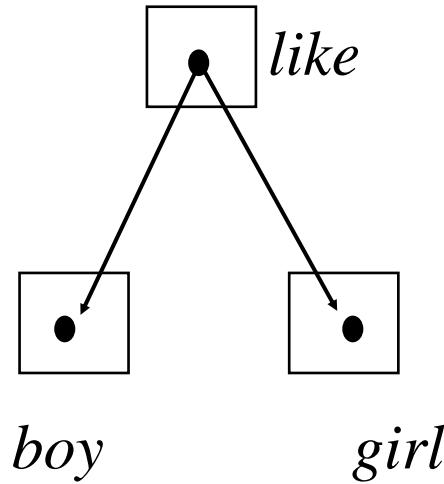
German

CA: Simple Example

T-Box



A-box

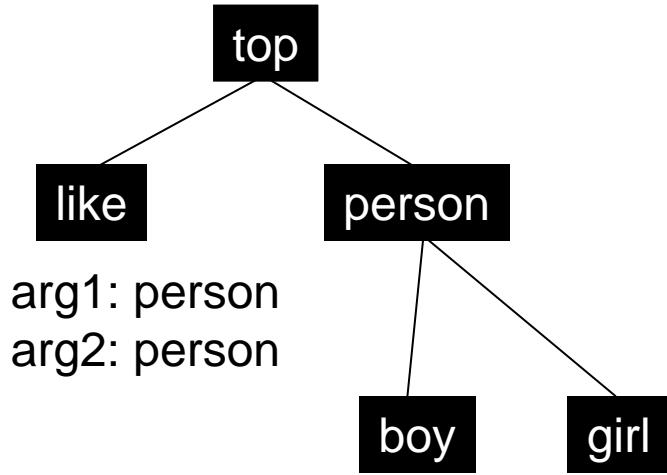


Ein Junge mag ein Maedchen.

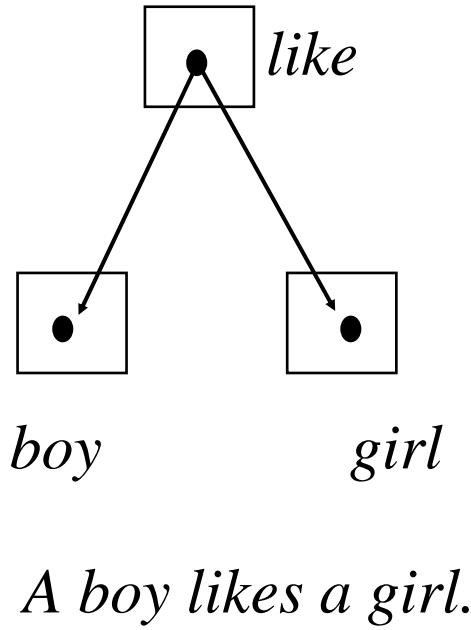
Englisch

CA: Simple Example

T-Box

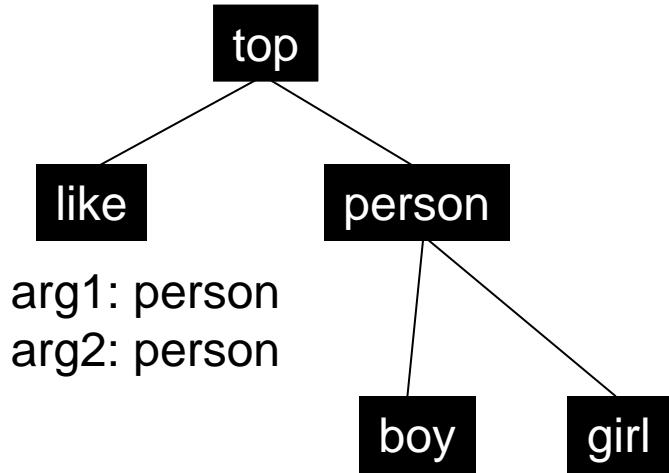


A-box

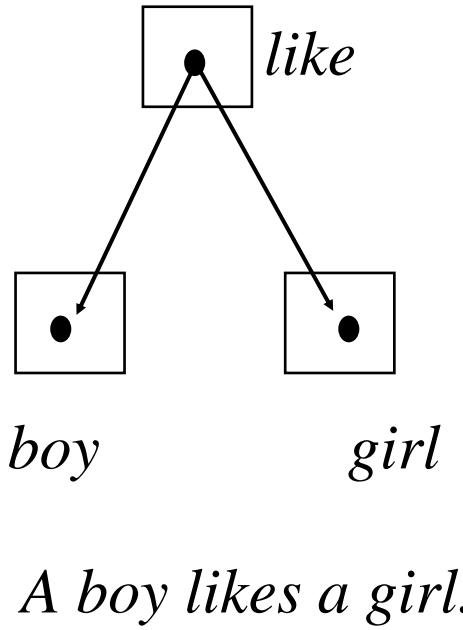


CA: Simple Example

T-Box



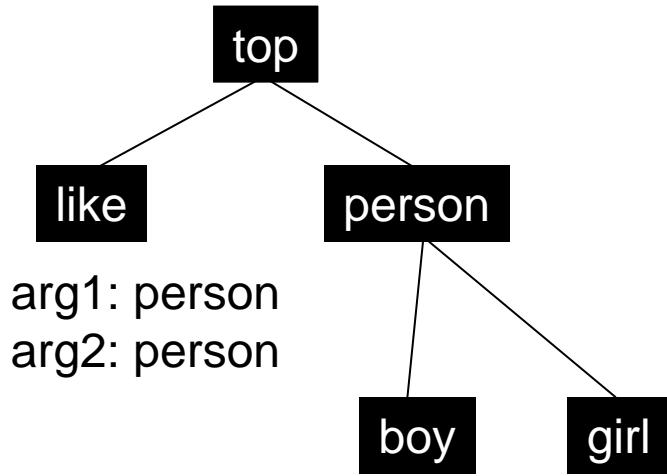
A-box



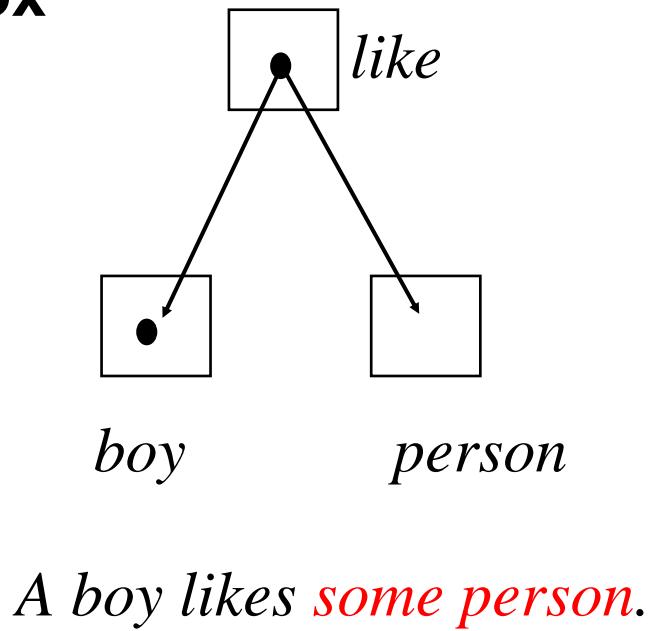
cut

CA: Simple Example

T-Box

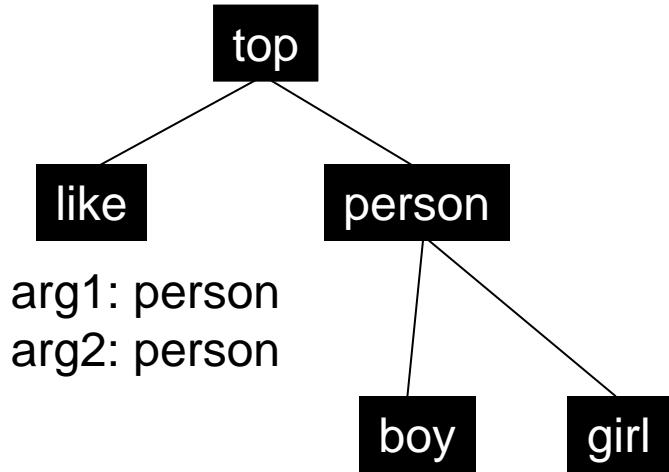


A-box

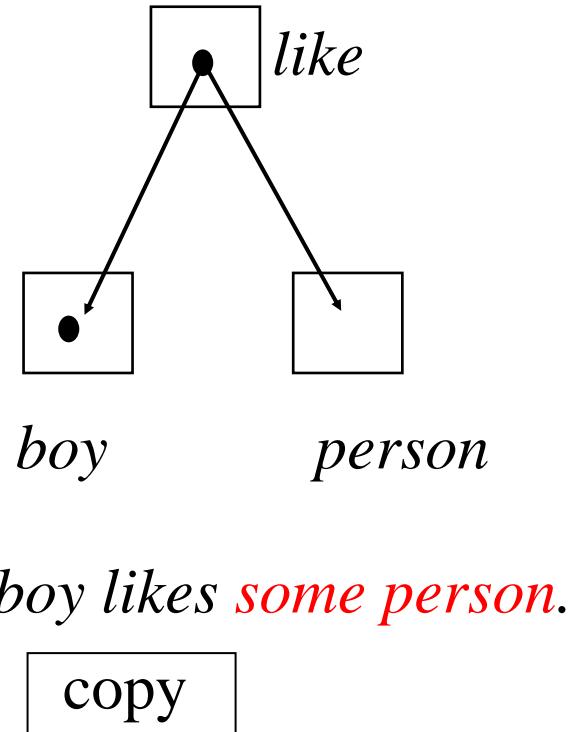


CA: Simple Example

T-Box

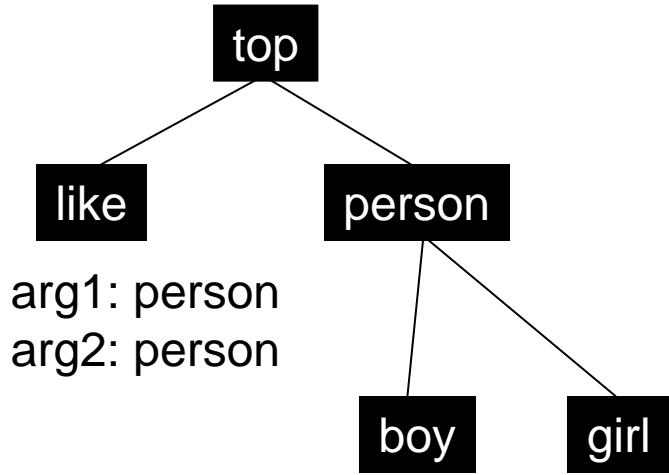


A-box

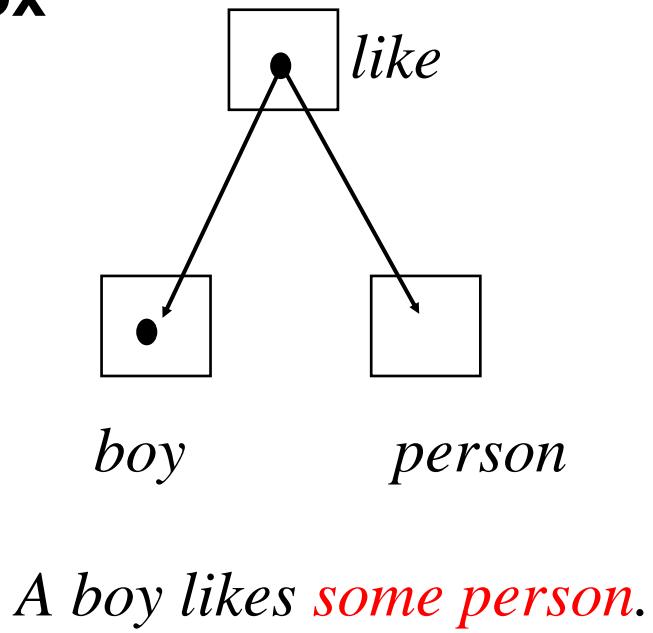


CA: Simple Example

T-Box

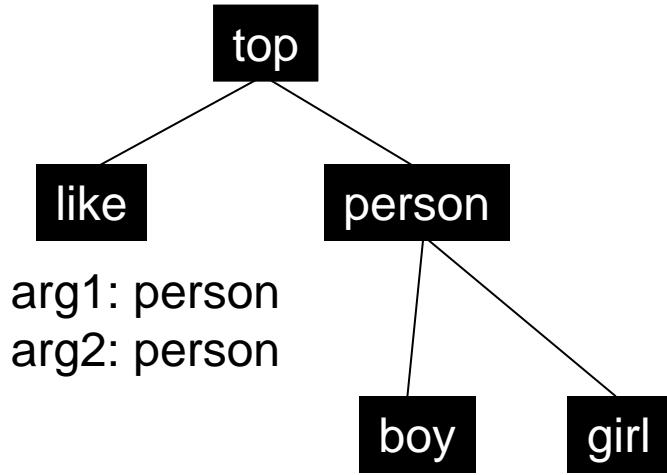


A-box

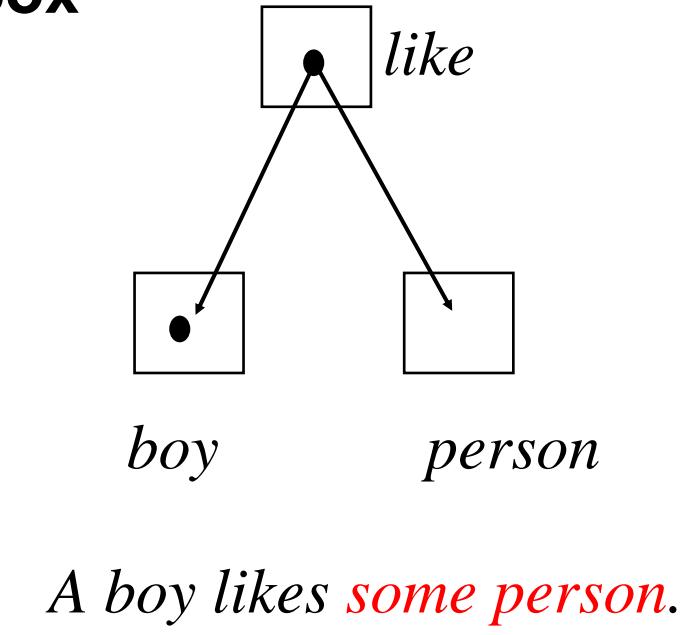


CA: Simple Example

T-Box

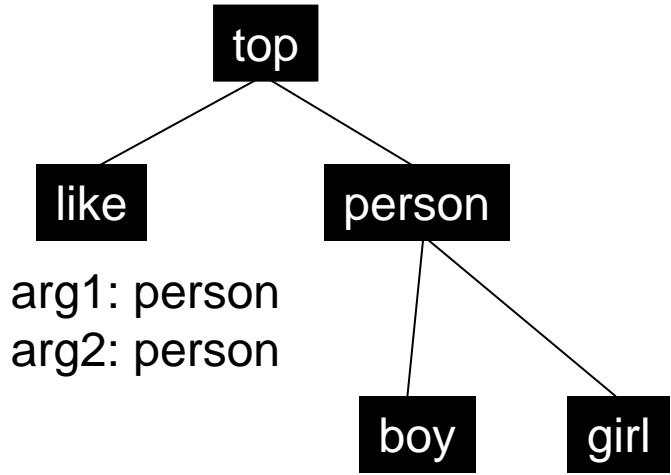


A-box

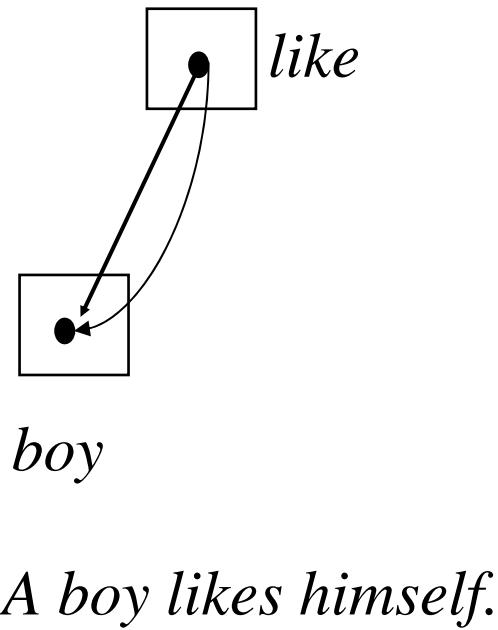


CA: Simple Example

T-Box



A-box

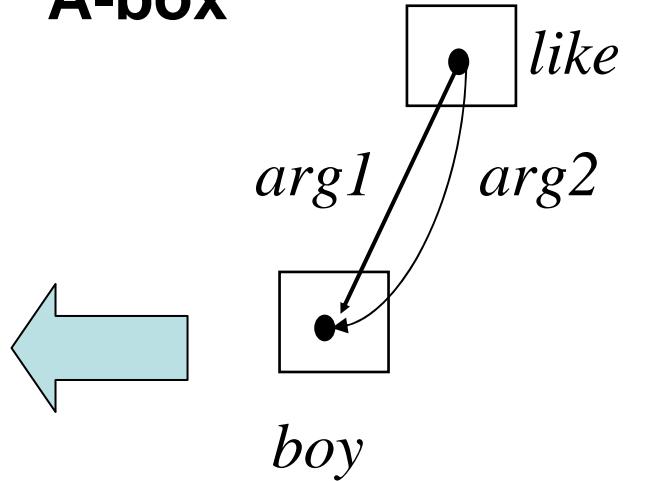


CA: Simple Example

DRS (Kamp & Reyle, 1993)

x	e
boy(x)	
like(e)	
subject(e,x)	
object(e,x)	

A-box



A boy likes himself.

Semantic complexity

Drafter II First Prototype

Power, Scott & Evans (1998)

Drafter III Coreference

Van Deemter & Power (1998)

Iconoclast Scope (DRT)

Power (1999)

CLIME Plural coreference

Piwek (2000) COLING

CLIME

EP25414



*Computerised Legal Information
Management and Explanation*



BUREAU
VERITAS



Evans, Piwek, Cahill and Tipper (2006) JNLE

CLIME

EP25414



*Computerised Legal Information
Management and Explanation*



BUREAU
VERITAS



Evans, Piwek, Cahill and Tipper (2006) JNLE

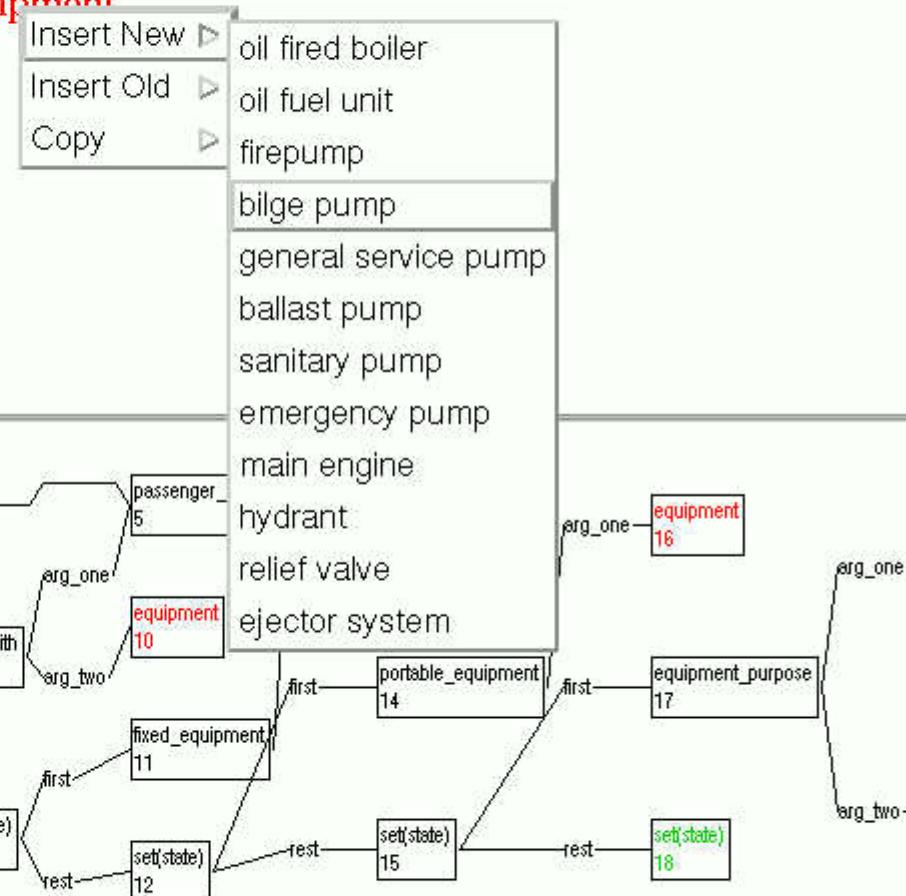
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with **some equipment**.
- **Some equipment** is fixed.
- **Some equipment** is portable.
- **Some equipment** is used for firefighting.
- **Some states**.

Some question.



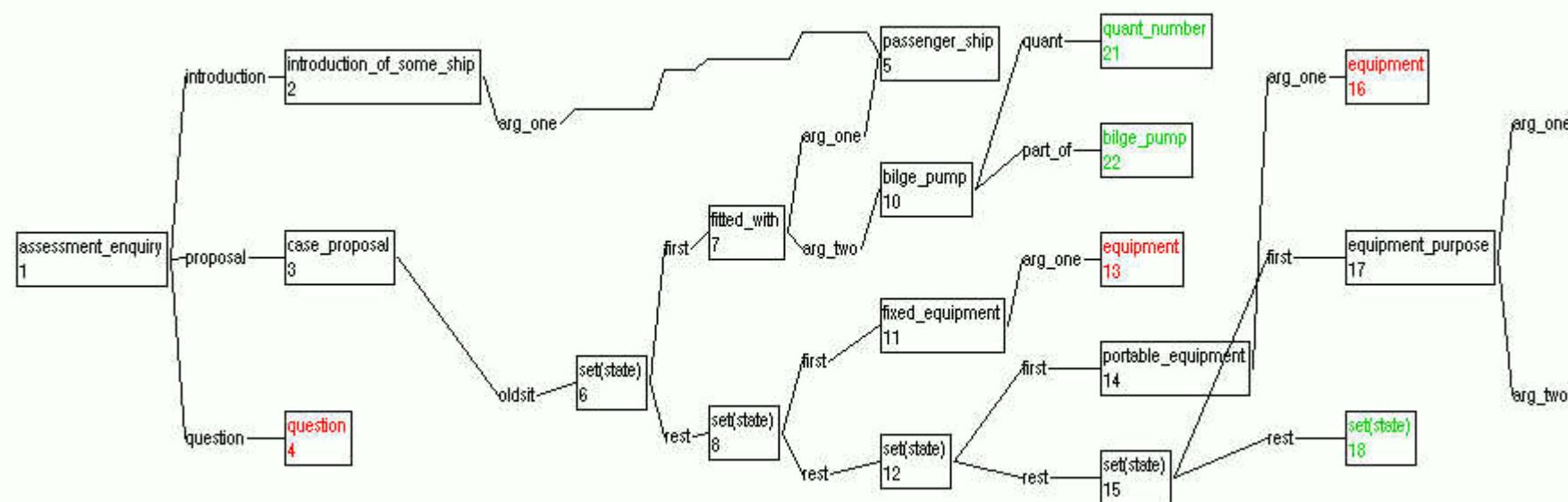
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with **some number** of bilge pumps.
- **Some equipment** is fixed.
- **Some equipment** is portable.
- **Some equipment** is used for firefighting.
- **Some states**.

Some question.

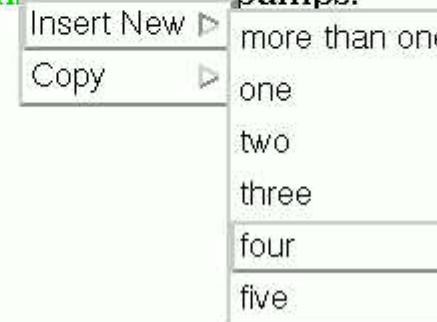


English feedback, version 1/3, subscripts off, highlighting on

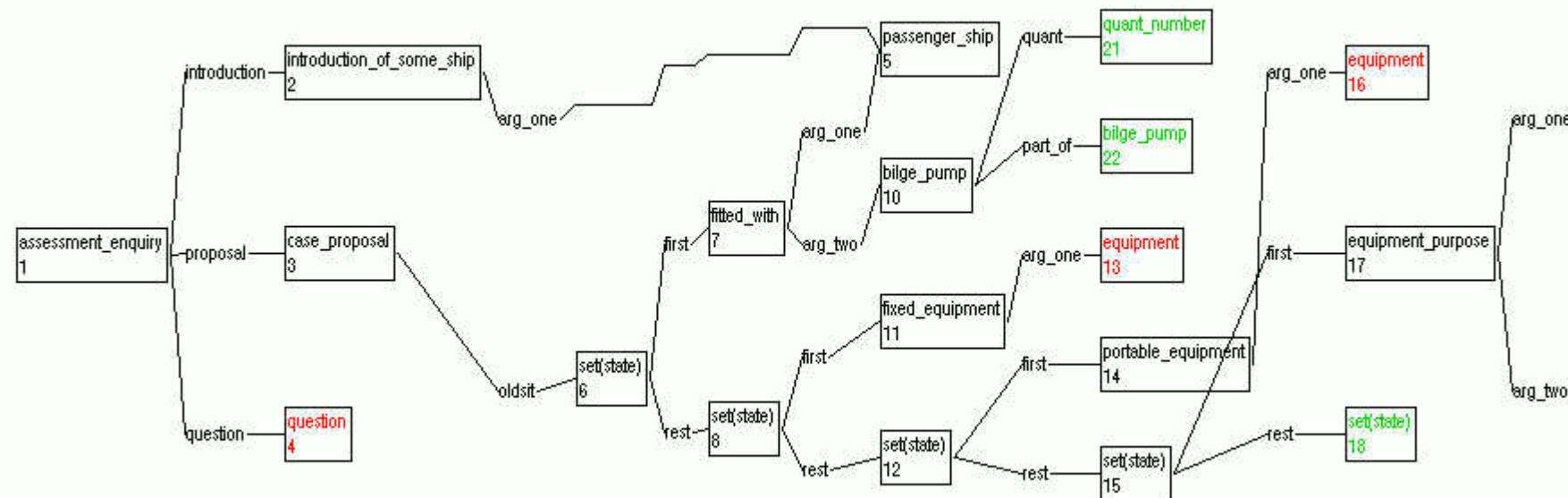
I have a passenger ship.

Some case.

- The passenger ship is fitted with **some number** of **bilge pumps**.
- **Some equipment** is fixed.
- **Some equipment** is portable.
- **Some equipment** is used for firefighting.
- **Some states**.



Some question.



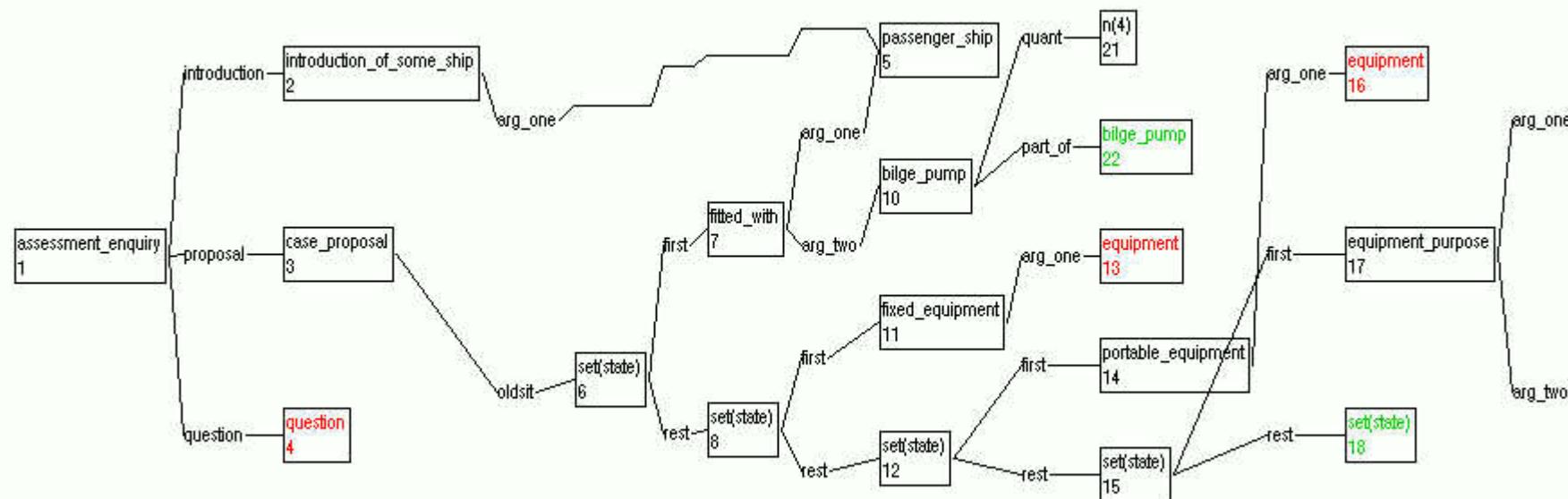
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- Some equipment is fixed.
- Some equipment is portable.
- Some equipment is used for firefighting.
- Some states.

Some question.



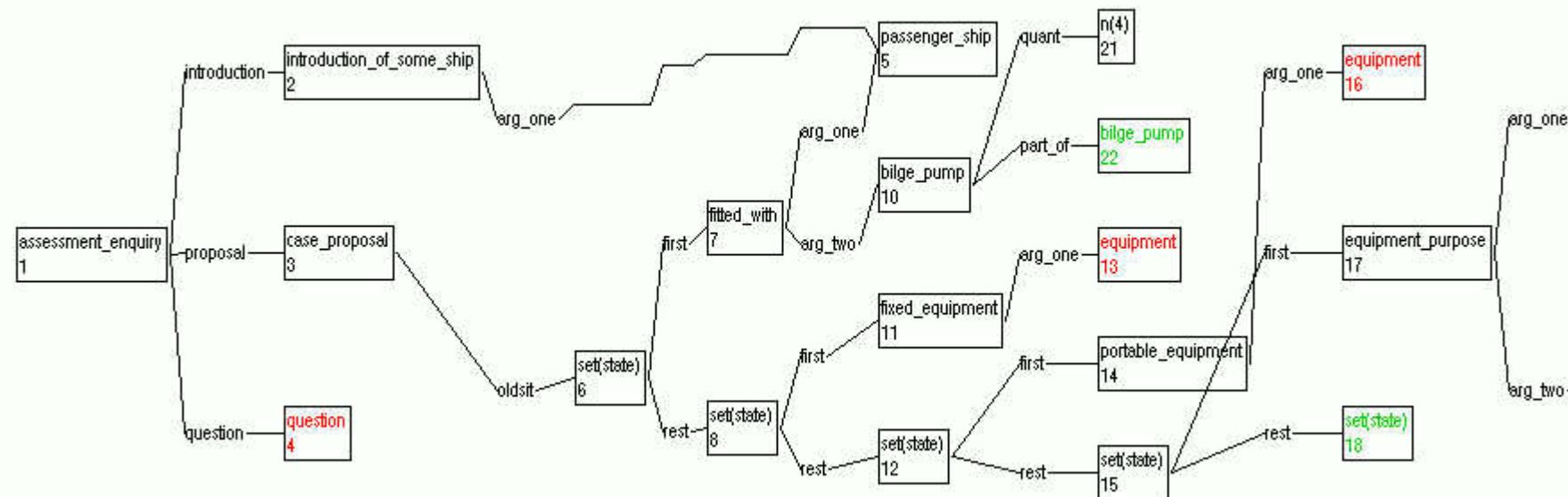
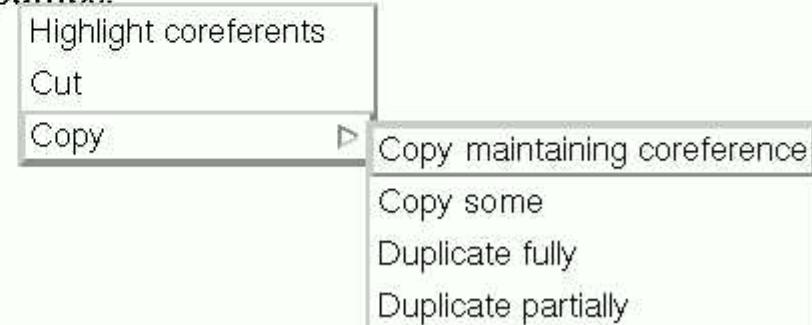
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- Some equipment is fixed.
- Some equipment is portable.
- Some equipment is used for firefighting.
- Some states.

Some question.



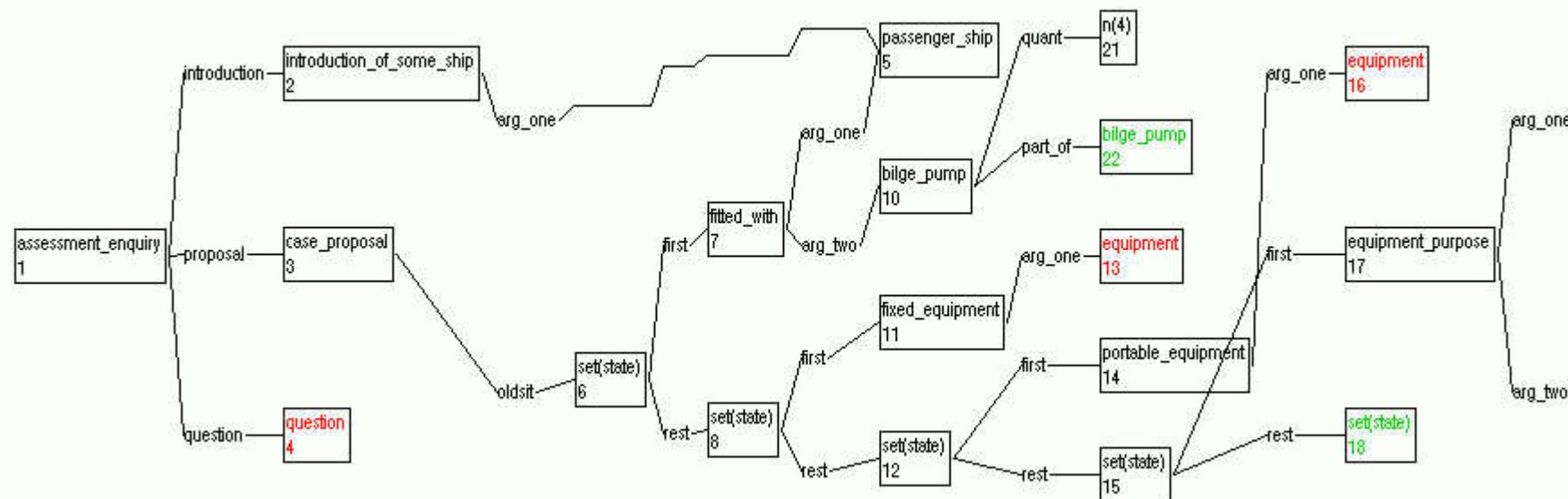
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- Some equipment is fixed
- Some equipment is used for firefighting.
- Some equipment is used for navigation.
- Some states.

Some question.



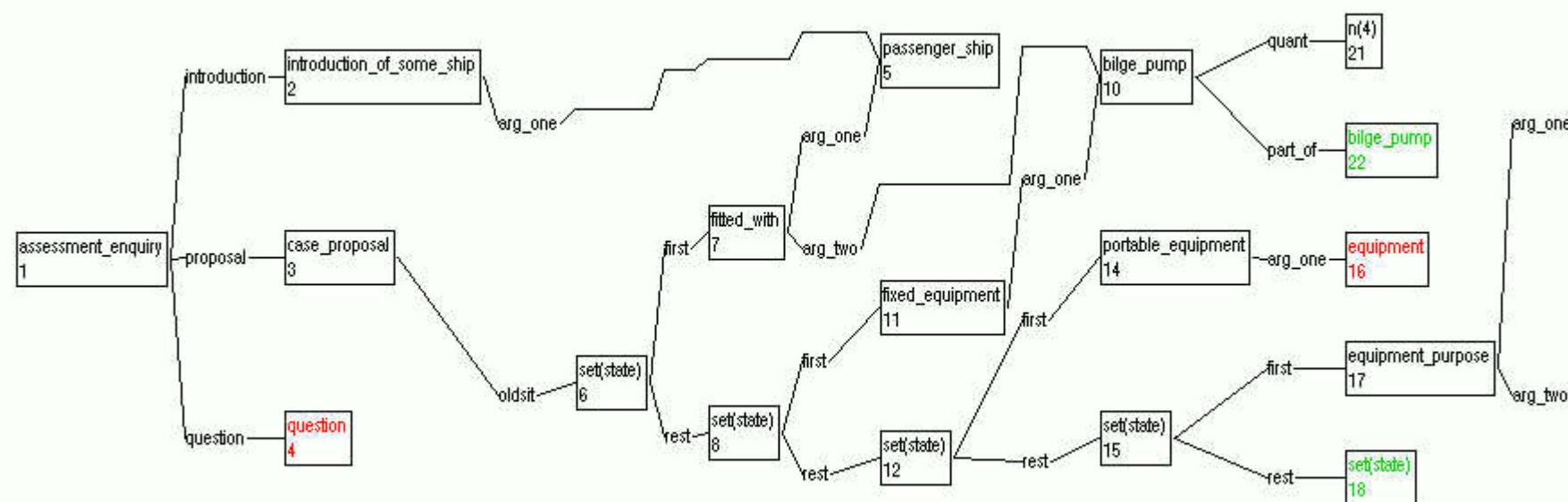
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- They are fixed.
- Some equipment is portable.
- Some equipment is used for firefighting.
- Some states.

Some question.



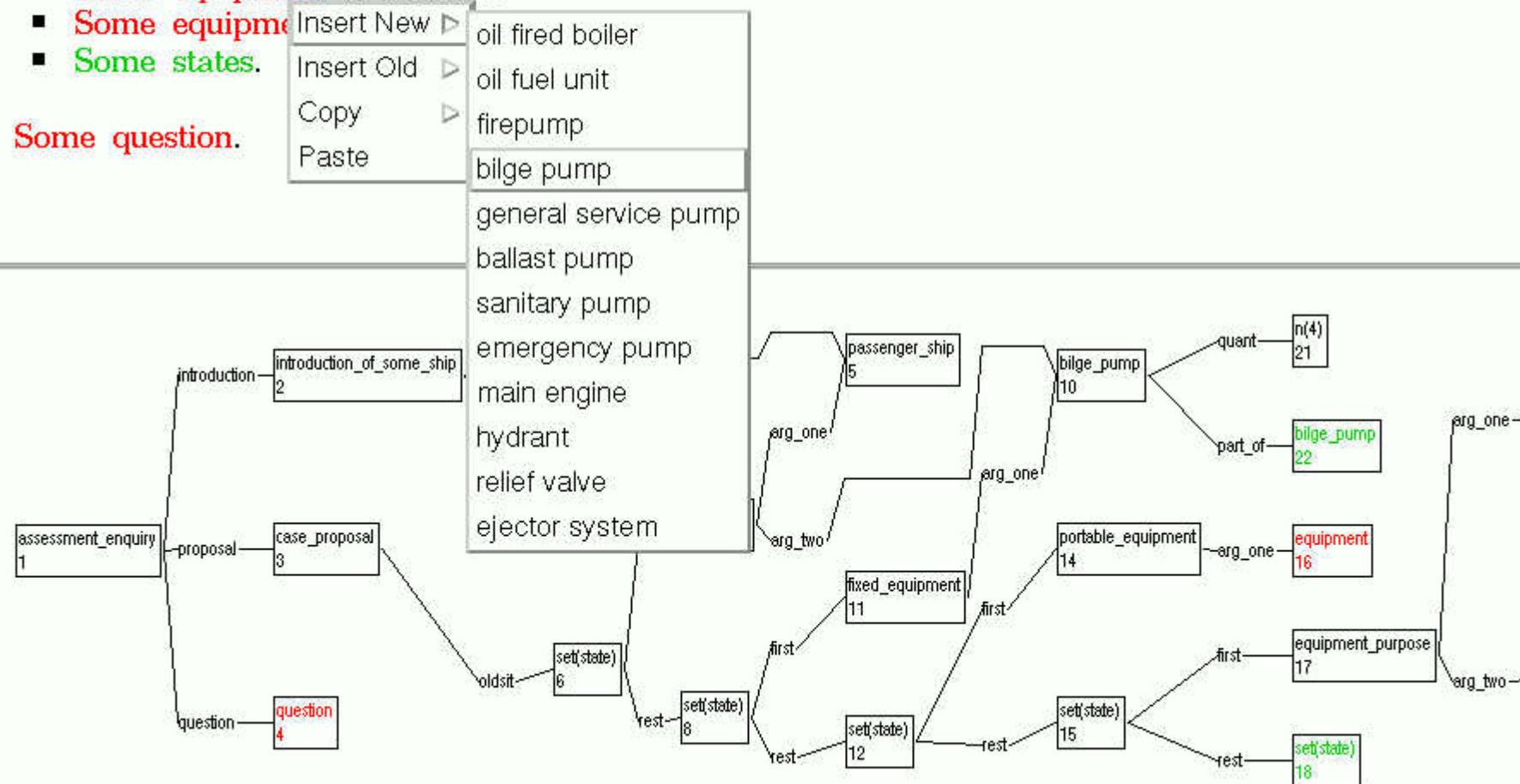
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- They are fixed.
- Some equipment is portable.
- Some equipment is not portable.
- Some states.

Some question.



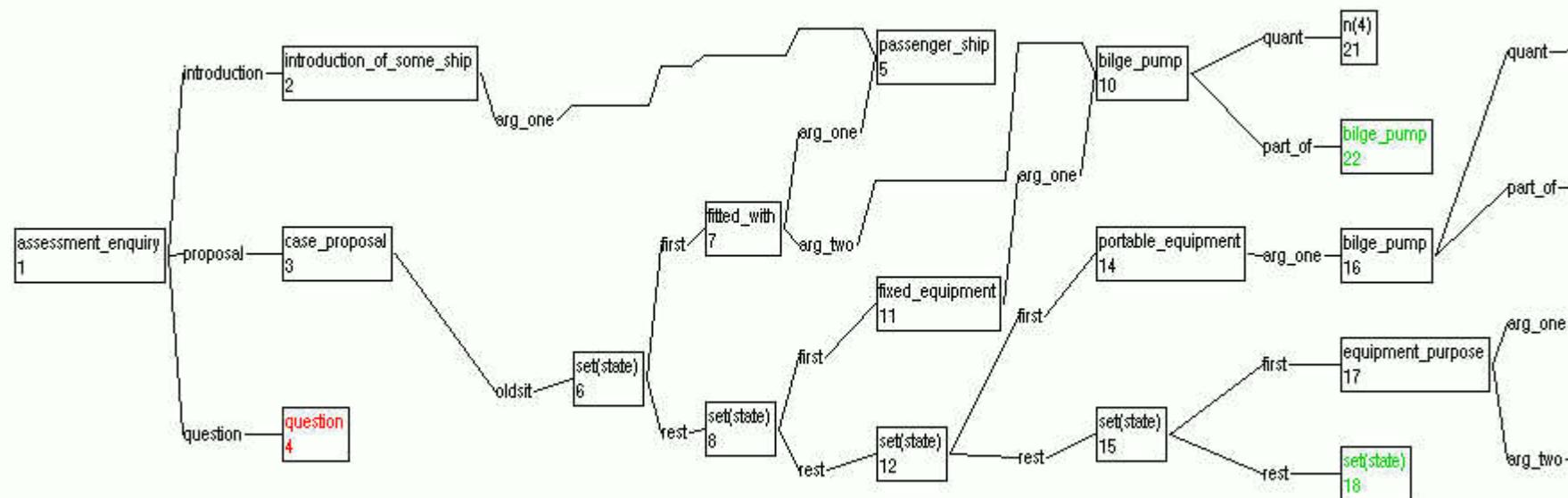
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- They are fixed.
- Three other bilge pumps are portable.
- Some equipment is used for firefighting.
- Some states.

Some question.



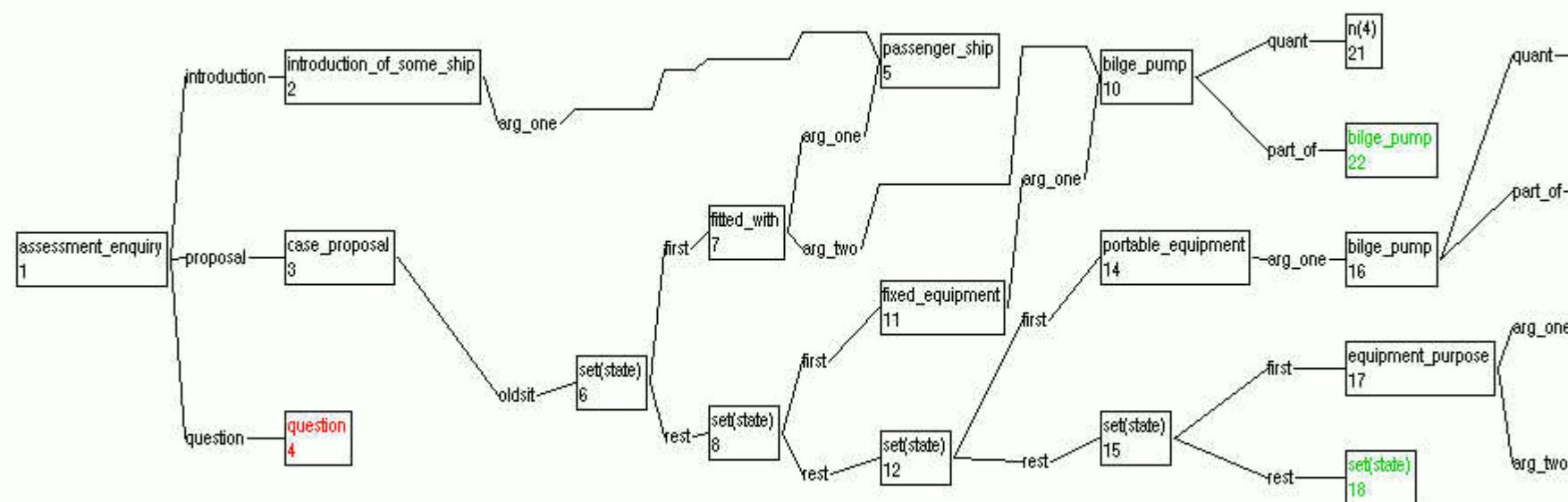
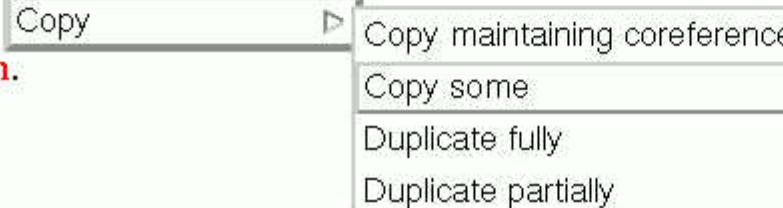
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- They are fixed.
- Three other ~~1:1~~
Highlight coreferents
Cut
- Some equ.
refighting.
- Some stat

Some question.



English feedback, version 1/3, subscripts off, highlighting on

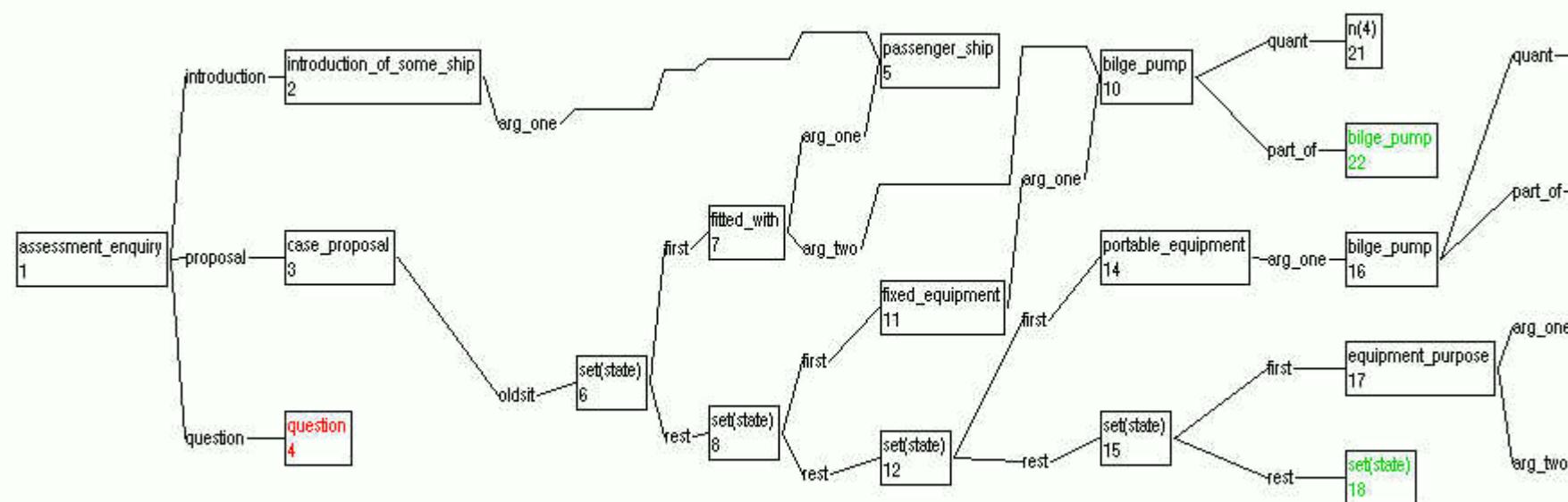
I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- They are fixed.
- Three other bilge pumps are portable.
- Some equipment is used for firefighting.
- Some states.

Some question.

Insert New ▶
 Insert Old ▶
 Copy ▶
 Paste



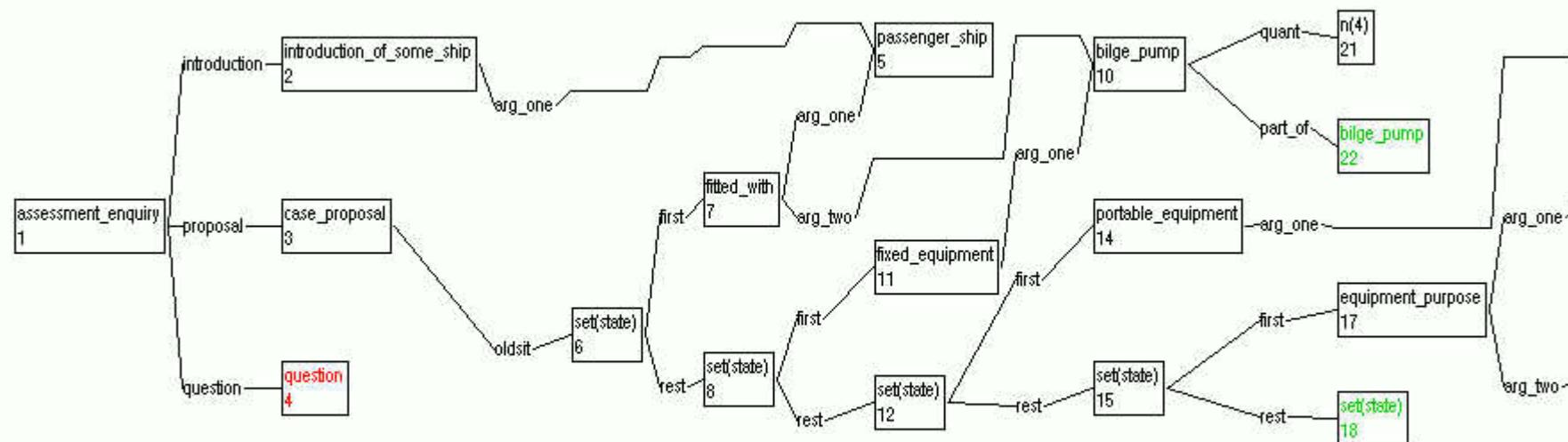
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- They are fixed.
- Three other bilge pumps are portable.
- Some number of the second three bilge pumps is used for firefighting.
- Some states.

Some question.



English feedback, version 1/3, subscripts off, highlighting on

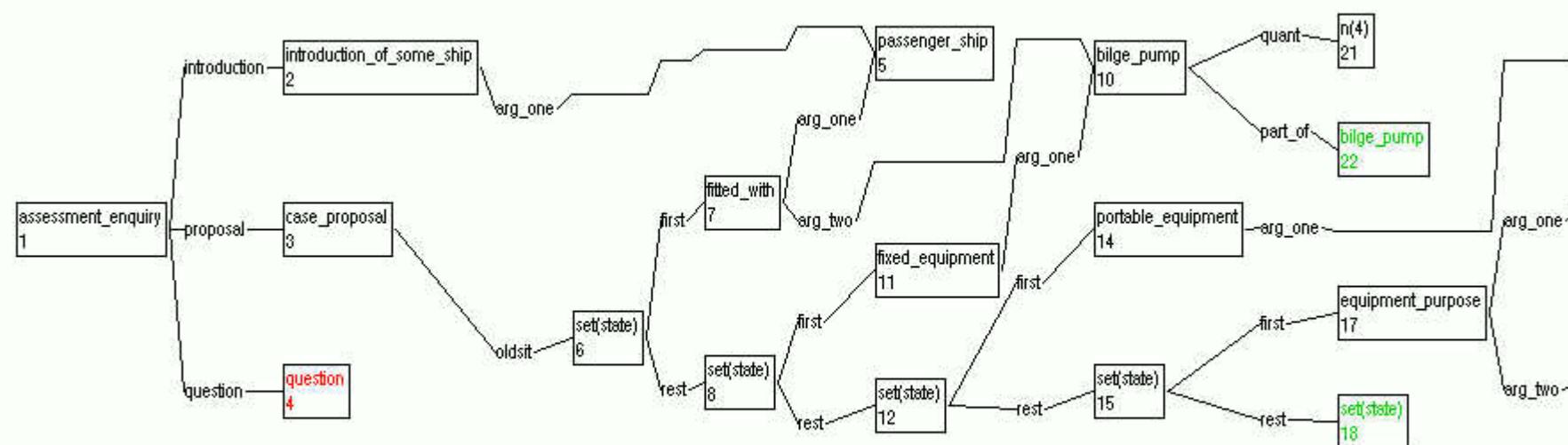
I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- They are fixed.
- Three other bilge pumps are portable.
- Some number of the second three bilge pumps is used for firefighting.
- Some states.

Some question.

Insert New	▶ more than one
Insert Old	▶ one
Copy	▶ two



File Language Modality Control

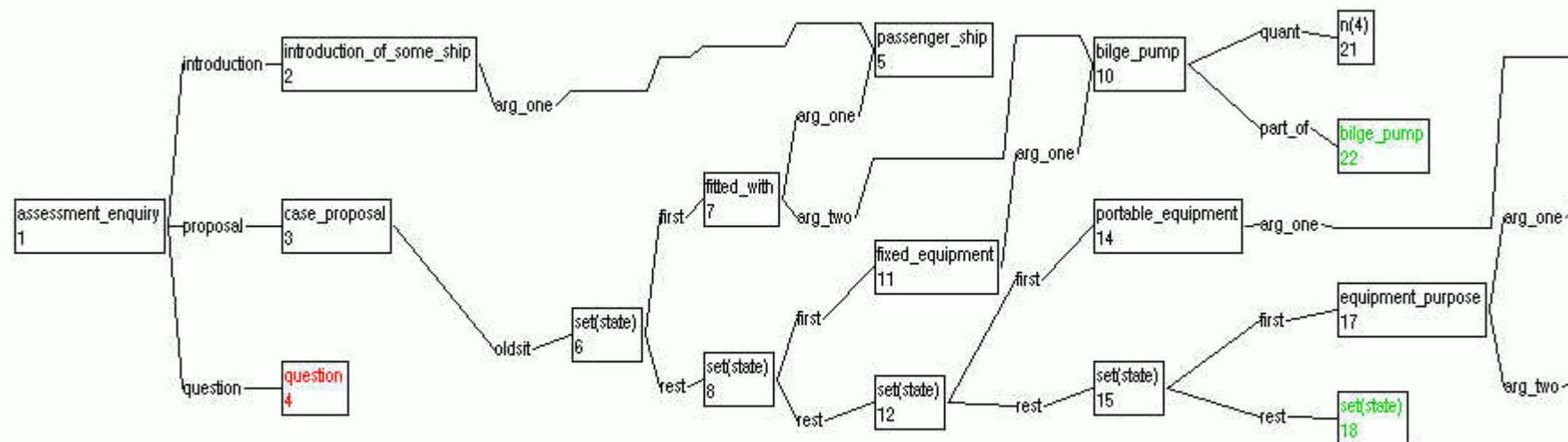
English feedback, version 1/3, subscripts off, highlighting on

I have a passenger ship.

Some case.

- The passenger ship is fitted with four bilge pumps.
- They are fixed.
- Three other bilge pumps are portable.
- Two of the three are used for firefighting.
- Some states.

Some question.



 MILE - Query Window

File Query Help



I have a new oil tanker.

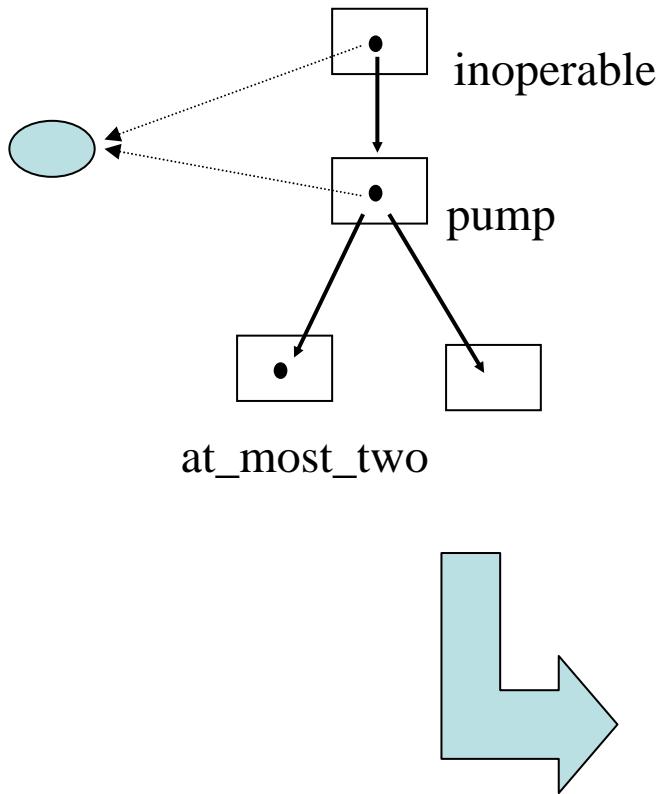
The case.

- o The new oil tanker has a gross tonnage that is equal to 2000.
- o The new oil tanker is fitted with a fuel oil tank.
- o The fuel oil tank is used to store ballast water.
- o *Some facts.*

Provide a legal assessment of this case.

Status: Ready

Java Applet Window



X S

at_most_2(X,all_pumps)
 pump(X)
 inoperable*(S)
 subject*(S,X)

X S

pump(x)
 inoperable(s)
 subject(s,x)

=>

member(x,X)
 member(s,S)

Clime - framespage.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Welcome Demo User (Normal User)

File Query Options Help

Personal Folder Templates OilTanker1 (** answered **)

I have a new oil tanker.

The case.

- The new oil tanker has a gross tonnage that is equal to 2000.
- The new oil tanker is fitted with a fuel oil tank.
- The fuel oil tank is used to store ballast water.

Provide a legal assessment of this case.

System Response

The MILE system inferred on the basis of the norms in regulations 13, 14 and 16 of MARPOL that your case is **disallowed**.

This conclusion was drawn because:

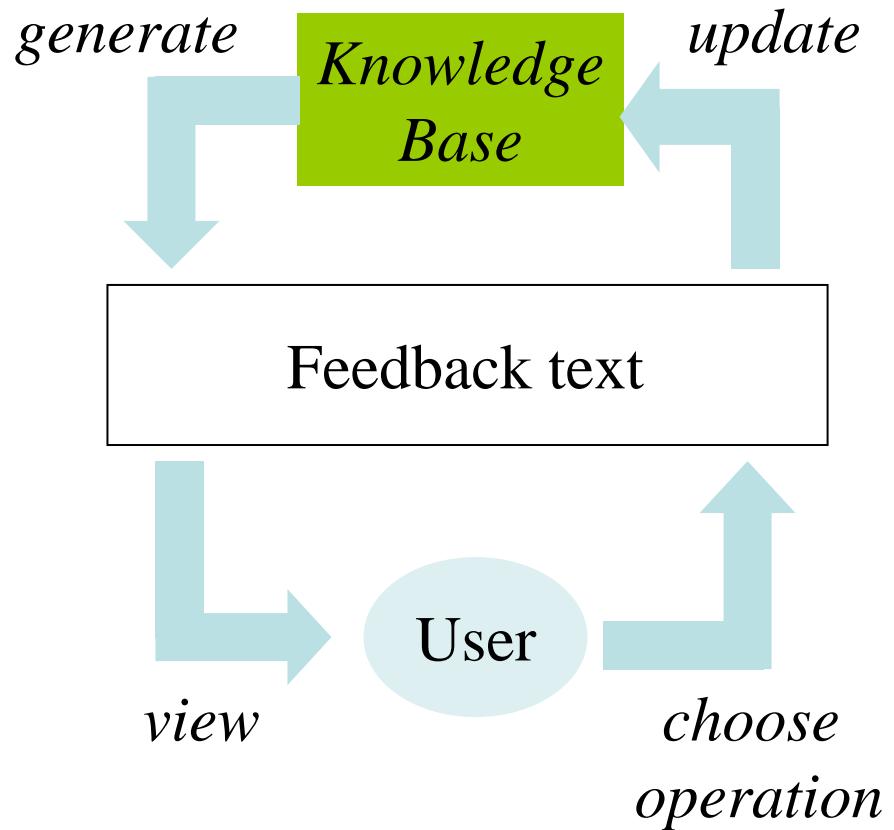
- **MARPOL-AI-P2-14-01**: the fuel oil tank is part of the new oil tanker, the ballast water is located in the fuel oil tank, the new oil tanker is an oil tanker and the gross tonnage of the new oil tanker is equal to or more than 150.

MARPOL-AI-P2-14-01

1. Except as provided in paragraph (2) of this Regulation, in new ships of 4,000 tons gross tonnage and above other than oil tankers, and in new oil tankers of 150 tons gross tonnage and above, no ballast water shall be carried in any oil fuel tank.

© 2001-2004 Bureau Veritas and the CLIME Consortium
CLIME is supported by the European Commission *ESPRIT* initiative, project no. EP25414.

Single-person Conceptual Authoring



Towards Enhancing Human-Human Dialogue

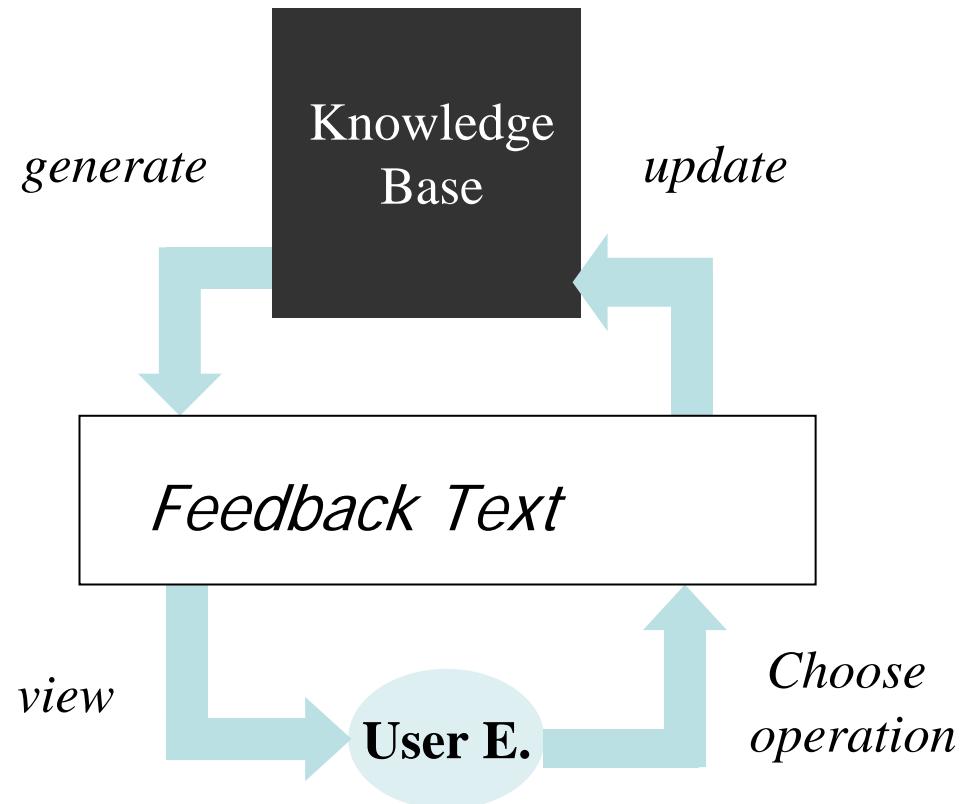
- Two persons producing contributions.
- They thus build up a **shared dialogue history**, in particular, *the speech acts* that each of them performed.
- Interpretation depends on the dialogue history, i.e., on the content that is already around: e.g., anaphora, presuppositions.

Dialogue as Conceptual Authoring

1. Move to **multi-person** conceptual authoring.
2. Think of the knowledge base as the **dialogue history**. In other words, the knowledge base functions as an explicit record of the history, which can be inspected and edited through the feedback text.

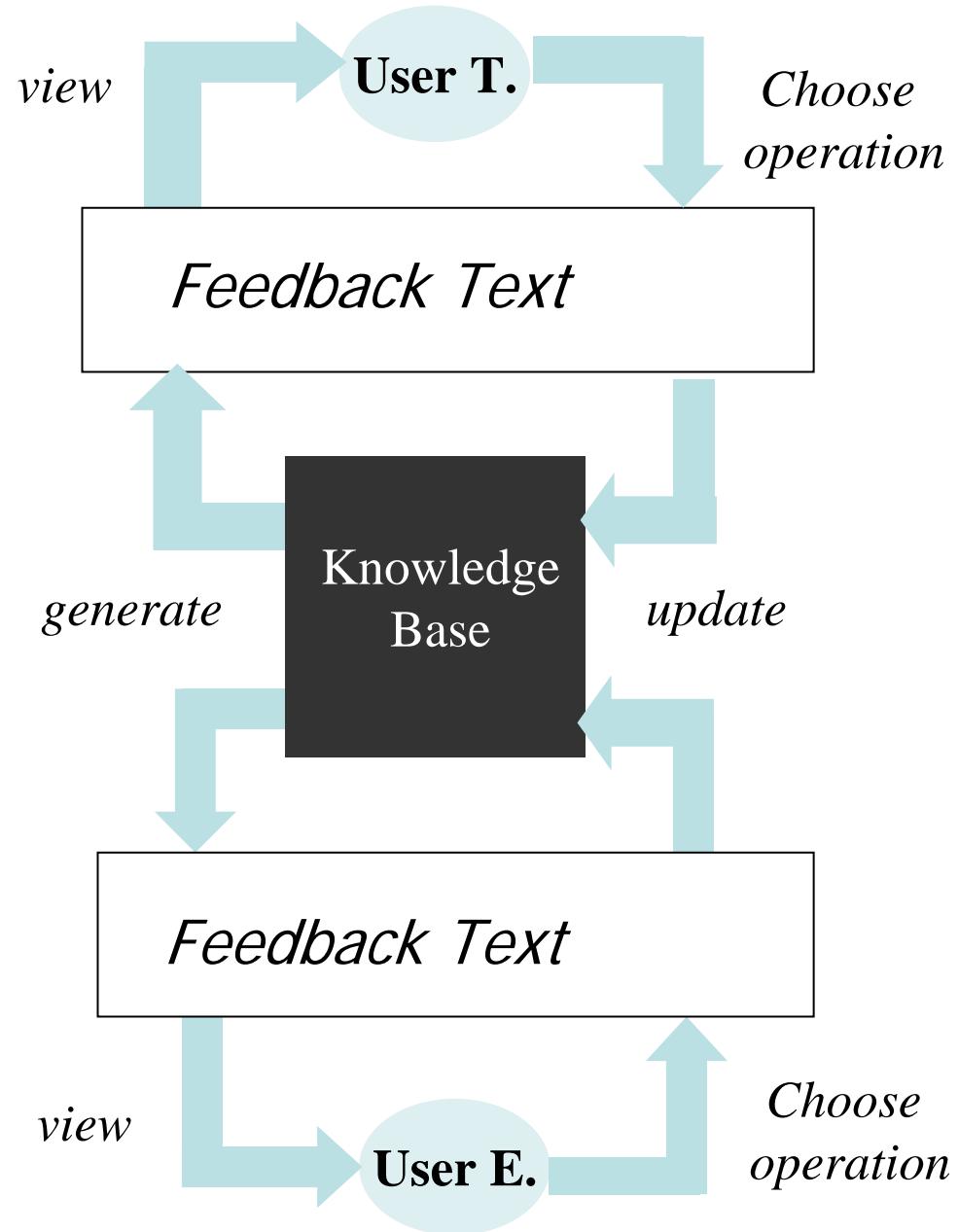
CA

Single-person KB editing



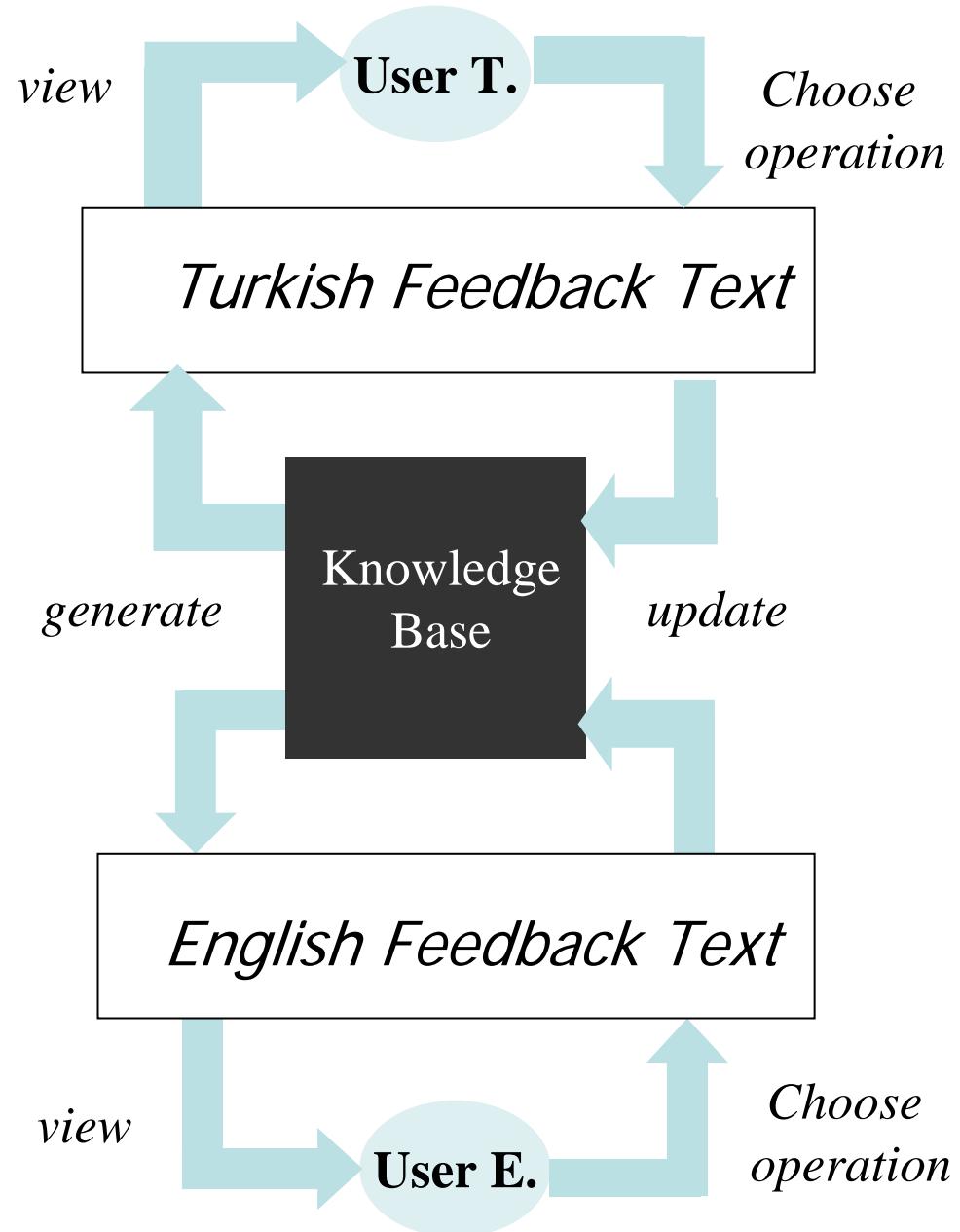
Dialogue as CA

*Multi-person
KB editing*



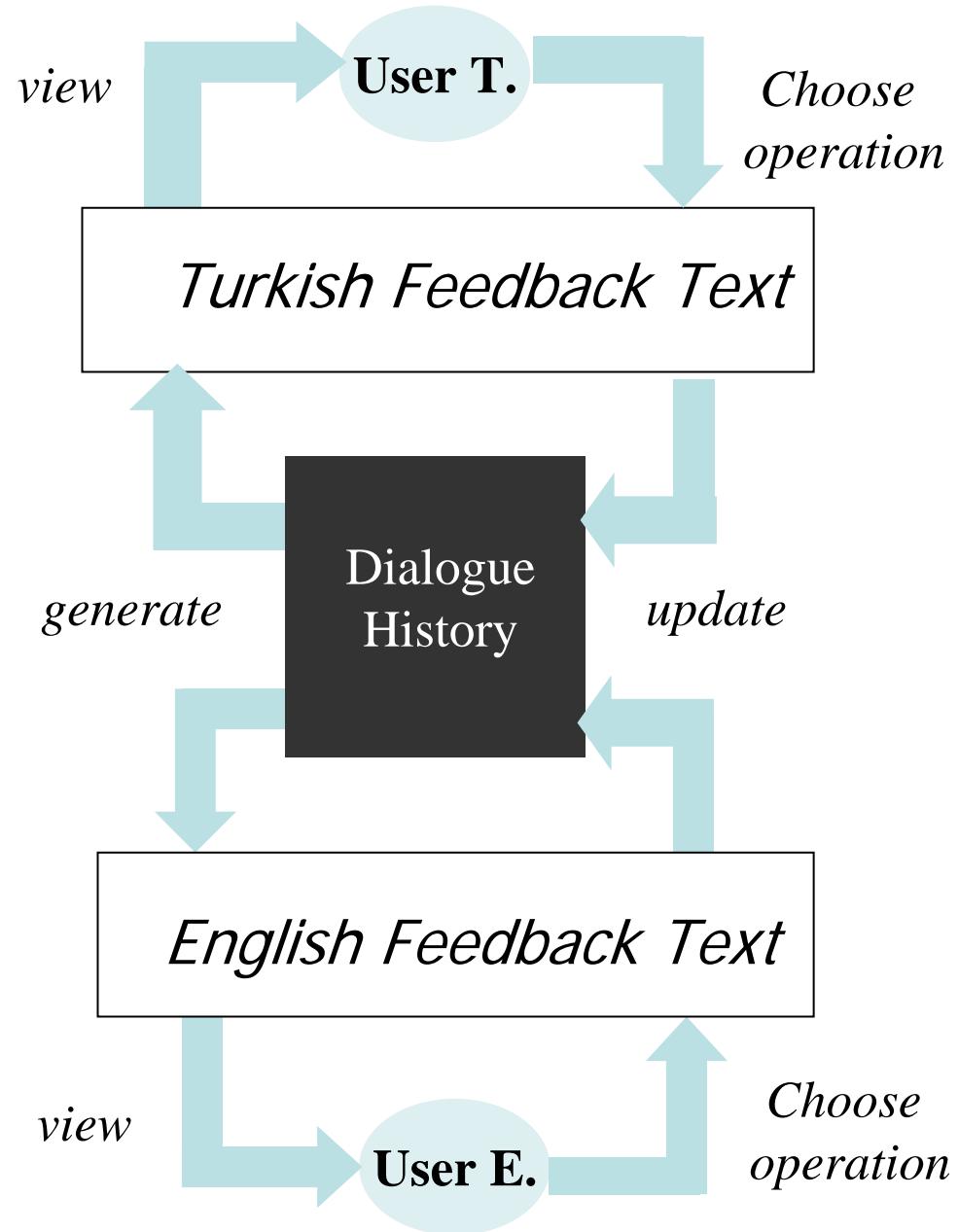
Dialogue as CA

*Crosslingual
Multi-person
KB editing*



Dialogue as CA

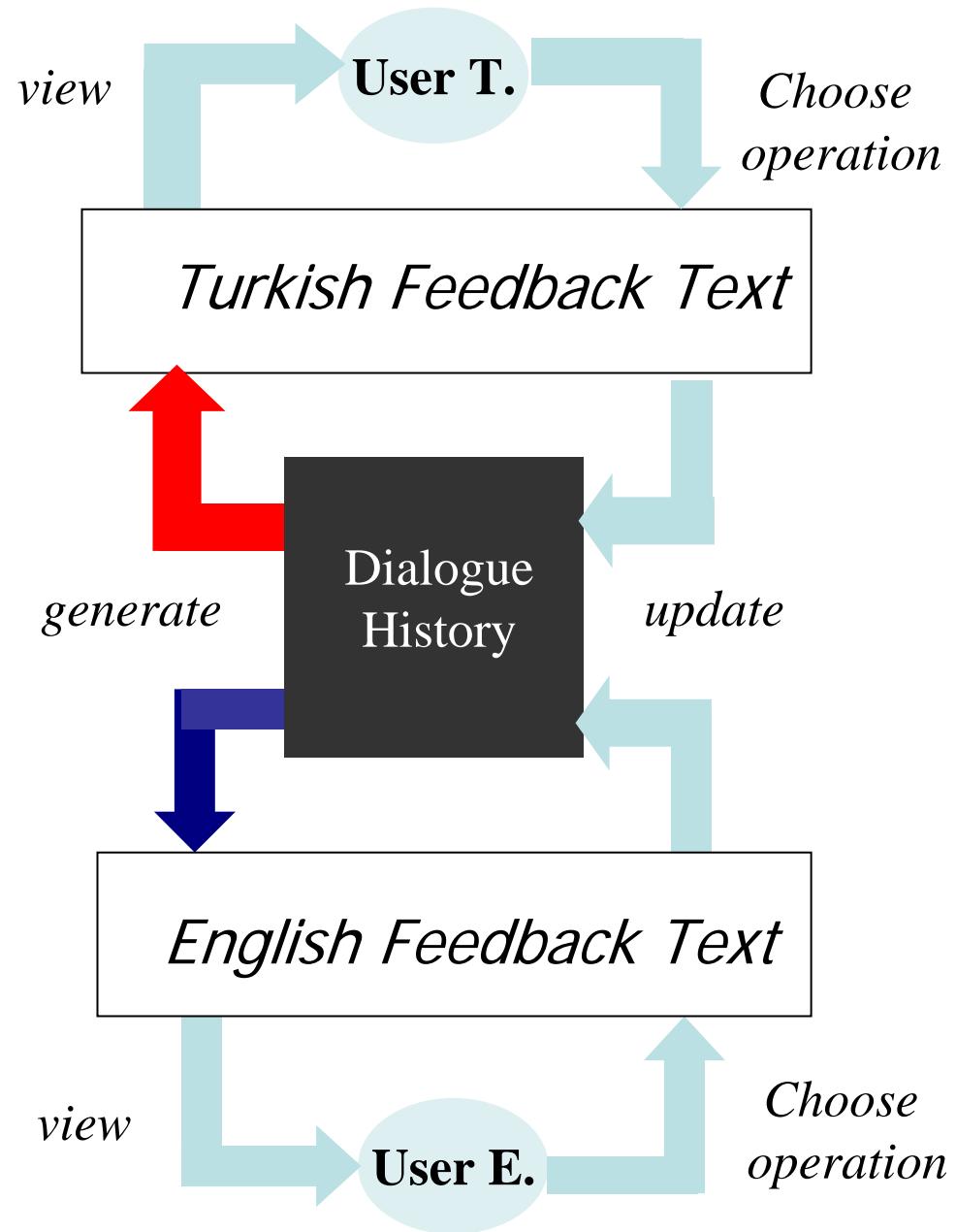
*The KB as a
dialogue
history*



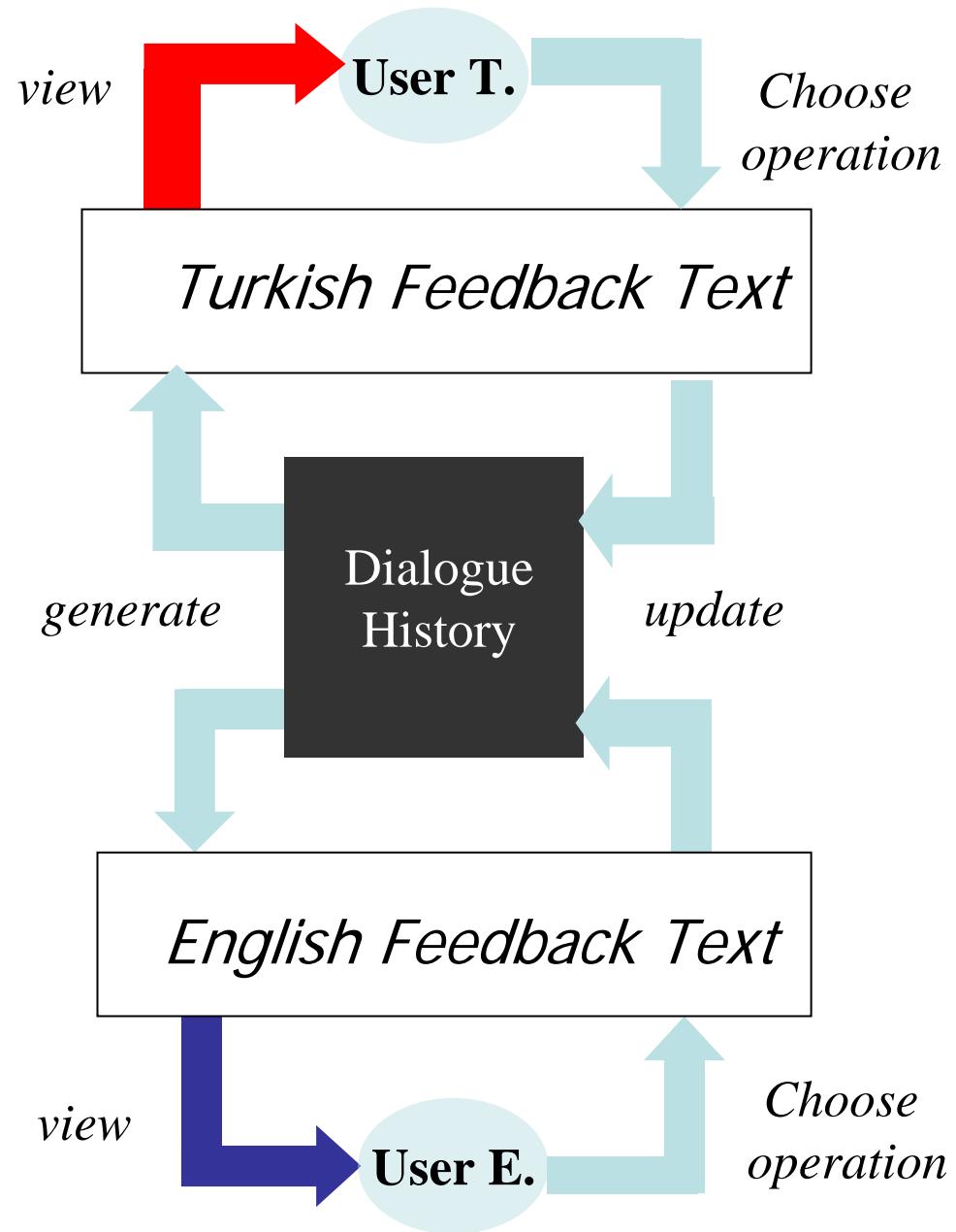
From KB to Dialogue History

- How? Imposing constraints on editing operations:
 - Turn taking.
 - Immutability of history.
 - Accessibility of content.

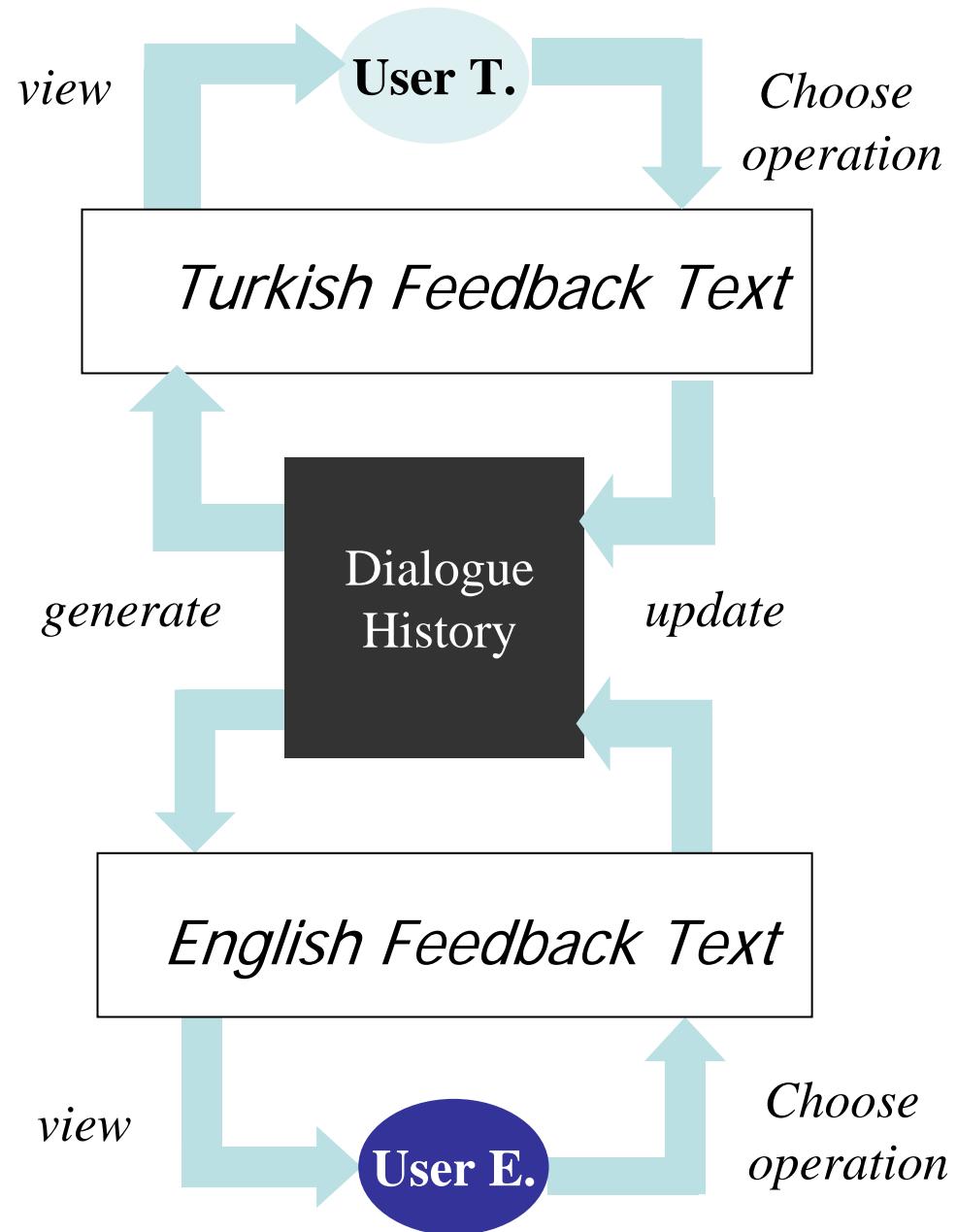
Dialogue as CA



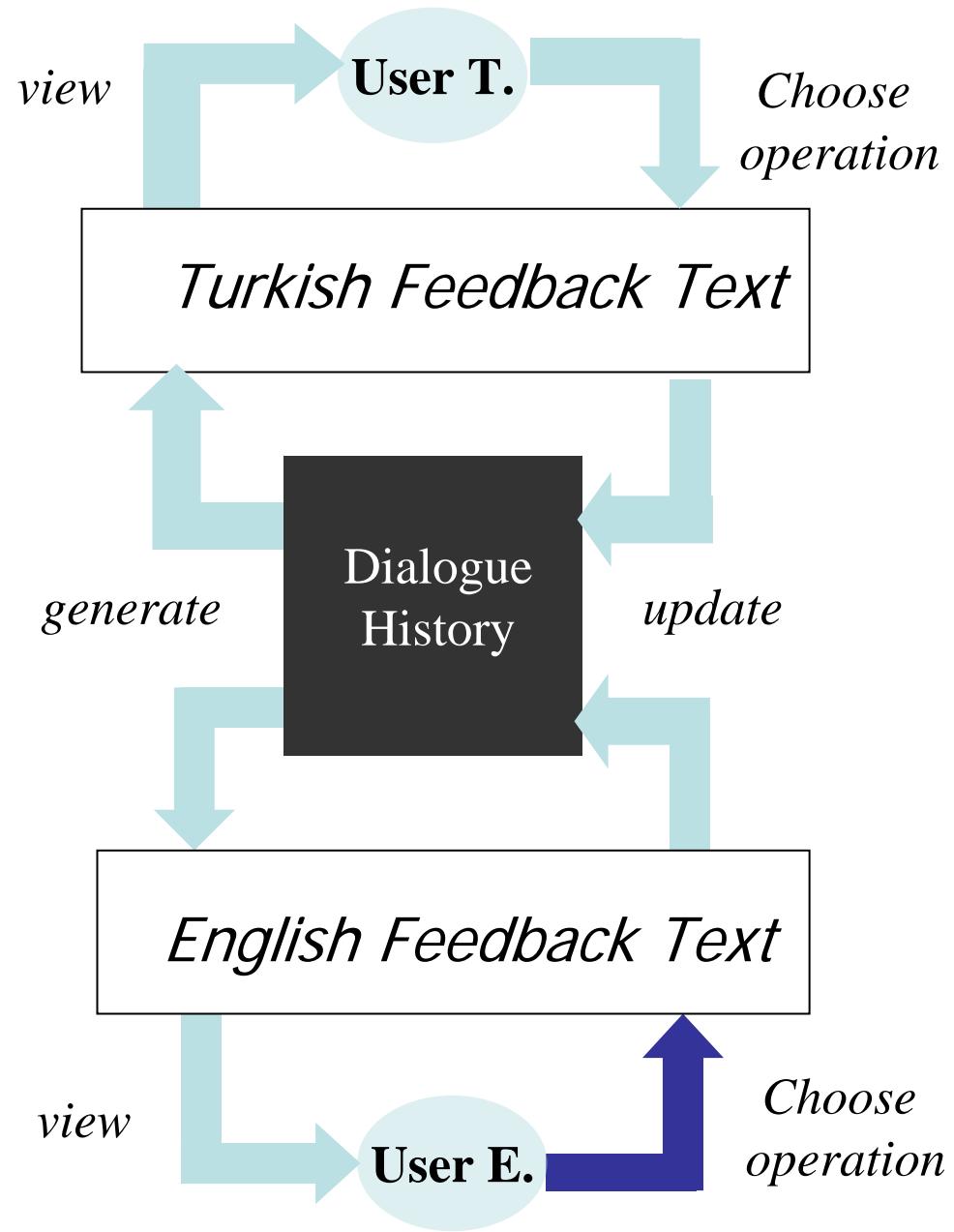
Dialogue as CA



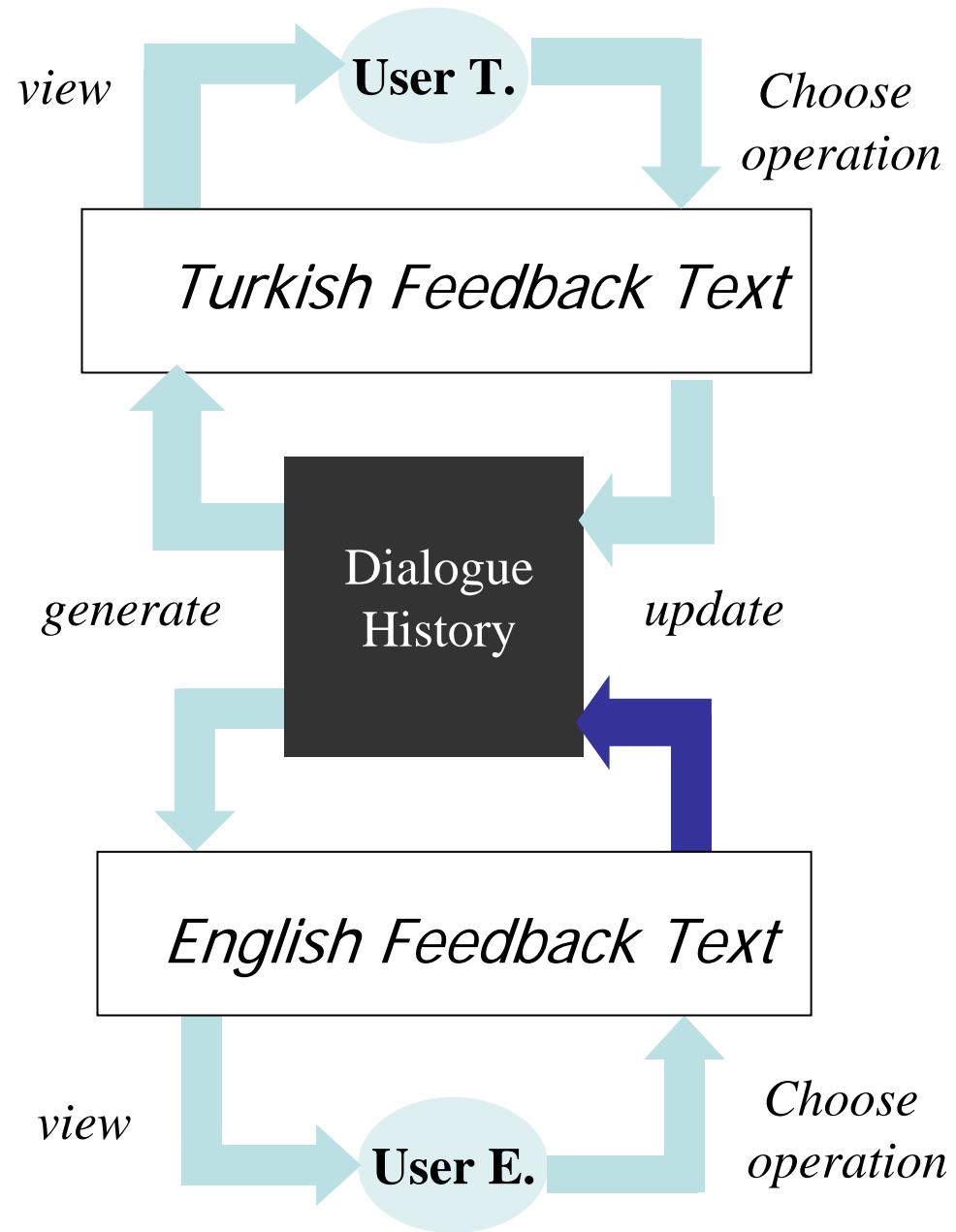
Dialogue as CA



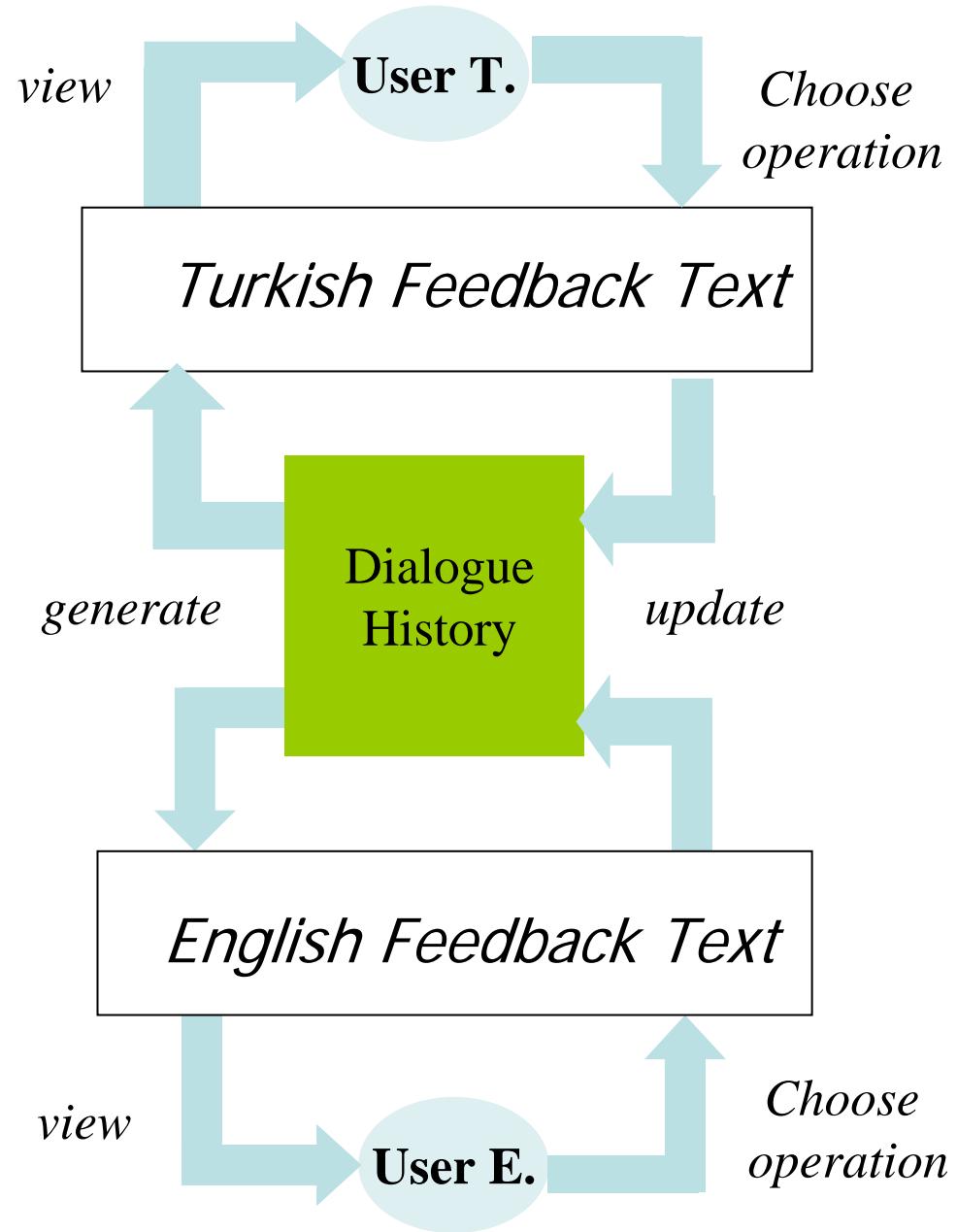
Dialogue as CA



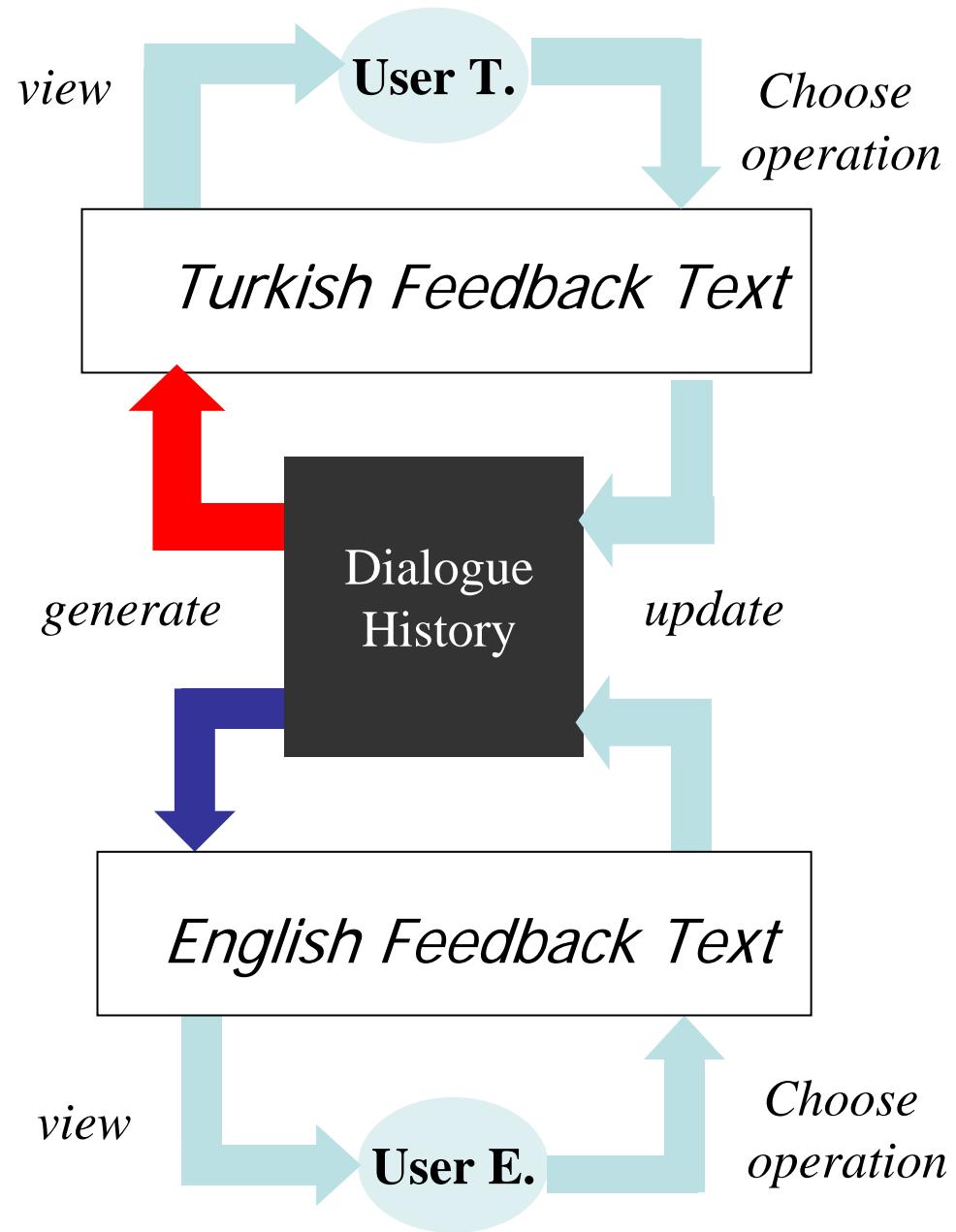
Dialogue as CA



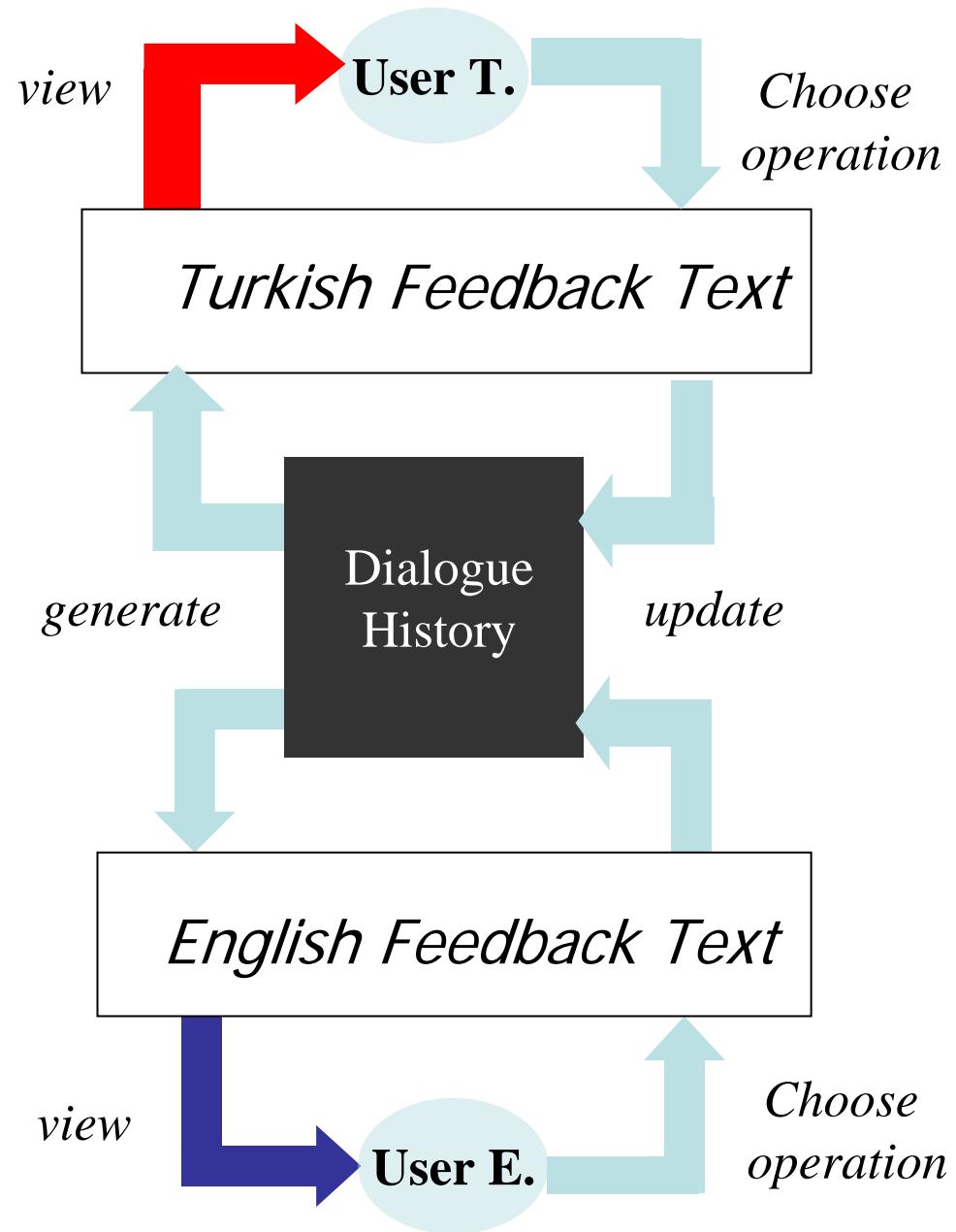
Dialogue as CA



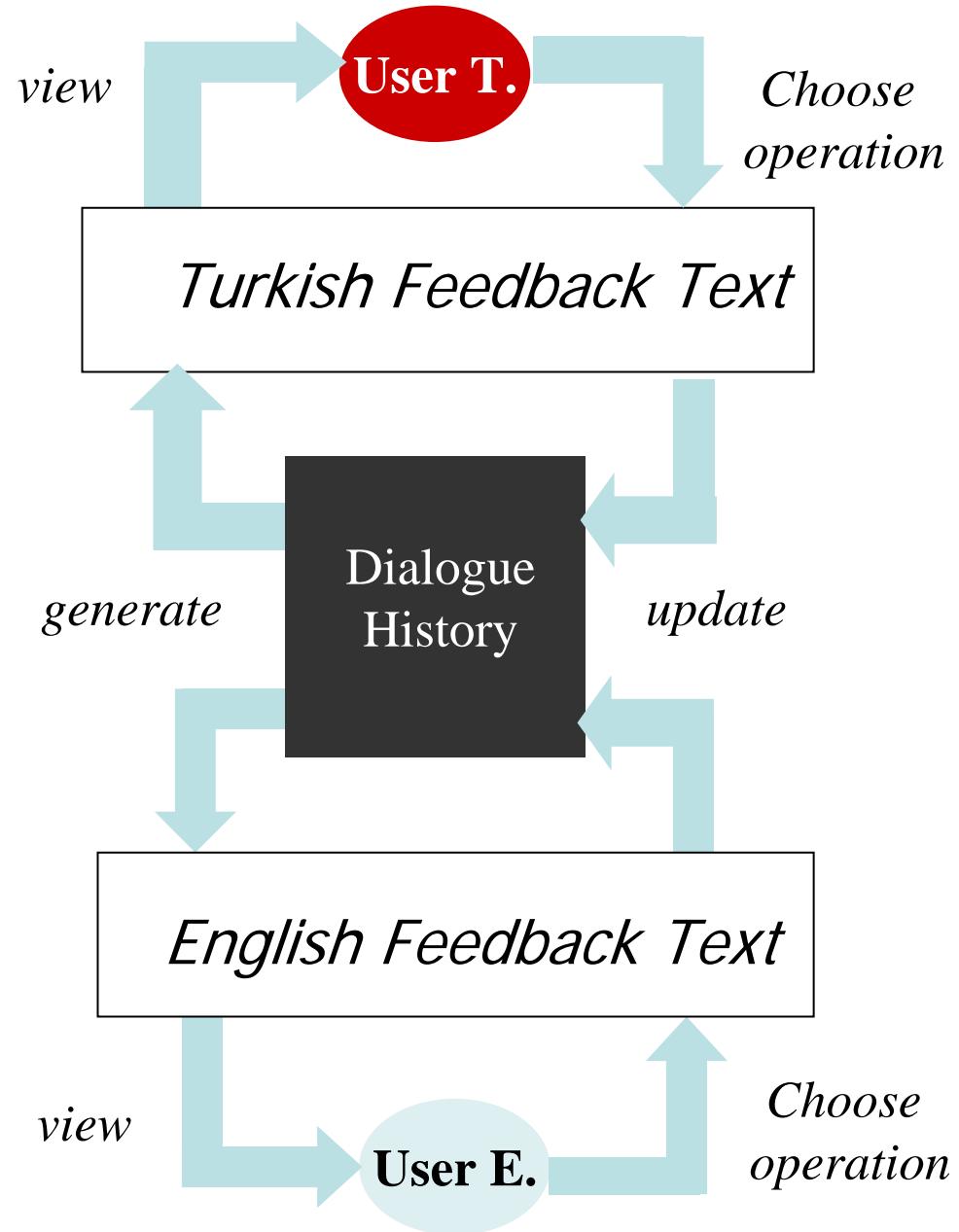
Dialogue as CA



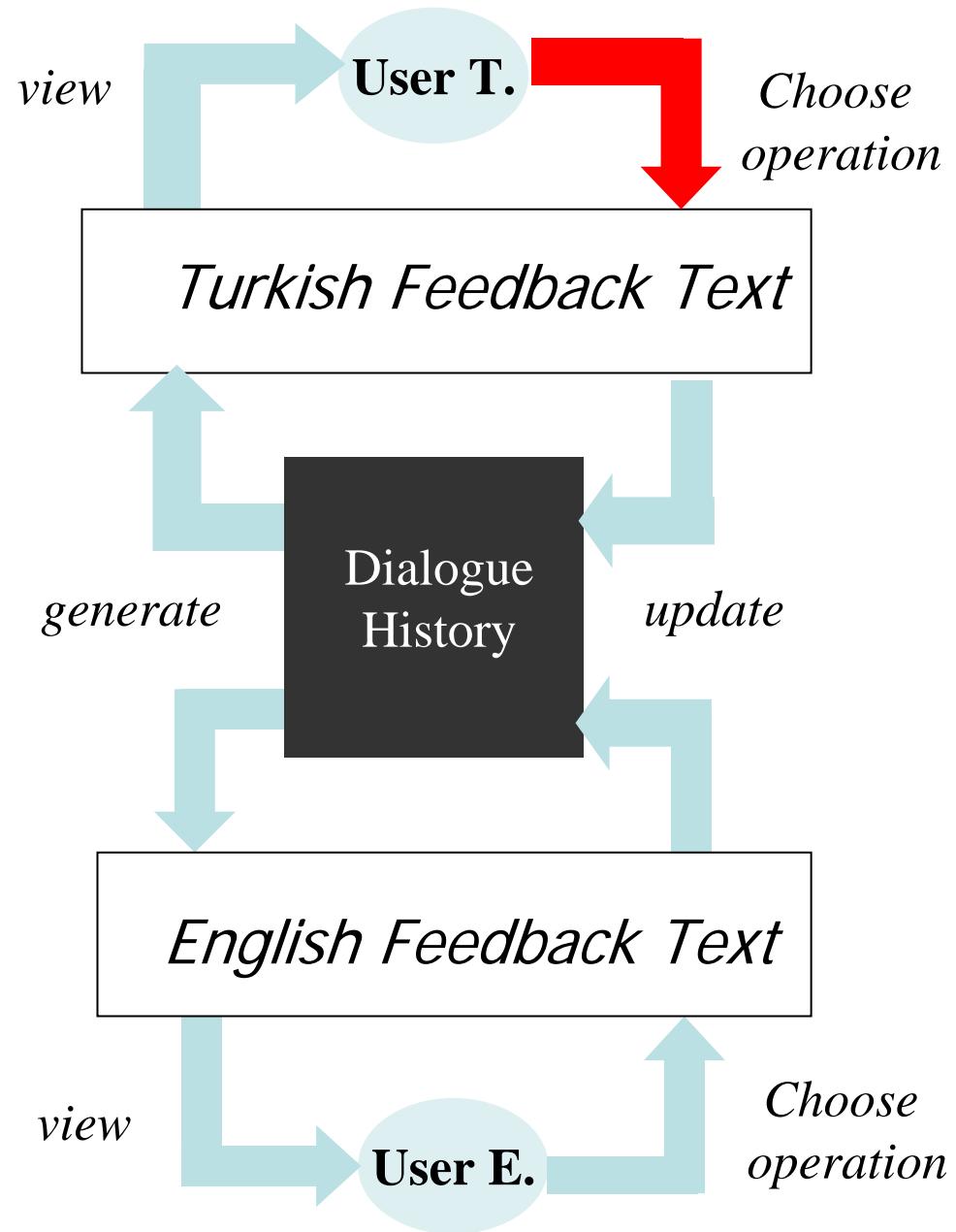
Dialogue as CA



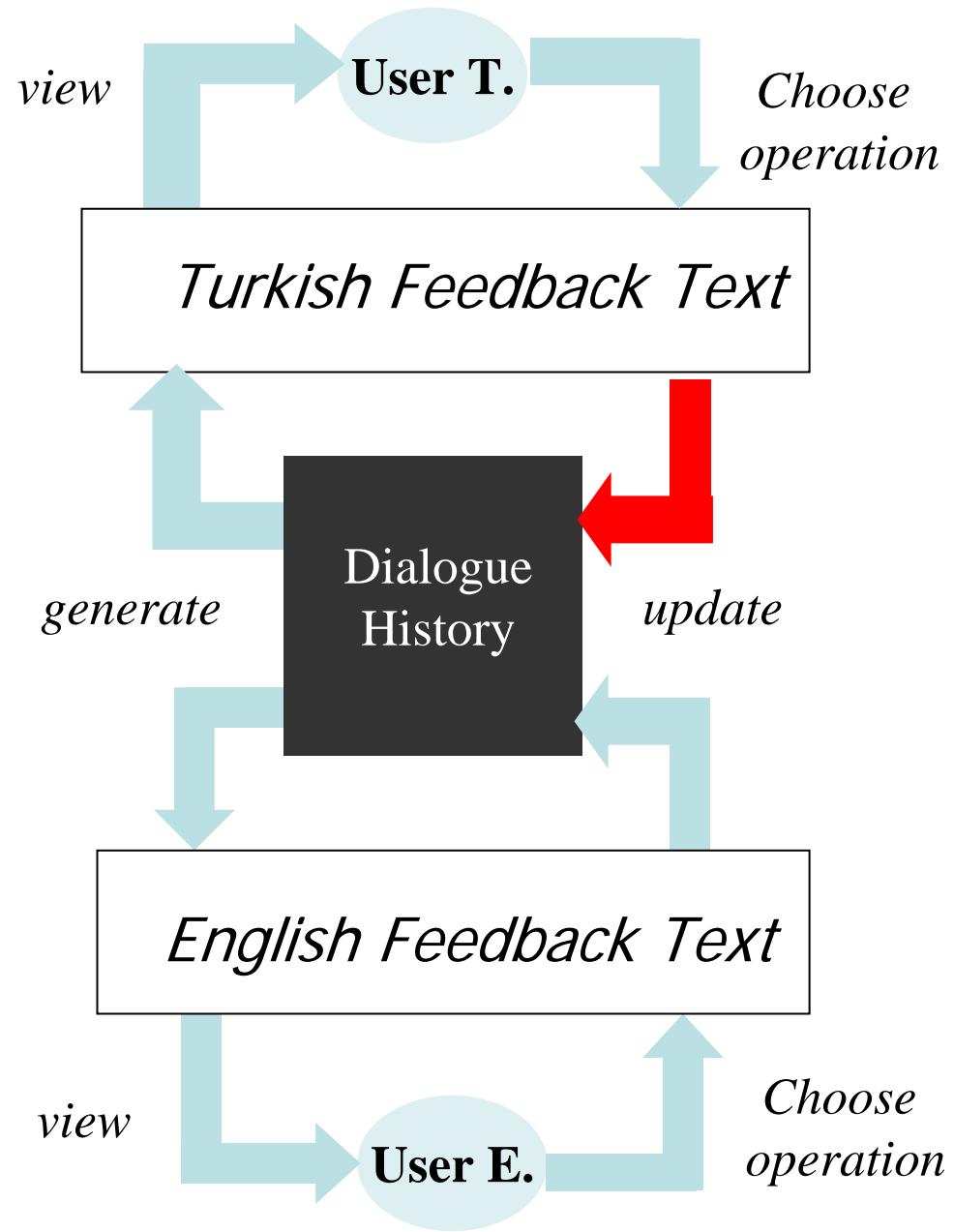
Dialogue as CA



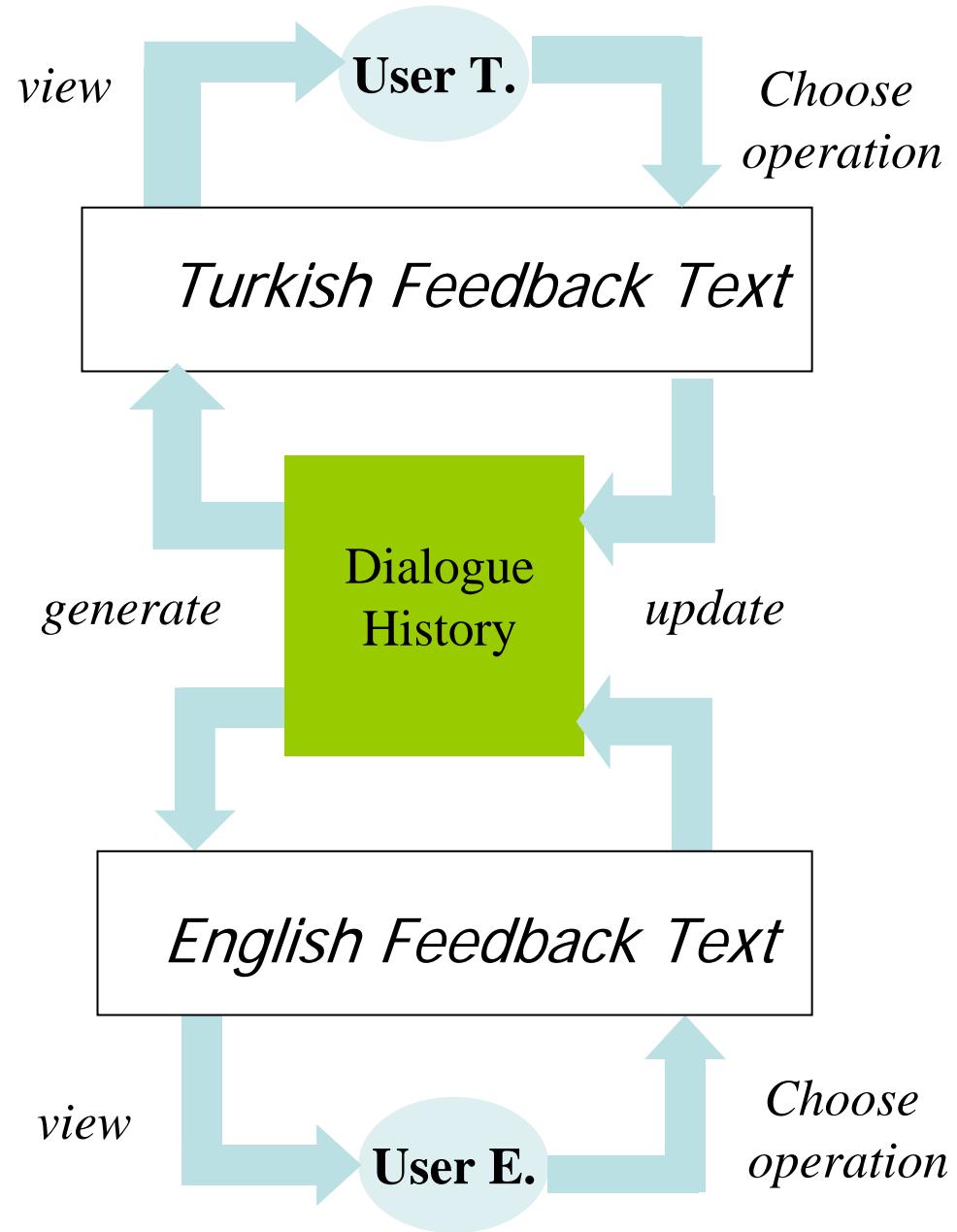
Dialogue as CA



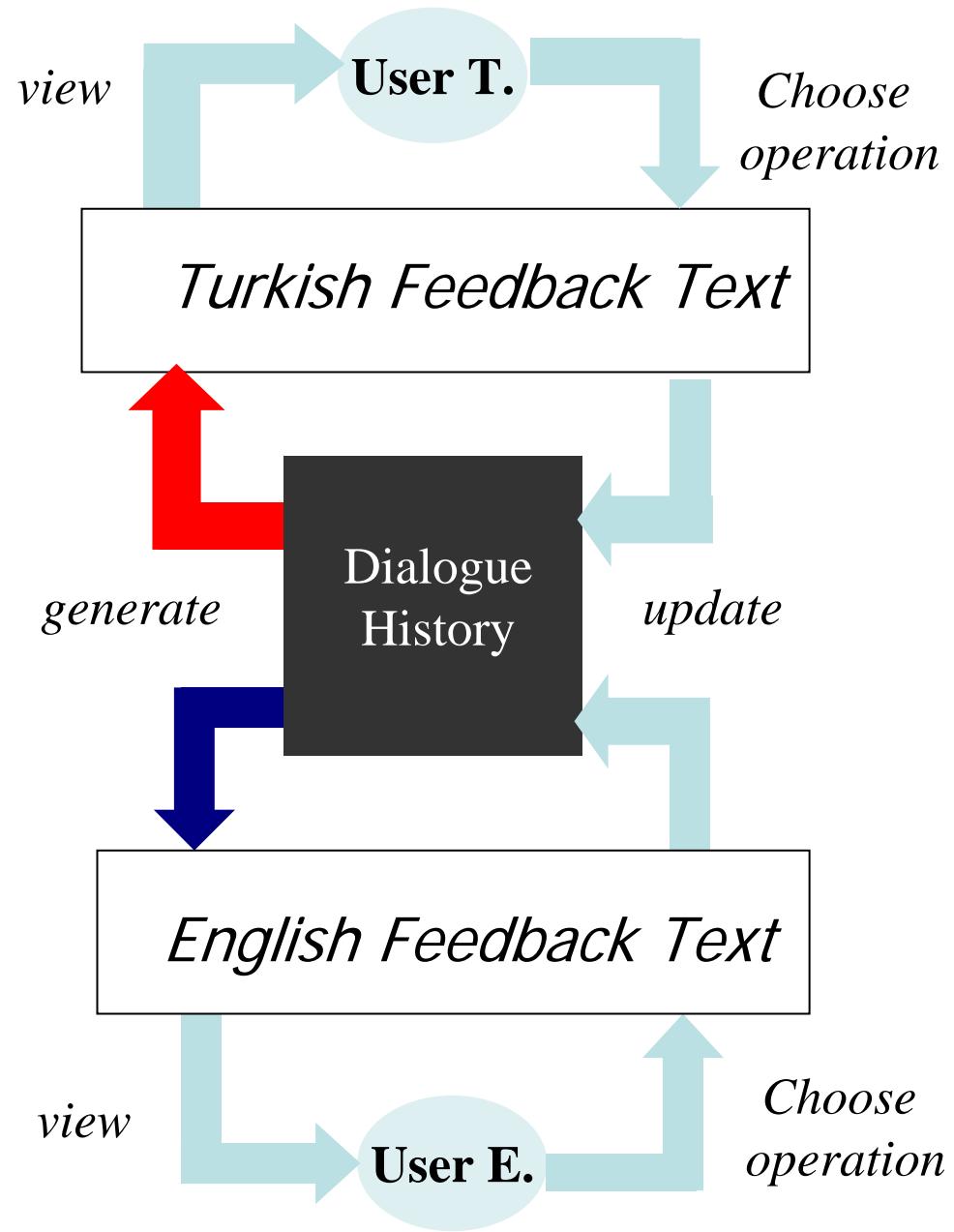
Dialogue as CA



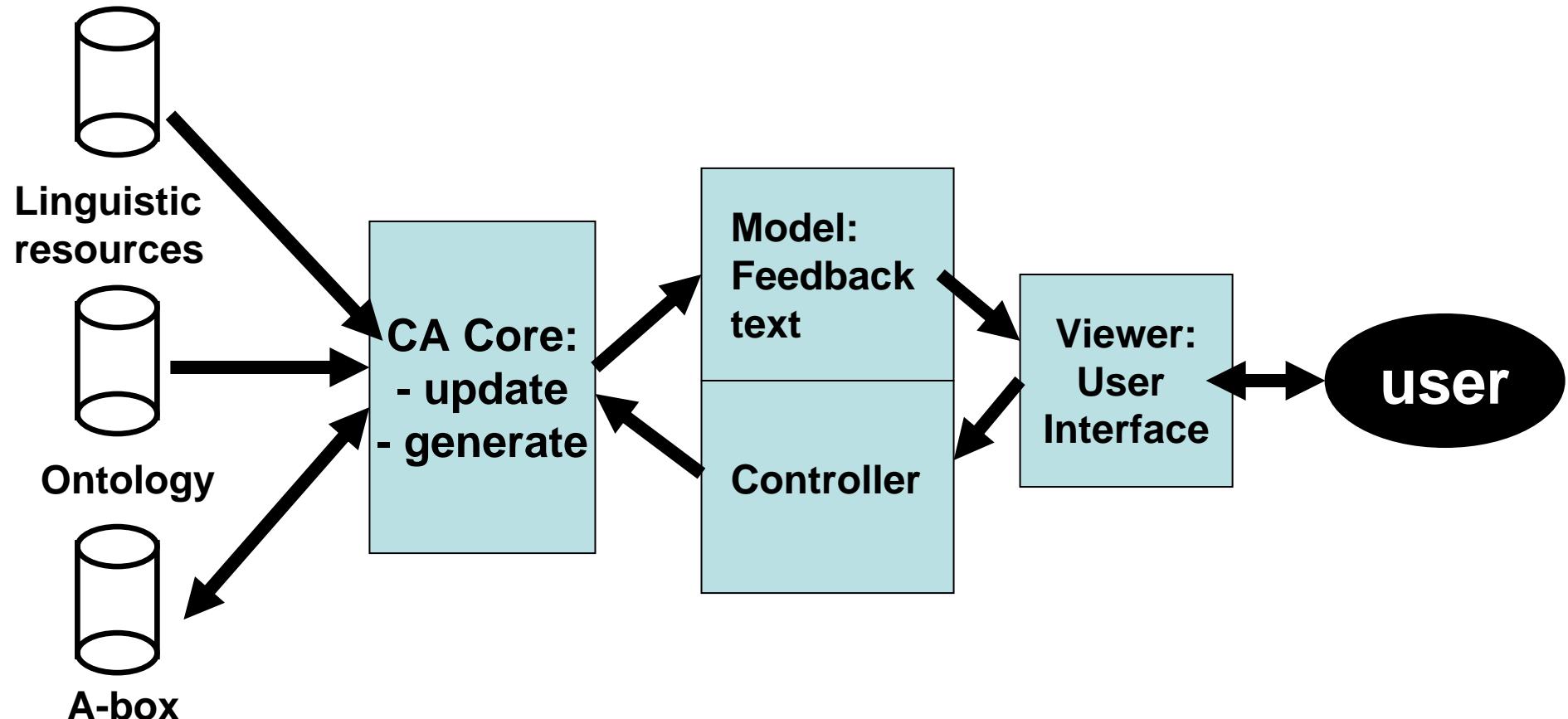
Dialogue as CA



Dialogue as CA



Architecture (single window version)



Demo

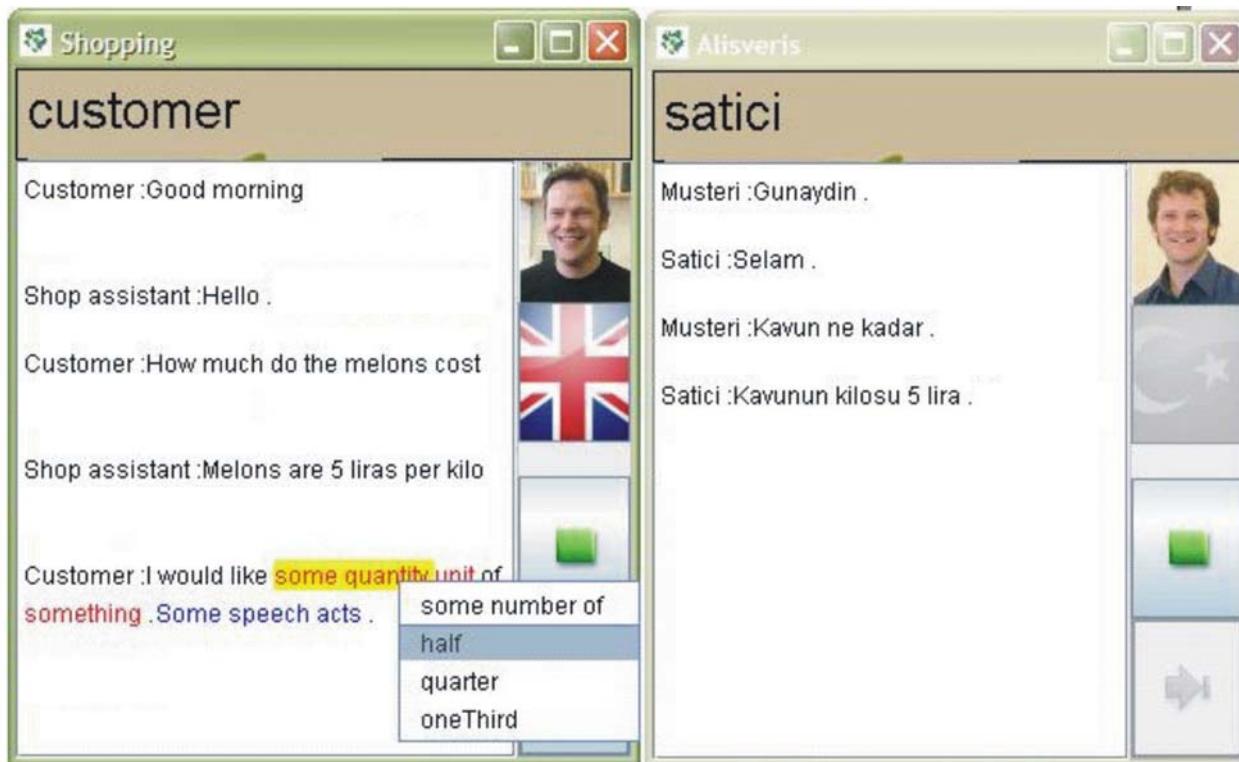


Figure 2: Screen shot of simple CROCODIAL prototype

Server-based CROCODIAL

Shopping

customer

Customer :Good morning

Shop assistant :Hello .

Customer :How much do the melons cost

Shop assistant :Melons are 5 liras per kilo

Customer :I would like some quantity unit of something . Some speech acts .

some number of
half
quarter
oneThird



Alisveris

satici

Musteri :Gunaydin .

Satici :Selam .

Musteri :Kavun ne kadar .

Satici :Kavunun kilosu 5 lira .



Further Dialogue Games?

- Travel/Entertainment (e.g., Chat room plugin)
- Financial (credit card companies, Internet Banking, B2B),
- Governmental (Immigration, Police, Tax, ...),
- e-Commerce (B2B, e.g., interaction with a supplier),
- Medical,
- Legal,
- ...

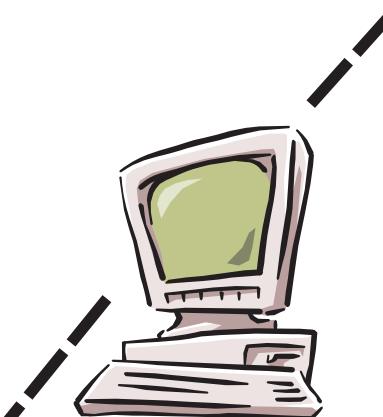
Example: financial domain



Mr. Rossi
at Italian Bank

Smith: Il destinatario del trasferimento TX735657 sostiene che il denaro non e' arrivato.
Rossi: Il trasferimento e' stato effettuato correttamente.
Smith: Il mio cliente non trova il denaro.
Rossi: E' stato versato nel suo conto in sterline.
Smith: *Copy and Paste*
Il cliente puo' prelevare il denaro utilizzando un bancomat locale?
Rossi: No, deve andare alla sua agenzia e trasferirlo sul conto di qualcuno.

→ Ms. Smith



Server at
clearinghouse

Smith: The client of transfer TX735657 complains that *the money* has not arrived.
Rossi: The money was successfully transferred.
Smith: *My client* cannot locate the money.
Rossi: *It* has been credited to *your client's* pound sterling account.
Smith: Can the client access *this money* from a local cash machine?



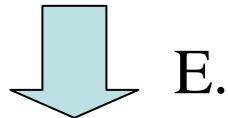
Ms. Smith
at UK Bank

Example: financial domain

*Dialogue
History 1*

Example: financial domain

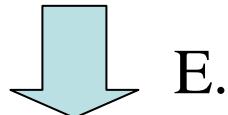
*Dialogue
History 1*



E.

Example: financial domain

*Dialogue
History 1*



E.

*Dialogue
History 2.*

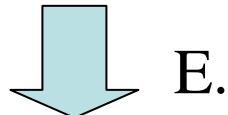


I.

...

Example: financial domain

*Dialogue
History 1*



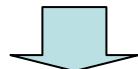
E.

*Dialogue
History 2.*



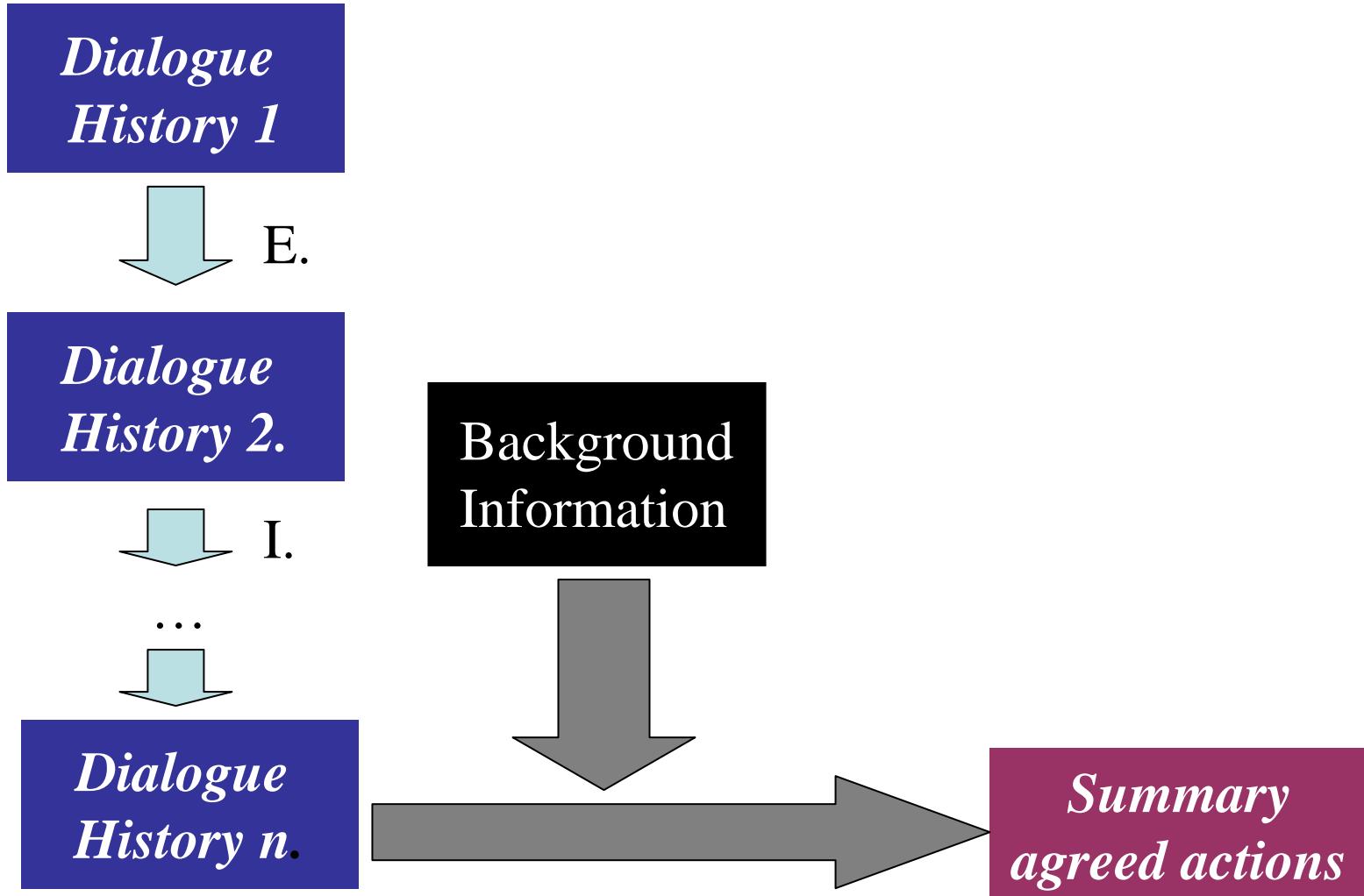
I.

...



*Dialogue
History n.*

Example: financial domain



Example: financial domain

*Dialogue
History 1*

↓ E.

*Dialogue
History 2.*

↓ I.

...

↓

*Dialogue
History n.*

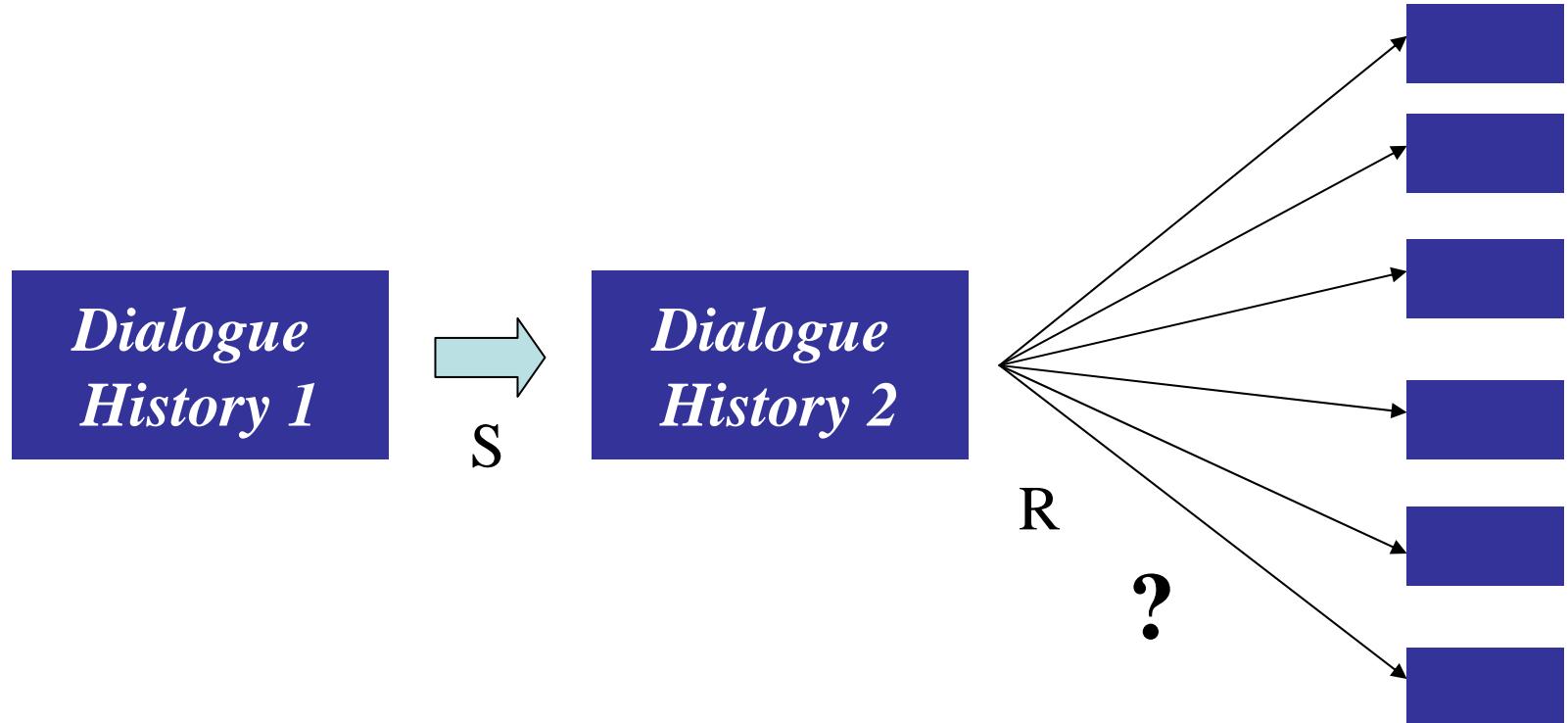
Background
Information

Op 15-1-2000 spraken
Mevrouw Smith (Citibank)
Meneer Rossi (Banca di Roma)
over de vertraging van een
transfer van \$250,000 naar de
rekening van **Graaf Roberto da**
Silva (654012). Er werd
overeengekomen dat Banca di
Roma \$50.000 zou overmaken
en de resterende \$200.000 op
23-1-2000.

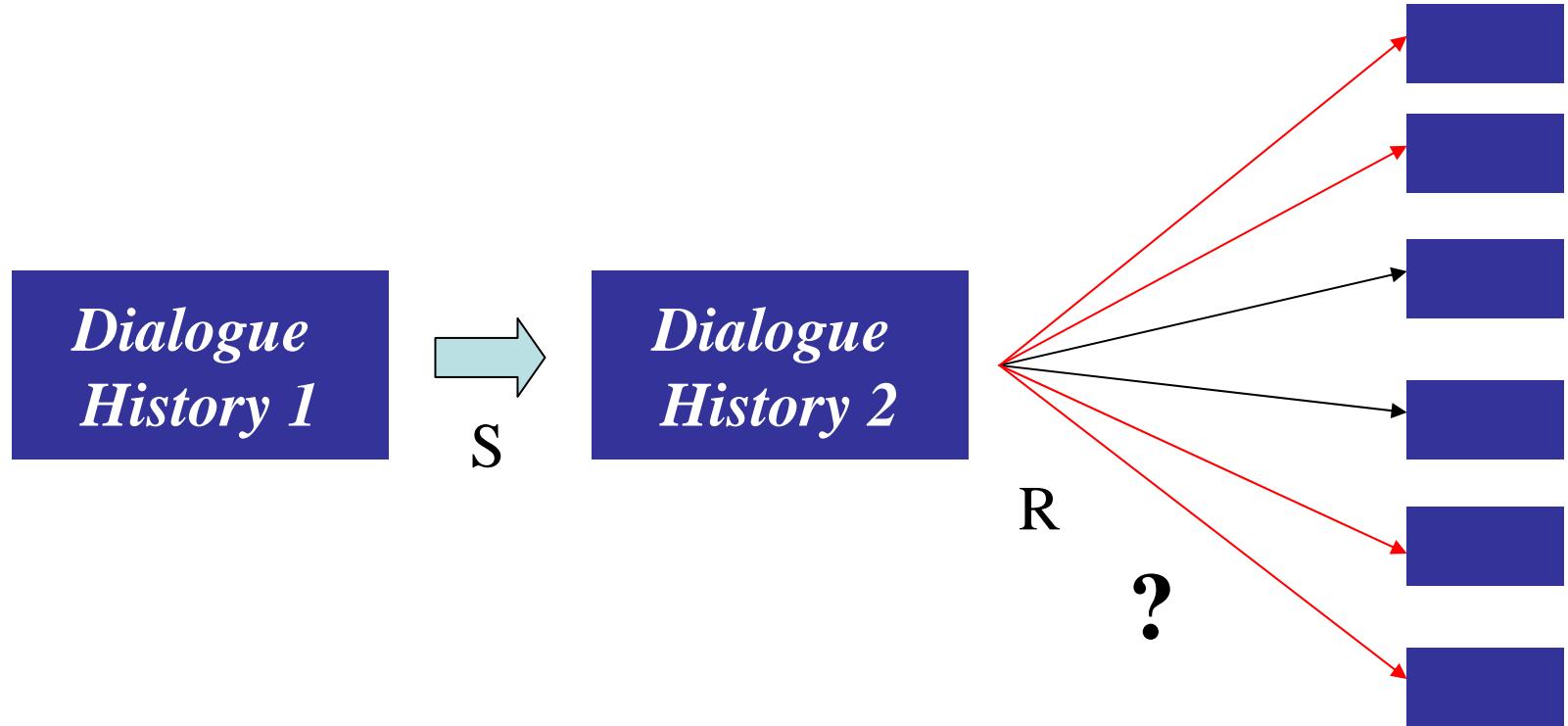
generate

*Summary
agreed actions*

Using theories of dialogue to improve CMC



Using theories of dialogue to improve CMC



Conclusions

- Contra CROCODIAL:
 - Text-based interaction;
 - Only for restricted domains.
- Pro CROCODIAL:
 - High level of accuracy;
 - Covers semantically complex information (anaphora, quantification, logical & rhetorical relations);
 - Exploitation of semantic content is possible (e.g., summarization).
- Platform for exploiting (and possibly testing) theories about dialogue

From Text to Dialogue for Computer-animated Characters

Presentation Teams

- Pioneered by André et al (2000)
- NECA project (Krenn et al., 2002; Piwek et al. 2002)
- CrAg Project (Isard et al., 2003)



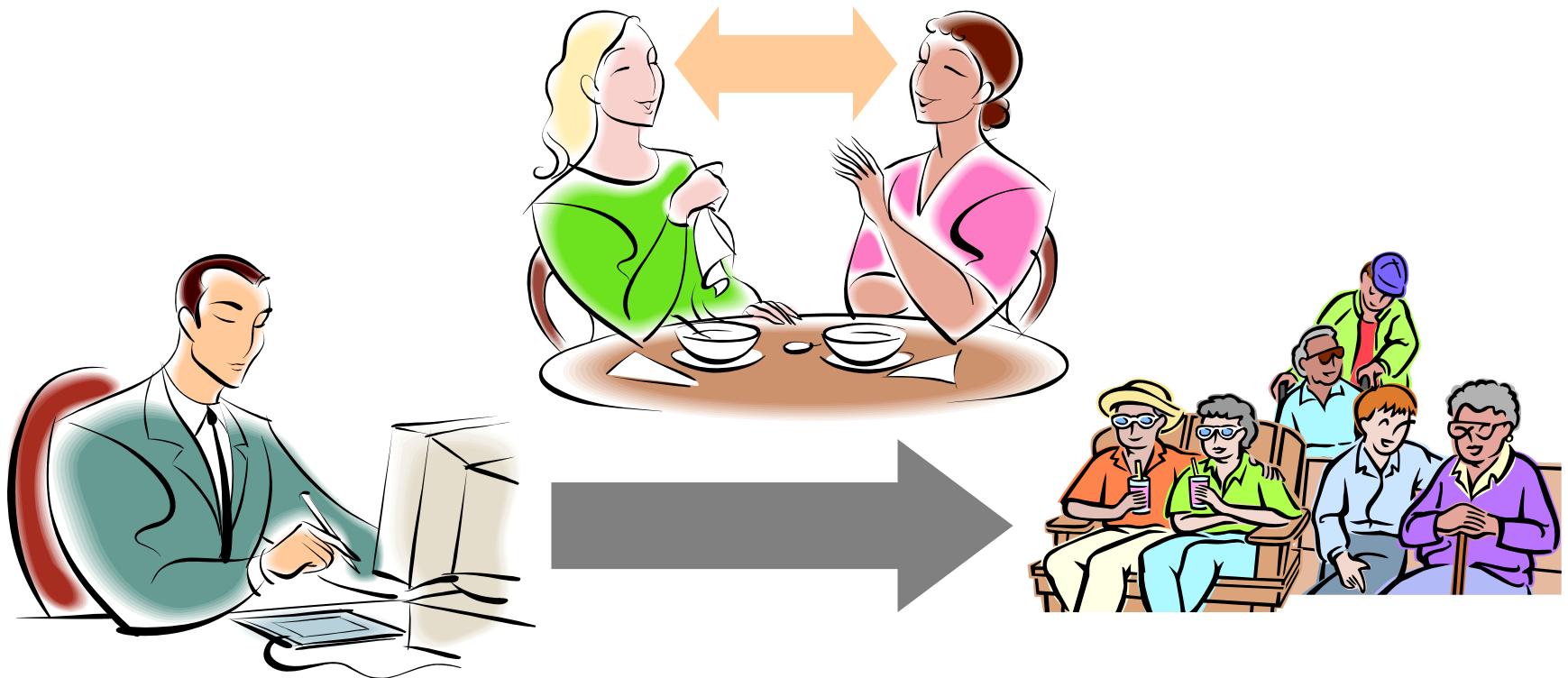
NECA

NET ENVIRONMENT FOR EMBODIED EMOTIONAL
CONVERSATIONAL AGENTS



Presentation Teams

Dialogue



Presentation Teams

Dialogue



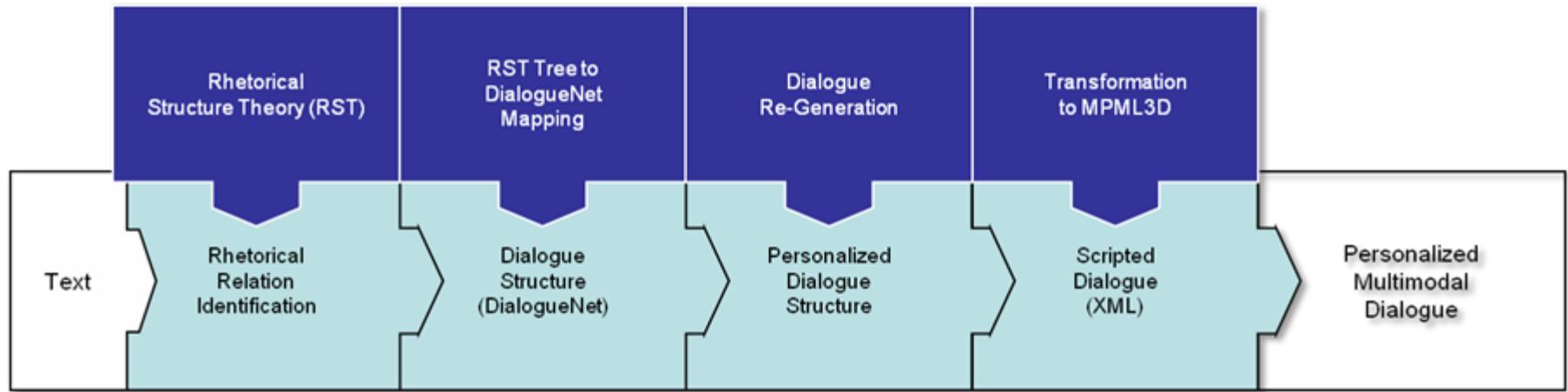
From Text to Dialogue

- Problem: producing content
- Solution: Text2Dialogue (T2D) system
- Generates natural dialogues between life-like agents automatically, from text
- Enables anyone to create quickly professional presentations

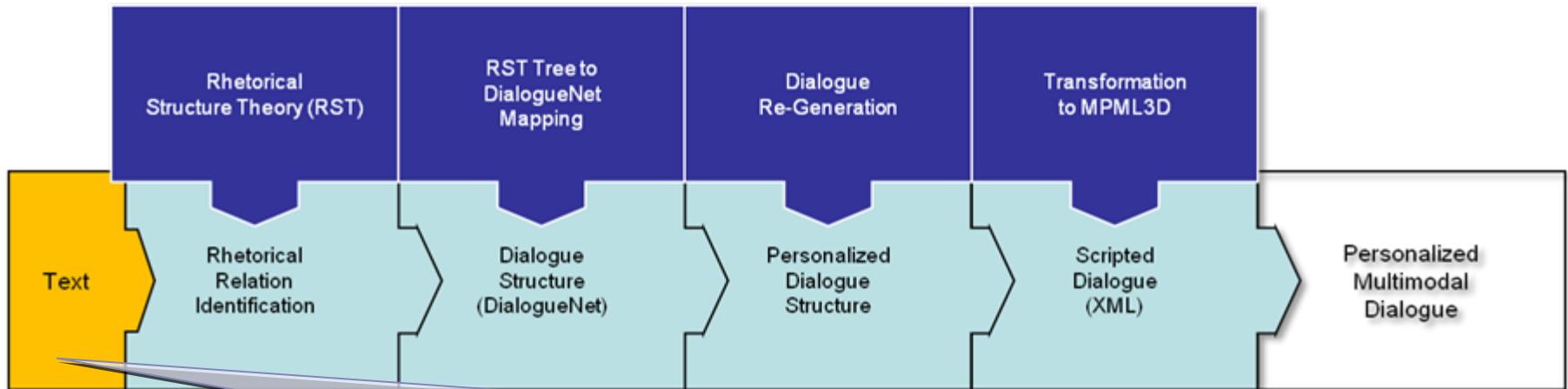
Potential Applications

- e-Healthcare: Help system for elderly people (giving medical advice).
- e-Learning: Teaching assistant.
- e-News: Automatic news presenter.

T2D: System Architecture

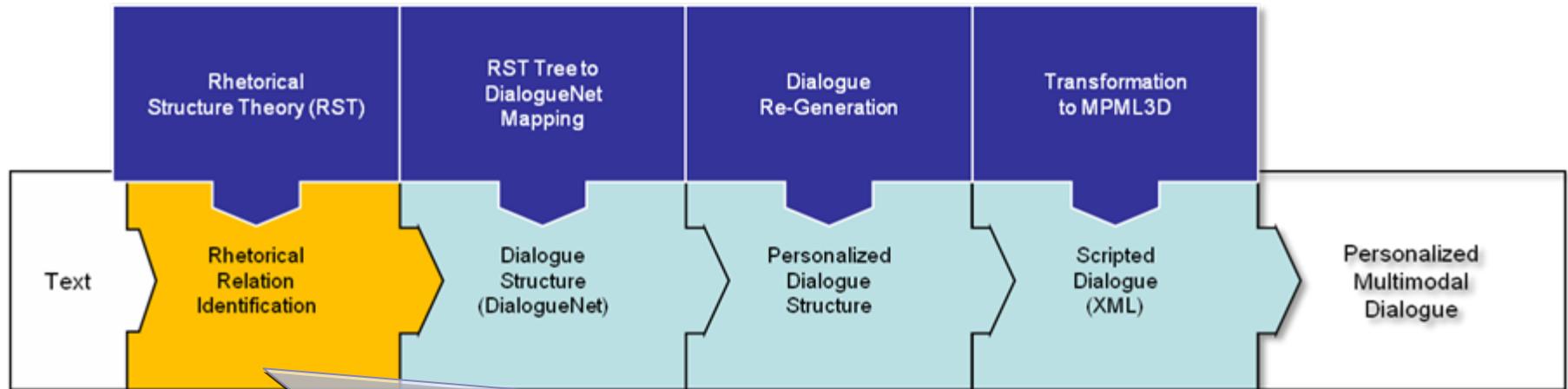


T2D: System Architecture



- Any text content.
- Web pages, books, wikis...

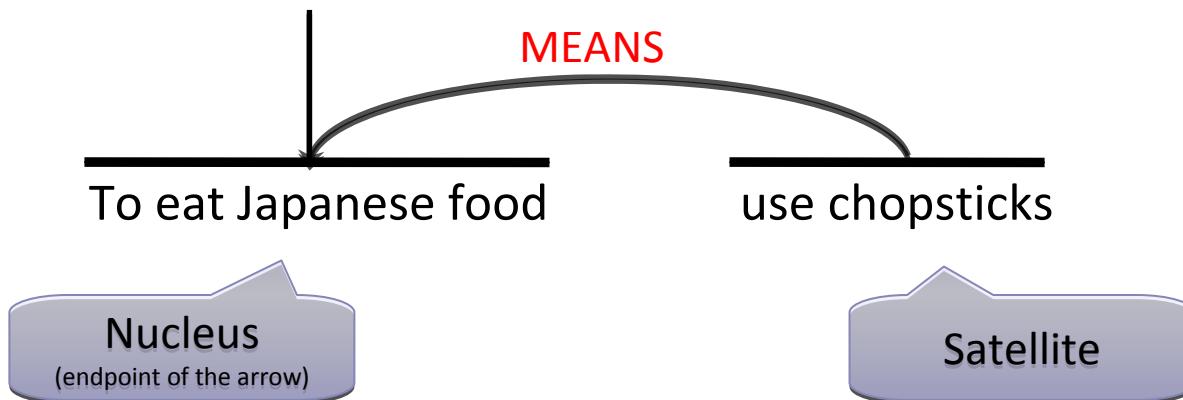
T2D: System Architecture



- Functional relation identification (RST).
- Tells which part of text is nucleus/satellite.
- Produces a RST tree (XML).

Rhetorical Structure Theory

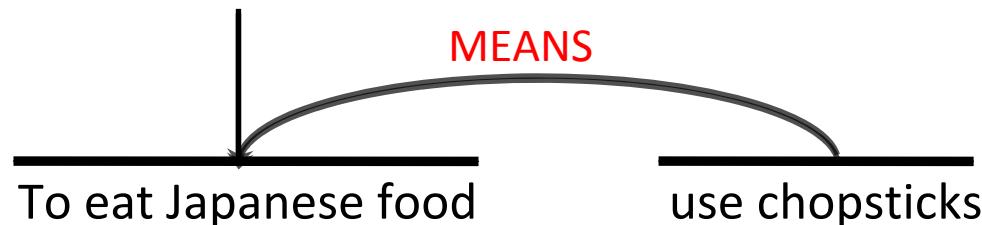
- Example: “To eat Japanese food, use chopsticks.”



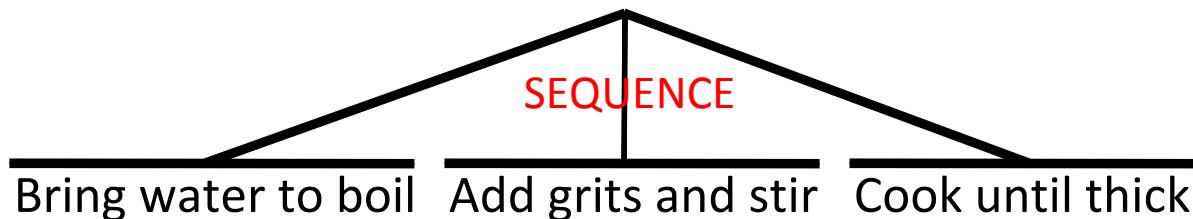
- Official Definition for MEANS: “S presents a method or instrument which tends to make realization of N more likely”.
- Generally: N is the prominent part of text, S is more “secondary”.

Rhetorical Structure Theory

- Mononuclear relations: nucleus and satellite are distinguished.



- Multinuclear relations: no distinguished nucleus.



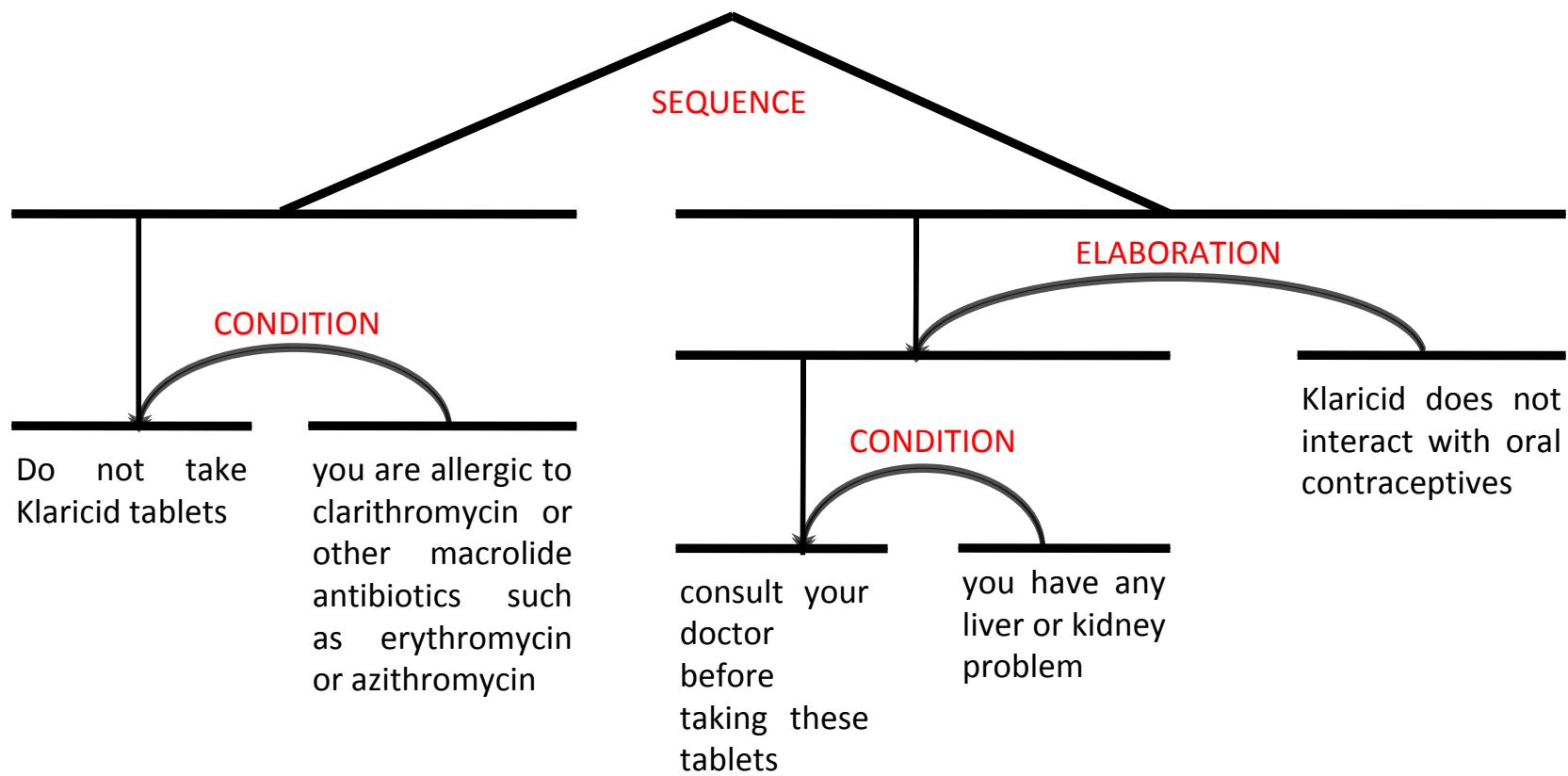
Rhetorical Relations Identification

- Performed by DiscourseAna (Huang T. Le).
- **Input:** A plain-text file.
- **Output:** An XML file containing the RST tree.

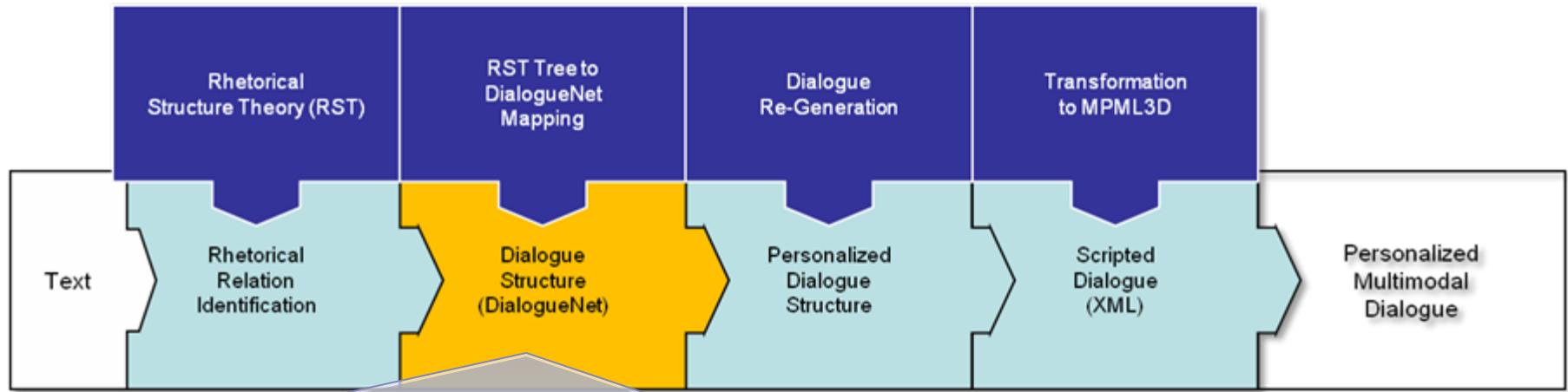
Rhetorical Relations Identification

"Do not take Klaricid tablets if you are allergic to clarithromycin or other macrolide antibiotics such as erythromycin or azithromycin.

If you have any liver or kidney problems consult your doctor before taking these tablets.
Klaricid does not interact with oral contraceptives."



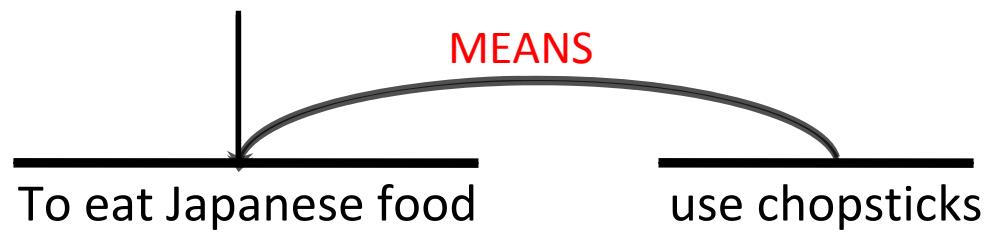
T2D: System Architecture



- Generates the dialogue.
- Maps a RST tree to a “DialogueNet”.
- i.e. Maps RST relations to question/answer pairs.

Dialogue Generation

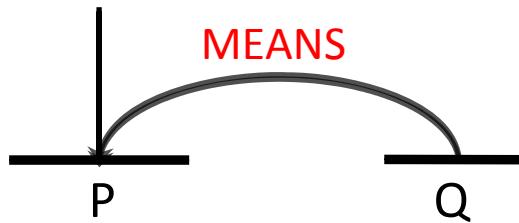
- How to generate a dialogue from this tree?
- → Novel “abstract-mapping” technique.
- Example:



Layman (Customer) > How should I eat Japanese food?
Expert (Chef) > You could use chopsticks.

Dialogue Generation

- “Formal” version:



Layman > How should I *inf_mark_rmv(P)*?

Expert > You could *Q*.

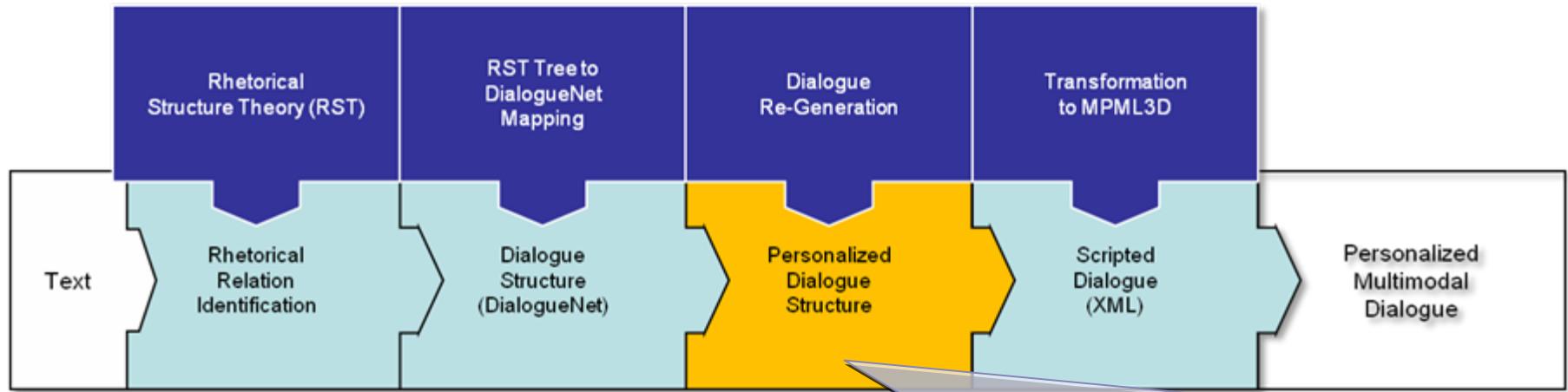
Where *inf_mark_rmv* is the function that removes the infinitive marks of the main verb.

Dialogue Generation

- The set of all query/answer pairs generated constitutes a DialogueNet.
- Formal definition:

DialogueNet (DN) Structure: An RST structure R is a *DN* structure for a text T , if and only there exists a partitioning of T into a set of non-overlapping spans $\{T_1, \dots, T_n\}$, such that this set consists of pairs of spans $\langle T_x, T_y \rangle$ which are related in R by the RST **Attribution** relation, with T_x the satellite of the **Attribution** relation, in particular, a clause of the form *Speaker said*, and T_y being the nucleus.

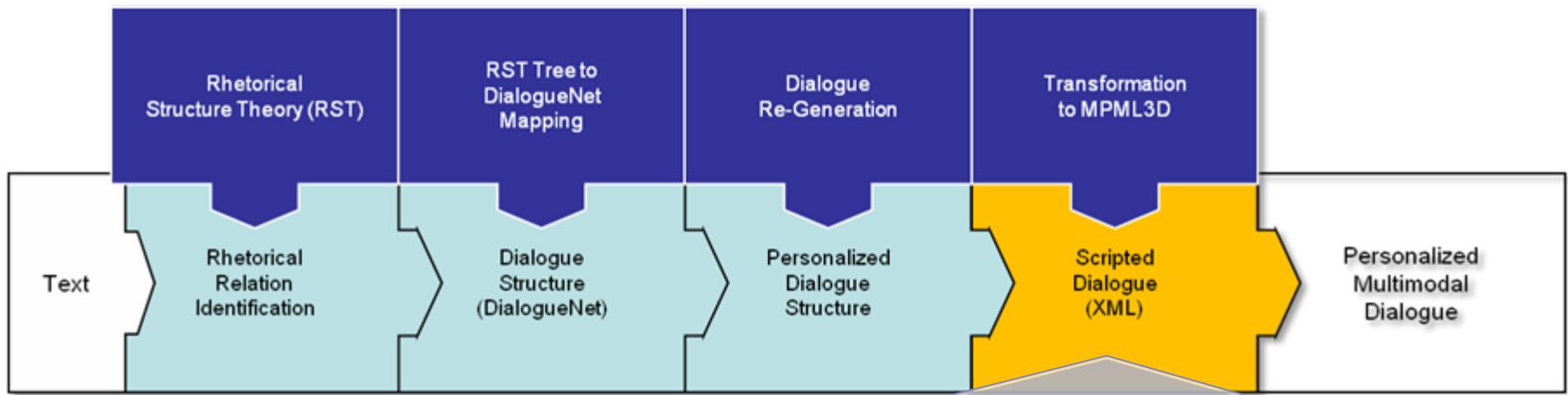
T2D: System Architecture



- Use coherence-preserving methods to personalize the dialogue.
- Adds geographic info, physical data, user history...

(Not done yet)

T2D: System Architecture



- Automatically adds gestures and gaze (c.f. Werner Breitfuß's work).
- Produces an MPML3D script.

(Not done yet)

T2D: Input

Patient Information Leaflet

Take your tablet by removing it from the foil and swallow it with water. Your doctor will tell you your correct dose; follow your doctor's advice and do not change the dose. Ask your doctor if you are unsure of the dosage or its timing. If you miss a dose, take another as soon as you remember or wait until it is time to take the next dose.

Then proceed as before. However, If you take an overdose, you should immediately tell your doctor or go to the casualty department (emergency ward) at your hospital. Keep your medicine in a place where children cannot reach it.

T2D Output



T2D: Concluding Remarks

- Novel approach (RST-based mappings, analysis on the discourse structure level).
- First results proved it to be efficient (Piwek et al. 2007).

Thank you for your attention!

<http://mcs.open.ac.uk/pp2464/dialogueGames/campinas.html>