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Interoperable semantic annotation for language resources

Volha (Olga) Petukhova

Spoken Language Systems Group
Saarland University

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Outline

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Annotation Theory

Abstract & Concrete Syntax | Annotation Structure

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Annotation Tool

ANVIL

Introduction

- Semantically annotated corpora tend to have corpus-specific ways of analyzing and annotating the data, with lack of theoretical underpinning, domain dependence, lack of generality, lack of interoperability across approaches and domains.
- Dialogue corpora (HCRC Map Task, AMI, TRAINS, ICSI-MRDA,...) mostly rather coarse-grained annotations of communicative functions of utterances and/or disfluencies

ISO:

- Lexical Markup Framework (LMF) for lexical resources
- Support for annotating corpus data in a way that is domain-independent and *interoperable* (and theoretically and empirically well-founded).

ISO 24617 Semantic Annotation Framework

- Part 1: Time and events ('ISO-TimeML', Pustejovsky, 2012)
- Part 2: Dialogue acts (Bunt et al., 2012)
- Part 4: Semantic roles (Palmer et al., 2014)
- Part 6: Principles of semantic annotation (Bunt, 2016)
- Part 7: Spatial information ('ISO-Space', Pustejovsky & Lee, 2015)
- Part 8: Semantic relations in discourse ('DR-Core', Prasad & Bunt, 2016)
- Part 10: Co-reference (Romary, proposed November 2018)
- Part 12: Quantification (Bunt, proposed December 2018)

Example: ISO-TimeML (24617-1) Annotation of time and events

“John drove to Boston on Friday”

m1

m2

```
<event xml:id="e1" target="#m1" pred="drive"/>
<timex3 xml:id="t1" target="#m2" pred="friday"/>
<tLink eventID="#e1" timex3ID="#t1" relType="during"/>
```

Semantics:

$Ee Et \text{ drive}(x) \wedge \text{friday}(t) \wedge \text{during}(e,t)$

Example: ISO 24617-4 Semantic Roles

“John drove to Boston on Friday”

m1 m2 m3

```
<event xml:id="e1" target="#m2" pred="drive" />
<entity xml:id="x1" target="#m1" pred="john"/>
<entity xml:id="x2" target="#m3" pred="boston"/>
<srLink eventID="#e1" participant="#x1" semRole="agent"/>
<srLink eventID="#e1" participant="#x2" semRole="final-loc"/>
```

Semantics:

$\exists e \exists x \exists y \text{ drive}(e) \wedge \text{john}(x) \wedge \text{boston}(y) \wedge \text{agent}(e, x) \wedge \text{final-loc}(e, y)$

As a DRS:

$\langle e, x, y \mid \text{drive}(e), \text{john}(x), \text{boston}(y), \text{agent}(e, x), \text{final-loc}(e, y) \rangle$

Example: ISO-TimeML (24617-1) and ISO 24617-4 combined

“John drove to Boston on Friday”

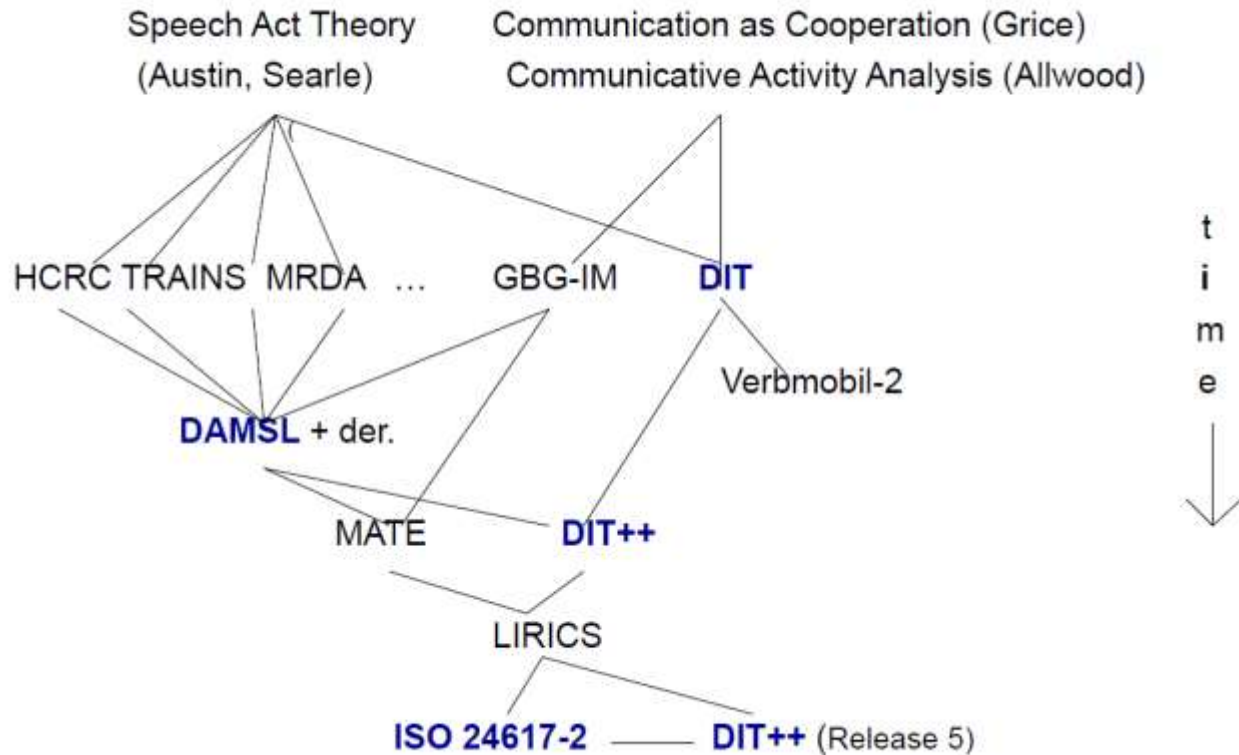
m1 m2 m3 m4 → ISO 24617-2 + ISO 24617-4

```
<event xml:id="e1" target="#m2" pred="drive"/>
<entity xml:id="x1" target="#m1" pred="john"/>
<entity xml:id="x2" target="#m3" pred="boston"/>
<timex3 xml:id="t1" target="#m2" pred="friday"/>
<srLink eventID="#e1" participant="#x1" semRole="agent"/>
<srLink eventID="#e1" participant="#x2" semRole="final-loc"/>
<tLink eventID="#e1" timex3ID="#t1" reltype="during"/>
```

<e,x,y,t | drive(e), john(x), boston(y), friday(t), agent(e,x), final-loc(e,y), during(e,t)>

→ Representation of sentence semantics!

Dialogue Act Annotation Frameworks



ISO 24617-2 dialogue acts annotations

Comprehensive, domain-independent taxonomy of dialogue acts

- Dialogue acts defined semantically as ***update operators*** applied to participants' ***information states***
- Dialogue utterances may be ***multifunctional***, due to multiplicity of tasks in communicating
- Dialogue annotation is ***multidimensional***, assigning multiple dialogue acts to segments of dialogue in multiple 'dimensions'
- Taxonomy organized according to ***orthogonal*** DIT++ ***dimensions*** of communication

Example

- A: Ehm, okay that's fine with me.

Stalling *Feedback* *Inform*

Take Turn

- sequential multifunctionality
- simultaneous multifunctionality

(Allwood, 1994)

Segmentation

Definition:

- **Functional segments** are *minimal* stretches of communicative behaviour that have one a communicative function.
- Minimal: no material that does not contribute to the expression of a communicative function or semantic content.
- Fine-grained segmentation supports high-accurate annotation.

Example

A1: We're aiming a fairly young market

Task

INFORM

B1: Do **you** think **then** we should really consider voice recognition

Task

Propositional Question

Auto-F.

Pos. to A1

TurnM

Assign to A

B2:

What do **you** think **Craig**

Task

Set Question

TurnM

Assign

Assign to C

C1: Well

did **you** not say it was the adults that we're going for

Auto-F.

Pos. exe B2
Neg. exe A1

Propositional Question to A1

TurnM

Accept

Assign A

Dialogue Act Annotations

- **Qualifiers**, e.g. for sentiment and certainty, for making fine-grained distinctions.
- **Functional dependence relations** (e.g. Answer à Question, Confirmation à Check Question) between dialogue acts
- **Feedback dependence relations** between a feedback act and its 'antecedent' dialogue act
- **Rhetorical relations** between dialogue acts or their semantic contents
- Annotation language **DiAML** (**D**ialogue **A**ct **M**arkup **L**anguage) with
 - Abstract syntax (annotation structures as pairs, triples,...)
 - Concrete syntax defining XML-representations
 - Semantics of annotation structures as information-state update operators

ISO 24617-2 dialogue acts

Scope:

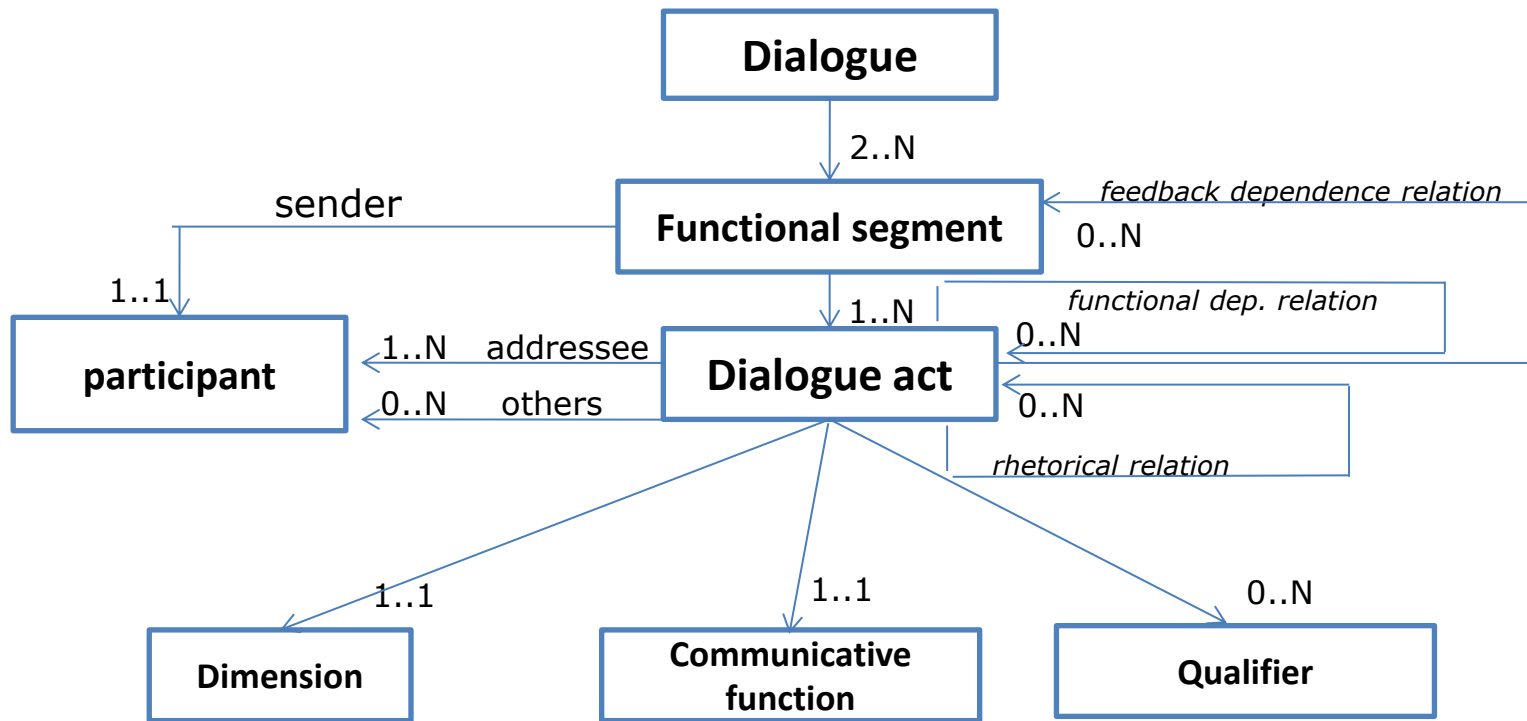
Indication of ***functional meaning*** of dialogue utterances in terms of dialogue acts.

Full characterization of dialogue acts:

- Sender, addressee(s), other participants
- Communicative function and dimension
- Qualifications (sentiment, certainty, conditionality)
- Semantic relations to other dialogue acts
- Semantic content

Semantic content left out of consideration.

ISO 24617-2 dialogue acts: metamodel



The representation of annotations in the ISO Dialogue Act Markup Language (DiAML) relies on a three-level architecture:

1. a primary source, which may correspond to a speech recording, textual transcription or any low-level annotation thereof, e.g. a tokenisation;
2. the marking of functional segments from the primary source;
3. the actual dialogue act annotation associated with a functional segment.

XML element <dialogueAct> has the following attributes:

- @target, whose value is a functional segment identified at the second level;
- @sender, @addressee, @otherParticipant;
- @communicativeFunction, @dimension;
- @certainty, @conditionality, and
- @sentiment qualifiers;
- @functionalDependence and @feedbackDependence, which have <dialogueAct> elements and functional segments as values.

DiAML example

P1: What time is the first train on Sunday to the Airport?

P2: The first train on Sunday is at 6.15, I believe.

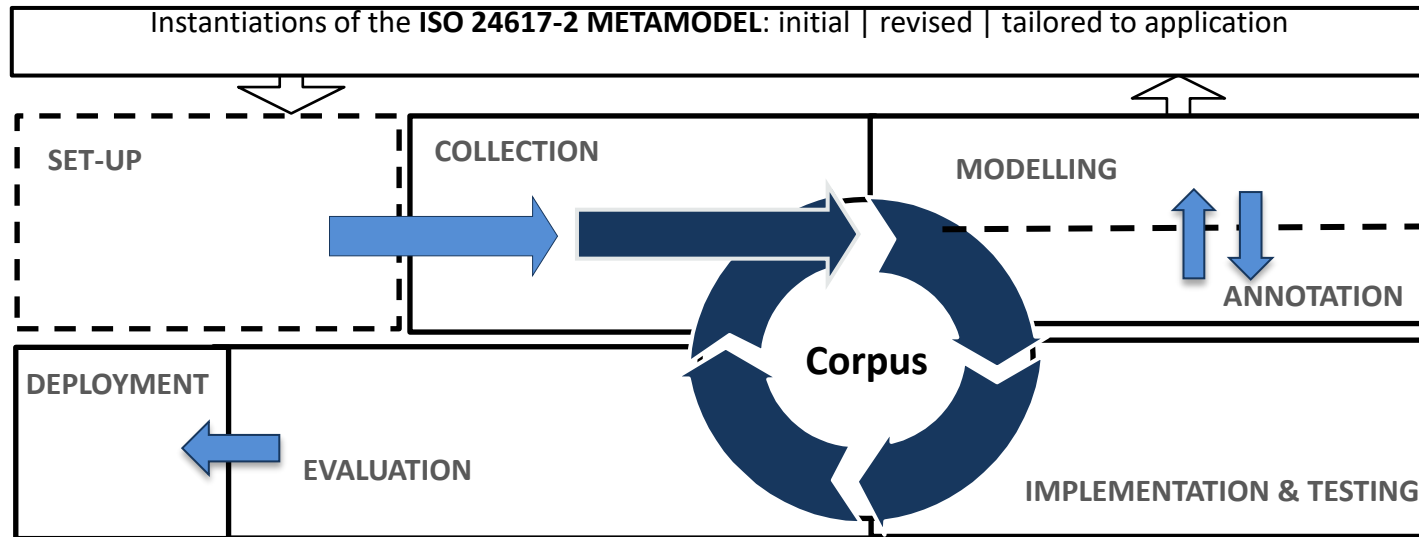
```
<diaml xmlns:"http://www.iso.org/diaml/">
```

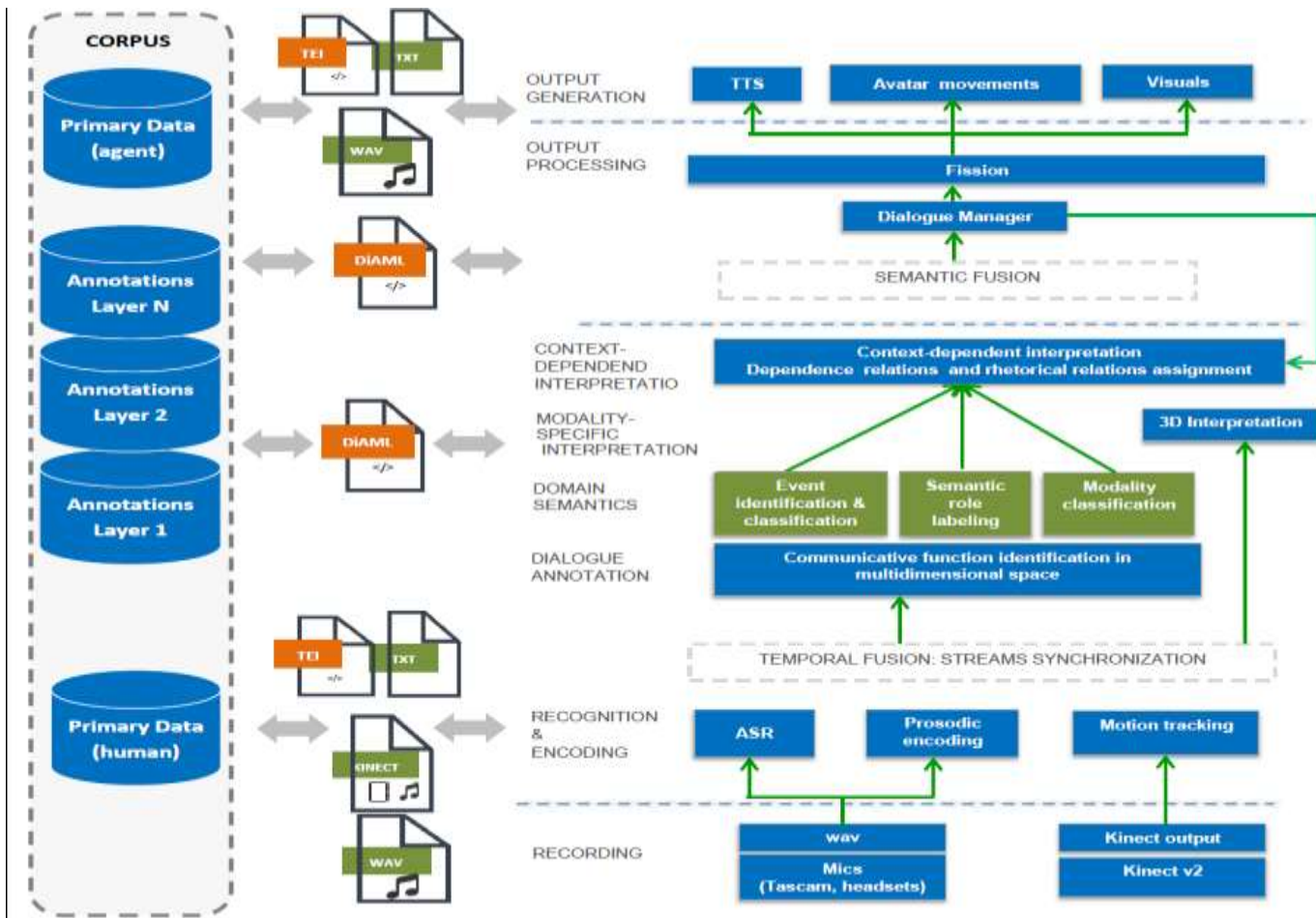
```
<dialogueAct xml:id="da1" target="#fs1"  
sender="#p1" addressee="#p2"  
communicativeFunction="setQuestion" dimension="task" />
```

```
<dialogueAct xml:id="da2" target="#fs2.1" sender="#p2"  
addressee="#p1" communicativeFunction="autoPositive"  
dimension="autoFeedback" feedbackDependence="#fs1"/>
```

```
<dialogueAct xml:id="da3" target="#fs2"  
sender="#p2" addressee="#p1"  
communicativeFunction="answer" dimension="task"  
certainty="uncertain" functionalDependence="#da1"/>  
</diaml>
```

Continuous Dialogue Corpus Creation





The DialogBank

Language resource built at Tilburg University (<https://dialogbank.uvt.nl/>)

Annotated dialogues:

- Using ISO 24617-2
- Gold standard
- Re-annotated dialogues from existing corpora
- Some with original annotations
- Some with annotations of previous DIT++ versions
- Newly annotated dialogues from existing corpora without annotation
- From newly collected corpora