Multidimensional Semantics

Lecture 4 - Dialogue theories and Multidimensionality

Laurent Prévot[1] and Laure Vieu[2]
[1] Laboratoire Parole et Langage (AMU & CNRS)
[2] Institut de Recherche en Informatique de Toulouse (CNRS)
laurent.prevot@lpl-aix.fr - vieu@irit.fr

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Introduction

- Course 2-3, solutions and mechanisms for dealing with multidimensionality
- This course, what did people put in the context / CG for modeling dialogue (in particular for handling meta-linguistic / communicative aspects)

Models presented

- Dialogue acts and communicative functions
  [Bunt, 2011b, Poesio and Traum, 1997]

  > *Our model is meant to be usable by an agent engaging in conversations as an internal, on-line representation of context. [Poesio and Traum, 1997]*

- Dialogue game board [Ginzburg, 2012] (if time allows)
- Discourse structure, SDRT
  [Asher and Lascarides, 2003, Lascarides and Asher, 2009]

Outline

Dialogue Acts coding schemes

- NLP task: provide the communicative function of a speech production
- Communicative functions : Generalization of illocutionary forces
- Various schemes (MAPTASK, TRAINS, DAMSL, SWBD-DAMSL,...)
- one-dimensional vs. multidimensional schemes
- DAMSL, DIT++ : multidimensional schemes

Why multi-dimensional tagsets?

- Cluster the communicative functions, helps keeping a clear tag set
- Cluster induce an organization, helps the decisions for the annotation process
- Within one-dimension choices are generally mutually exclusive, helps for the annotation process (decision tree)

Definition

Dimension [Bunt, 2011a] A dimension is an aspect of participating in dialogue which:

- dialogue participants can address by means of dialogue acts
- can be addressed **independently** of the other aspects of participating in dialogue which are distinguished.

[Popescu-Belis, 2005, Bunt, 2011a]

Dialogue acts: one or more dimensions [Popescu-Belis, 2005]

What is dimensionality (of a communicative act tagset)?

- one-dimensional tagset: $a = \{a_1, \ldots, a_n\}$
- multi-dimensional tagset:
  - dimensions $\mathcal{T} = \{\mathcal{A}, \mathcal{B}, ...\}$
  - tags: $\mathcal{A} = \{a_1, \ldots, a_n\}$
  - tags: $\mathcal{B} = \{b_1, \ldots, b_n\}$

Constraints:

- Supposedly, tags in a given dimension are mutually exclusive
- However, 3 kinds of instructions / rules for tagging:
  1. pick **exactly** one tag per dimension
  2. pick **at most** one tag per dimension
  3. pick **all** relevant tags for each dimension

Subsection 2

DIT++

DIT objectives

- Framework for interpretation and generation of dialogue moves
  - Centered on the informational state of the dialogue 'agent'
- Used also as the theoretical counterpart of an conversation annotation framework
- Backbone of a standard (interoperability) for semantic annotation

Not focused on 'described' content, but assumed to be there

Multifunctionality [Bunt, 2011b]

- reduce multi functionality through fine-grained segmentation into functional units

Definition

[Bunt, 2011b] A functional segment is a minimal stretch of communicative behavior that has a communicative function. Such stretches do not need to be grammatically well-formed or contiguous, and may have more than one communicative function.

Examples of multifunctionality

(1) John's account, let me finish, is totally incoherent.

(2) A: Could you tell me what departure times there are for flights to Frankfurt on Saturday?
B: Yes, let me have a look. OK, There's a Lufthansa flight leaving at 07:45,
A: yes,
B: and a KLM flight at 08:15.

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Function: Answer to the question+ Assert

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Function: Request-Time + Request

Examples of multifunctionality

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B: Yes, let me have a look. OK, There's a Lufthansa flight leaving at 07:45,
A: yes,
B: and a KLM flight at 08:15.

Function: Execution of the (indirect) request + Assert (2)

Different kinds of multi-functionality [Bunt, 2011b]

- independent multi functionality: occurs when a functional segment has several, logically independent communicative functions in different dimensions, due to containing indicators of more than one such function.

Example

(3) a. A: So you have been out all night without letting us know.
B: Yes. *(positive feedback + turn giving)*
A: That's all what you have to say!

- entailed communicative functions (usually same dimensions, more specific entails more generic functions) *(e.g Confirmation > Answer)*
- implicated communicative functions (e.g indirect speech acts)

Dimensions in DIT++

- General Purpose functions (inform, offer, check question...)
- 10 Specific Purpose functions
  1. contact management
  2. turn management
  3. allo-feedback
  4. auto-feedback
  5. discourse structuring
  6. time-management
  7. own communication management (self repairs)
  8. partner communication management (other-repairs)
  9. social obligations management (politeness, face-saving,...)
  10. Task/Activity

[Petukhova and Bunt, 2009, PETUKHOVA, 2011] shows the rather independent nature of these dimensions.

Semantics of communicative acts [Bunt, 2011b]

A speech act structure $\langle A, S, f, d \rangle$ is defined:

- An addressee A
- A sender S
- A communicative function f and its relevant component of the context d

Interpretation (V) of the speech act structure:
$V(\langle A, S, f, d \rangle) = (V(f))(F(A), F(S), F(d))$
where F assigns:

- individuals provided by metadata to A and S
- a component of the information state to d

Semantics of communicative acts

[Bunt, 2011b, Bunt, 2011a]

- combination of elementary update functions
- [Bunt, 2011b]: an agent context model does **not** necessarily have a separate component for each DIT dimension, but **convenient** to distinguish 5 contexts:
- Update semantics onto these dimensions
- Levels of processing [Clark, 1996]

Semantics of communicative acts

[Bunt, 2011b, Bunt, 2011a]

- combination of elementary update functions
- [Bunt, 2011b]: an agent context model does **not** necessarily have a separate component for each DIT dimension, but **convenient** to distinguish 5 contexts:
  1. Linguistic context
  2. Semantic context
  3. Cognitive context
  4. Physical / Perceptual Context
  5. Social Context
- Update semantics onto these dimensions
- Levels of processing [Clark, 1996]

Semantics of communicative acts

[Bunt, 2011b, Bunt, 2011a]

- combination of elementary update functions
- [Bunt, 2011b]: an agent context model does **not** necessarily have a separate component for each DIT dimension, but **convenient** to distinguish 5 contexts:
- Update semantics onto these dimensions
- Levels of processing [Clark, 1996]
  1. attention
  2. perception
  3. understanding: dialogue segments $\rightsquigarrow$ dialogue acts $\rightsquigarrow$ update
  4. evaluation: **check model consistency**
  5. execution

Interpretation and Update functions

- Interpretation of assertive communicative functions

F(Inform)	=	$\lambda s.\lambda X.\lambda Y.\lambda D_i.\lambda p.U_1(X,Y,D_i,p,s) \sqcup U_2(X,Y,D_i,p,s)$
F(Agreement)	=	$\lambda s.\lambda X.\lambda Y.\lambda D_i.\lambda p.U_1(X,Y,D_i,p,s) \sqcup U_2(X,Y,D_i,p,s) \sqcup U_5(X,Y,D_i,p)$
F(Disagreement)	=	$\lambda s.\lambda X.\lambda Y.\lambda D_i.\lambda p.U_1(X,Y,D_i,\neg p,s) \sqcup U_2(X,Y,D_i,\neg p,s) \sqcup U_5(X,Y,D_i,p)$
F(Correction)	=	$\lambda s.\lambda X.\lambda Y.\lambda D_i.\lambda p.U_1(X,Y,D_i,p_1,s) \sqcup U_2(X,Y,D_i,\neg p_1,s) \sqcup U_6(X,Y,D_i,p_2)$
F(Answer)	=	$\lambda s.\lambda X.\lambda Y.\lambda D_i.\lambda p.U_1(X,Y,D_i,p,s) \sqcup U_2(X,Y,D_i,p,s) \sqcup U_9(X,Y,D_i,p)$ $\sqcup U_7(X,Y,D_i,p)$
F(Confirm)	=	$\lambda s.\lambda X.\lambda Y.\lambda D_i.\lambda p.U_1(X,Y,D_i,p,s) \sqcup U_2(X,Y,D_i,p,s) \sqcup U_8(X,Y,D_i,p)$ $\sqcup U_9(X,Y,D_i,p,s) \sqcup U_7(X,Y,D_i,p)$
F(Disconfirm)	=	$\lambda s.\lambda X.\lambda Y.\lambda D_i.\lambda p.U_1(X,Y,D_i,\neg p,s) \sqcup U_2(X,Y,D_i,\neg p,s) \sqcup U_8(X,Y,D_i,\neg p,s)$ $\sqcup U_9(X,Y,D_i,p) \sqcup U_7(X,Y,D_i,p)$

- Update functions

Interpretation and Update functions

- Interpretation of assertive communicative functions
- Update functions

$$
\begin{array}{ll}
U_1(X, Y, D_i, p, s) & Y_i' =+ \textbf{Bel}(Y, \textbf{Want}(X, \textbf{Bel}(Y, p, s))) \\
U_2(X, Y, D_i, p, s) & Y_i' =+ \textbf{Bel}(Y, \textbf{Bel}(X, p, s)) \\
U_3(X, Y, D_i, p) & Y_i' =+ \textbf{Bel}(Y, \textbf{Assume}(X, p)) \\
U_4(X, Y, D_i, p) & Y_i' =+ \textbf{Bel}(Y, \textbf{Wk-Bel}(X, p)) \\
U_5(X, Y, D_i, p) & Y_i' =+ \textbf{Bel}(Y, \textbf{Bel}(X, \textbf{Assume}(Y, p)))
\end{array}
$$

The (partial) treatment of an example

(4) John, let me finish, is crazy.

1. John is crazy. $\rightsquigarrow$ *Inform*
2. let me finish. $\rightsquigarrow$ *Turn-Keep*

The (partial) treatment of an example

(4) John, let me finish, is crazy.

1. John is crazy. $\rightsquigarrow$ *Inform*
   1. $F(Inform) = \lambda X.\lambda Y.\lambda D_i.\lambda p.U_1(X, Y, D_i, p) \sqcup U_2(X, Y, D_i, p)$
   2. $U_1(X, Y, D_i, p) : Y_i' = +Bel(Y, Want(X, Bel(Y, p)))$
   3. $U_2(X, Y, D_i, p) : Y_i' = +Bel(Y, Bel(X, p))$
   4. Application : $F(Inform)(Bill)(Mary)(GP)(crazy(J)) =$
      $U_1(Bill, Mary, GP, crazy(J)) \sqcup U_2(Bill, Mary, GP, crazy(J)$
   5. $\rightsquigarrow D_{Sem}^{Mary'} + =$
      $Bel(Mary, Want(Bill, Bel(Mary, crazy(J))))+ =$
      $Bel(Mary, Bel(Bill, crazy(J)))$
2. let me finish. $\rightsquigarrow$ *Turn-Keep*

The (partial) treatment of an example

(4) John, let me finish, is crazy.

1. John is crazy. $\rightsquigarrow$ *Inform*
2. let me finish. $\rightsquigarrow$ *Turn-Keep*
   1. $F(Inform) = \lambda X.\lambda Y.\lambda D_i.U_{101}(X, Y, D_i) \sqcup U_{105}(X, Y, D_i)$
   2. $U_{101}(X, Y, TurnM) : Y'_{LiC} = +Bel(X, Current - Speaker(X))$
   3. $U_{105}(X, Y, TurnM) : Y'_i = +Wants(X, Next - Speaker(X))$
   4. Instanciation : $F(Turn - Keep)(Bill)(Mary) = U_{101}(Bill, Mary, TurnM) \sqcup U_{105}(Bill, Mary, TurnM)$
   5. $\rightsquigarrow D_{LiC}^{Mary'} += Bel(Bill, CurrentSpeaker(Bill)) += Wants(Bill, NextSpeaker(Bill))$

The (partial) treatment of an example

(4) John, let me finish, is crazy.

1. John is crazy. $\rightsquigarrow$ *Inform*
2. let me finish. $\rightsquigarrow$ *Turn-Keep*

Mary's pending Semantic Context	Mary's pending Linguistic Context
$Bel(Mary, Want(Bill, Bel(Mary, crazy(J))))$ $Bel(Mary, Bel(Bill, crazy(J)))$	$Bel(Bill, CurrentSpeaker(Bill))$ $Wants(Bill, NextSpeaker(Bill))$

Mary's Semantic Context	Mary's Linguistic Context

Semantics [Bunt, 2011b]

- general-purpose functions

description	notation	meaning
believes that	**Bel**(S, p, σ)	*S believes that p*; σ indicates whether this is a firm belief or an uncertain belief (σ can have the values 'firm' and 'weak')
knows value of	**Know-val**(S, z)	*S possesses the information z*
has goal	**Wantl**(S, p)	*S has the goal that p*
is able to do	**CanDo**(S, α)	*S is able to perform the action* α
is willing to do	**WilDo**(S, α, C_α)	*S is willing to perform the action* α *if the condition* C_α *is* fulfilled; C_α may be the universally true statement $\top$
is committed to do	**CommitDo**(S, α, C_α)	*S is committed to perform the action* α *if the condition* C_α *is* fulfilled; the condition C_α may be 'empty' ($\top$)
is committed to refrain from doing	**RefrainDo**(S, α, C_α)	*S is committed to refrain from performing the action* α *if the condition* C_α *is fulfilled* C_α may be 'empty' ($\top$)
is considering to be done	**ConsidDo** (X, α, Y, C_α)	*X is considering the action* α*, to be performed by Y, if the condition* C_α *is fulfilled* C_α may be 'empty' ($\top$)
is in the interest of	**Interest**(Y, α)	action α is of interest to agent Y.

- specific-purpuse functions

Semantics [Bunt, 2011b]

- general-purpose functions
- specific-purpuse functions

Dimension	*Primitives*
Auto- and Allo-feedback	**Attended, Perceived, Understood, Accepted, Executed, Attention-Problem, Perception-Problem, Interpretation-Problem, Evaluation-Problem, Execution-Problem**
Turn Management	**Current-Speaker, Next-Speaker**
Time Mangement	**Time-Need, small, substantial**
Contact Management	**Present**
Discourse Structuring	**Ready, Available, Start-Dialogue, Close-Dialogue**
Own and Partner Communication Man.	**Delete, Replace, Append**
Social Obligations Man.	**Available, Thankful, Regretful, Knows-id, Final**

Bunt's approach and multidimensionality

- Context:
  - 1 structure / participant
  - Different components identified for 'conveniency'
  - Semantics with many primitives rather informally defined
- Dynamicity: Strong (Info-state update approach)
- Representation : unspecified but does not seem required
- Semantics aspect:
  - Indices : unspecified, but at least the participants
  - Type inventory: entities, propositions, actions + primitives of the specific dimensions ,...
  - Form-proposition mapping: 1 to n

Subsection 3

Poesio&Traum

Poesio and Traum objectives

- Framework for interpretation of dialogue
- Still oriented toward dialogue system
- But focus more on the 'described' content
- More like an early attempt at putting all the pieces of dialogue together in a formal framework

See also [Larsson, 2002]

Conversation Acts

- Core speech act (illocutionary acts), turn-taking acts, argumentation acts, locutionary acts...
- Organized as layers / levels rather than dimensions
  - Hierarchical structure
  - Clearly not independent in a standard sense
- Conversation acts are ordinary events

Example

(5) A (to B): There is an engine at Avon.

$$ce : Assert(A, B, K) \; where \; K = \begin{array}{|l|}\hline x,w,e \\ \hline engine(x) \\ Avon(w) \\ at(e,x,w) \\ \hline \end{array}$$

Multiple Conversation Acts

- Locutionary acts: $utter(e, A, P)$ where e is the uttering event, A an individual (speaker), P is a 'string'
- One locutionary event may 'generates' multiple "events"

Example

(6) A: take the Avon train to Dansville.
B: Okay.

$utter(e_1, B, "okay") \rightsquigarrow$

- B acknowledges A's contribution
- B commits (toward the audience) to take the train tomorrow

Conversational score

- "utterances are observable actions (SPEECH ACTS) whose occurrence is recorded by both participants"
  [Poesio and Traum, 1997]
- CG is really common (same structure for both participants) :
  1. G : grounded elements
  2. DU_i : discourse units
  3. List of pending discourse units (Current Discourse Unit being on top of this list)
- States representing attitudes, private (Beliefs,...) and public (Commitments)
- All represented in DRT
  [Kamp and Reyle, 1993, Muskens, 1994]

Example of the Grounded part

c. A: *It* is hooked to a boxcar.

G=

u1-6 u7 u8-13 ce1 ce3 s s′ s″ K1 K2

---

u1-6 : **Utter**(*A*, "*There is an engine at Avon*")
ce1 : **Assert**(*A*,*B*,*K1*)

K1 =
x w e
---
engine(*x*)
Avon(*w*)
e : **at**(*x*,*w*)

K1(*s*)(*s′*)
generate(*u1-6*,*ce1*)
u7 : **Utter**(*B*, "*Okay*")
ce3 : **Accept**(*B*,*ce1*)
generate(*u7*,*ce3*)
u8-13 : **Utter**(*A*, "*It is hooked to a boxcar*")
ce4 : **Assert**(*A*,*B*,*K2*)

K2 =
y u e′
---
boxcar(*y*)
e′ : **hook**(*y*,*u*)
u **is** *x*

K2(*s′*)(*s″*)
generate(*u8-13*,*ce4*)
satisfaction-precedes(*ce*,*ce4*)

Evolution of the Common Ground

- Each Conversation Act extends the current focus space [Grosz and Sidner, 1986]
- Focus spaces are *situations*
- Situations are organized in an inclusion hierarchy
  - each constituent of a situation x is also a constituent of every situation x' that extends x
- Results of update are added to the CG, together whith linguist events, semantic representations,...

Multidimensionality evaluation

- Context:
  - 1 structure common to all participant but with grounded / ungrounded parts
  - Participants included in the models
  - No components in the common ground
  - DRT [Muskens, 1994] + Many primitives concerning meta-linguistic aspects (defined from various frameworks)
- Dynamicity: Strong (Info-state update approach)
- Intermediate Representation : DRT
- Semantics aspect:
  - Indices : unspecified, but at least the participants and situations
  - Type inventory: entities, propositions, situations, discourse referents
  - Form-proposition mapping: 1 to n

Outline

The basic picture

Approach:

- Provides a full linguistic formal theory of dialogue
- by looking at fragments (non-sentential utterances) [Fernandez and Ginzburg, 2002]
- In particular Clarification Requests

Model (KoS):

- Structure game board approach, for each participant
  - private part
  - public game board
- Expressed in Type-Theory with Records [Cooper, 2005] (and ESSLLI course next week)

Difficulty for comparison: Crucially uses *Situation Theory* [Barwise and Perry, 1983]

Clarification Requests [Purver, 2006]

(7) A: Did Bo leave?

a. Eh? / What? / Pardon?

b. *Explicit:* B: What did you say? / Did you say Bo / What do you mean leave?

c. *Literal reprise:* B: Did BO leave? / Did Bo LEAVE?

d. *Wh-substituted Reprise :* B: Did WHO leave? / Did Bo WHAT?

e. *Reprise sluice:* B: Who? / What? / Where?

f. *Reprise Fragments:* B: Bo? / Leave?

Public game board

- Speaker, Adressee: Individuals
- Facts: set(proposition)
- Pending: list(locutionary proposition)
- Moves: list(locutionary proposition)
- Questions-Under-Discussion: Partially-Ordered-Set(Question)

Locutionary Propositions: utterances and the types that classify them [Ginzburg, 2012]

Utterance type / token

$$\begin{bmatrix} \text{PHON}: \text{jo left} \\ \text{CAT} = \text{V}[+\text{fin}]: \text{syncat} \\ \text{C-PARAMS}: \begin{bmatrix} s0:\text{SIT} \\ s:\text{IND} \\ a:\text{IND} \\ t0:\text{TIME} \\ t1:\text{TIME} \\ c1:\text{addressing}(s,a,t1) \\ c2:\text{Precedes}(t0,t1) \\ j:\text{IND} \\ c3:\text{Named}(j,\text{'jo'}) \end{bmatrix} \\ \text{cont} = \begin{bmatrix} \text{sit} = s0 \\ \text{sit-type} = \text{Leave}(j,t0) \end{bmatrix}: \text{Prop} \end{bmatrix}$$

b.
$$\begin{bmatrix} \text{PHON}: \text{jo lef'} \\ \text{CAT} = \text{V}[+\text{fin}] \\ \text{C-PARAMS} = \begin{bmatrix} s0 = \text{sit0} \\ s = \text{spkr0} \\ a = \text{addr0} \\ t0 = \text{time0} \\ t1 = \text{time1} \\ c1 = c10 \\ c2 = c20 \\ j = j0 \\ c3 = c30 \end{bmatrix} \\ \text{cont} = \begin{bmatrix} \text{sit} = s0 \\ \text{sit-type} = \text{Leave}(j,t0) \end{bmatrix} \end{bmatrix}$$

Multidimensionality evaluation

- Context:
  - 1 structure per participant with public / private parts
  - Participants included in the structure
- Dynamicity: Update rules
- Intermediate Representation : The game board in TTR
- Semantics aspect:
  - Index: Contextual-parameters are very rich version of the indexes
  - Type inventory: Rich type inventory in the game board
  - Form-proposition mapping: 1 to 1 but very fine grained

Outline

Introduction

- Semantic theory that includes as much "pragmatic" aspects as needed to handle various phenomena
- Indirect Speech Acts, Biased questions, Parentheticals, Presuppositions, Imperatives
- Correction / Denial
  - Basic issue: Handling inconsistency of Assertion-Denial pairs
  - Secondary issue: Even rhetorical/argumentative links can be denied

Original Dialogue SDRT

[Asher and Lascarides, 2003]
SDRT +

- Speakers (available at the representation level)
- Dialogue relations (Question-Answer-Pair, Acknowledgment, Elaboration$_q$,...)
- Basic modes ('.','?','!') used in the Glue Logic only for inferring relations and the structure
- Veridical vs. non-veridical relations
- Mechanism for allowing of inconsistent information (in case of corrections)
- Revision mechanism for correction (involving downdate operator) [Van Leusen, 2004]
- Semantics is the interpretation of the structure

SDRT interpretation reminder

$(w, f)[\![R(\alpha, \beta)]\!](w', g)$ iff $(w, f)[\![\mathcal{K}_\alpha \wedge \mathcal{K}_\beta \wedge \phi_{R(\alpha,\beta)}]\!](w', g)$
Semantics of a discourse/dialogue, the model (world,assignment) after the last update for this discourse

- standard semantics of the constituents
- semantic effects of the relations

Current SDRT for dialogue [Lascarides and Asher, 2009]

Representation

- 1 SDRS per speaker (Speaker publicly committed to his/her structure)
- (Logical representation of a dialogue turn : tuple of SDRS)

Interpretation

- (CCP of a turn = product of the CCP of each SDRS composing the turn)
- When applied to 1 SDRS the basic entailment ($\models_m$) is the entailment for 1 participant (his/her *public commitments* [Hamblin, 1970])
- Shared entailment (Facts agreed upon of the CG) : $T \models_d \phi$ iff $\forall a \in D, S_a \models_m \phi$

Example [Lascarides and Asher, 2009]

(8) a. $\text{Mark}_{1.1}$: Karen 'n' I're having a fight,
b. $\text{Mark}_{1.2}$: after she went out with Keith and not me.
c. $\text{Karen}_{2.1}$: Wul Mark, you never asked me out.

Turn	Mark's SDRS	Karen's SDRS	Sharon's SDRS
1	$\pi_{1M} : Explanation(\pi_{1.1}, \pi_{1.2})$	$\emptyset$	$\emptyset$
2	$\pi_{1M} : Explanation(\pi_{1.1}, \pi_{1.2})$	$\pi_{2K} : Explanation(\pi_{1.1}, \pi_{1.2}) \wedge Explanation(\pi_{1.2}, \pi_{2.1})$	$\emptyset$

A dialogue SDRS (DSDRS) more precisely

Definition

D is a set of agents, then a DSRDS is a tuple $\langle n, T, \Pi, F, last \rangle$ where

- n, the number of turns
- Π is a set of labels
- F function assigning SDRS-formula ($\mathcal{L}$) to labels (Π)
- T mapping from each turn number to a function from participants to SDRS
- $last =_{def} last_n^d$ (the label of the last clause from the last turn)

Consequence: labels are shared (no handling of misunderstandings) [Lascarides and Asher, 2009]

Interpretation of DSRDS

For

- K a DSDRS $\langle n, T, \Pi, F, last \rangle$,
- $D = \{d_1, \ldots, d_k\}$ a set of participants,
- σ_1, σ_2 sets of k world assigment ($\langle w, f \rangle$) pairs (one per participant)
- ρ_i a projection function onto the i-th element of σ_1 and σ_2

$$\sigma_1 [\![K]\!]_d \sigma_2 \textit{ iff } \sigma_1 [\![T(n)]\!]_d \sigma_2$$

$$\sigma_1 [\![T(j)]\!]_d \sigma_2 \textit{ iff } \forall d_i \in D, \rho_i(\sigma_2) = \rho_i(\sigma_1) \circ [\![T^{di}(j)]\!]_m$$

Semantics of Correction

$(w, f)[\![Corr(\alpha, \beta)]\!](w', g)$ iff $(w, f)[\![\neg \mathcal{K}_\alpha \wedge \mathcal{K}_\beta \wedge \phi_{R(\alpha,\beta)}]\!](w', g)$

Example : Correction/Denial

(9)
1.1. A: John went to jail.
1.2. A: He embezzled the pension funds.
2.1. B: No, it was Bill who stole the pension funds.
2.2. B: I was at the trial.
3.1. A: Oh, OK.
4.1. B: John did go to jail though.

Turn	A's SDRS	B's SDRS
1	$\pi_{1A} : Explanation(\pi_{1.1}, \pi_{1.2})$	$\emptyset$
2	$\pi_{1A} : Explanation(\pi_{1.1}, \pi_{1.2})$	$\pi_{2B} : Correction(\pi_{1A}, \pi_{2.1}) \wedge Correction(\pi_{1.2}, \pi_{2.1}) \wedge Explanation^*(\pi_{2.1}, \pi_{2.2})$
3	$\pi_{3A} : V(\pi_1, \pi_2^b) \wedge Background(\pi_{2B}, \pi_{1.2}^b) \wedge Acceptance(\pi_{2B}, \pi_{3.1})$	$\pi_{2B} : Correction(\pi_{1A}, \pi_{2.1}) \wedge Correction(\pi_{1.2}, \pi_{2.1}) \wedge Explanation^*(\pi_{2.1}, \pi_{2.2})$
4	$\pi_{3A} : V(\pi_{1.1}, \pi_{1.2}^b) \wedge Background(\pi_{2B}, \pi_{1.2}^b) \wedge Acceptance(\pi_{2B}, \pi_{3.1})$	$\pi_{4B} : Acceptance(\pi_{1.1}, \pi_{4.1}) \wedge Contrast(\pi_{2B}, \pi_{4.1})$

Multidimensionality evaluation

- Context:
  - 1 structure per participant
  - Participants representation: included in the models, with a specific status
- Dynamicity: Yes
- Representation : 1 SDRT / participant
- Semantics aspect:
  - Indices : classics
  - Type inventory: e, t but need u
  - Form-proposition mapping: 1-to-1 (but fine-grained segmentation)
  - One satisfiability per participant

Subsection 3

Rhetoricality of discourse relations

Discourse Relations are rhetorical [Mann et al., 1992]

- DRs relate utterances (speech acts)
- a DR characterizes the rhetorical role of one speech act in the discourse context, the rhetorical intentions of the speaker to relate this utterance to a previous one
- The speech act so characterized in a relation $R(\alpha, \beta)$ is β
- DRs are "asymmetric"
  $R(\alpha, \beta)$ cannot be equivalent to any $R'(\beta, \alpha)$

- This alone doesn't prevent their semantics to be equivalent

Main questions

- Is the rhetorical role of DRs completely accounted for through information packaging?
- Does the semantics of DRs reduce to their semantic effects, do we have $[\![\mathit{Result}(\alpha, \beta)]\!] = 1$ iff $[\![\mathit{Expl}(\beta, \alpha)]\!] = 1$?

Blocking in discourse [Vieu, 2007]

- A linguistic marker blocks the inference to discourse relations that would hold in its absence

(10) L'acide tomba dans le liquide.(a) Une explosion se produisit.(b)
The acid fell into the liquid. An explosion happened.
$Result(\pi_a, \pi_b)$

(11) L'acide tomba dans le liquide.(a) Puis une explosion se produisit.(b)
The acid fell into the liquid. Then an explosion happened.

- Causal reading absent in (11): Puis blocks Result [Bras et al., 2001]
- Also observed for and with subord relations [Txurruka, 2003] and for anyway with Explanation [Taboada, 2006]

Blocking what?

$\neg Result(\pi_a, \pi_b)$ ... and $Narration(\pi_a, \pi_b)$

- Blocking is not asserting "the two events are not causally related"
  Actually, the explosion was caused by the mixing up.
  - X adding $\neg cause(e_a, e_b)$ in the SDRS
- Blocking is more than not saying anything relative to this
  - X removing $Result(\pi_a, \pi_b)$ from the SDRS, and simply adding $Narration(\pi_a, \pi_b)$
- "I don't want to claim that the two events are causally related"
  - adding $\neg Result(\pi_a, \pi_b)$ in the SDRS

What blocking tells us

The semantics of Result cannot be reduced to causation

- Assume $[\![Result(\pi_a, \pi_b)]\!] = 1$ iff $[\![K_a \wedge \mathcal{K}_b \wedge cause(e_a, e_b)]\!] = 1$
- $\neg Result(\pi_a, \pi_b)$ in the SDRS entails $\neg cause(e_a, e_b)$
- But (11) can truthfully describe a world where $cause(e_a, e_b)$

The semantics of a discourse relation includes the public commitment of the speaker towards its semantic effects, since this is what is negated by blocking

- "I don't want to claim that the two events are causally related"
- No commitment regarding the causal relationship
- Moreover, a commitment not to commit

The proposal-1 [Vieu, 2011]

Add a commitment operator C over the semantics effects of a DR in its semantics: $C(S, \phi_{R(\alpha,\beta)})$

- We can distinguish
  - asserting the negation of the causal link: $C(S, \neg cause(e_a, e_b))$
  - not saying anything: $\neg C(S, cause(e_a, e_b)) \wedge \neg C(S, \neg cause(e_a, e_b))$
  - blocking Result: $C(S, \neg C(S, cause(e_a, e_b)))$
- We can use $\leftrightarrow$ instead of $\rightarrow$

The proposal-2

- This still doesn't suffice to fully characterize the rhetorical role of DRs!
  - That blocking is also brought by one speech act doesn't even show in the information packaging
    "By asserting (b), I don't want to claim that e_a and e_b are causally related"
  - Blocking *Result* between (a) and (b) shouldn't be equivalent to blocking *Explanation* between (b) and (a)
- Add a rhetorical link within the semantics of DRs
  $A(\alpha, \beta)$: "β attaches to α"
- And within the blocked relations too

Revised DR semantics, fully characterized

Substitute satisfaction schemata :

(12) $[\![R(\alpha,\beta)]\!] = 1$ iff
$[\![A(\alpha,\beta) \wedge C(S_\beta, \mathcal{K}_\alpha) \wedge C(S_\beta, \mathcal{K}_\beta) \wedge C(S_\beta, \phi_{R(\alpha,\beta)})]\!] = 1$

(13) $\phi_{R(\alpha,\beta)} \leftrightarrow \langle R\text{'s semantic effects}\rangle$

$[\![Result(\alpha,\beta)]\!] = 1$ iff
$[\![A(\alpha,\beta) \wedge C(S_\beta, \mathcal{K}_\alpha) \wedge C(S_\beta, \mathcal{K}_\beta) \wedge C(S_\beta, cause(e_\alpha, e_\beta)]\!] = 1$

$[\![Blocked(R(\alpha,\beta))]\!] = 1$ iff $[\![A(\alpha,\beta) \wedge C(S_\beta, \neg C(S_\beta, \phi_{R(\alpha,\beta)}))]\!] = 1$
$\rightsquigarrow$ need to add a relation in the models: commitment

Conclusion

- Today, From communication agent modellers to semantics
  - Difficult to detail the semantic status of the structure built in the 'Dialogue Agent Modelling'
  - Lascarides&Asher: Public commitments of participants, commitments on the structure built
  - Vieu: Commitments in the models
- Tomorrow, Compare the different accounts (from the 3 last courses) wrt the same criteria of multidimensionality

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