Unifying Dimensions: A proposal and its evaluation

Vera Demberg & Merel Scholman
Universität des Saarlandes, Germany

TextLink Training School – Charles University

Introduction

- In order to achieve a one-to-decomposing features approach, we need to define these decomposing features
- Easiest to start with an existing proposal, and adapt it to our needs
- The Cognitive approach to Coherence Relations (CCR) might be a viable starting point

- We will first discuss CCR and the Unifying Dimensions proposal
- Then we will look at the mapping in practice

CCR – The theory

- Cognitive approach to Coherence Relations (Sanders, Spooren & Noordman, 1991)
- CCR first applied to discourse annotation in 2012 (DiscAn corpus)
- Novel discourse relation annotation approach:
  break up annotation task into smaller steps by decomposing relations
- Basic assumptions of the theory:
  - Coherence relations (and their markers) are cognitive entities
  - They affect discourse processing and understanding
  - Connectives are very important to determine relations
  - First argument = segment 1; second = segment 2 (surface structure)
  - Segments of a relation map on to P and Q (logic)

P & Q

Here's a short intro to how P and Q can work:

- **P & Q** = The situation described in P holds and the situation described in Q holds (additive/temporal)
  I visited the Prague Castle.$_{(P)}$ **I** also **went to the Charles Bridge.**$_{\mathbf{(Q)}}$
- **P** $\rightarrow$ **Q** = The situation in P leads to the situation in Q (causal/conditional)
  I am in Prague,$_{(P)}$ so **I tried Kulajda.**$_{\mathbf{(Q)}}$
- **P**$<$**X**[1] & **Q** $\rightarrow$ $\neg$**X (**$\neg$ **X can be the same as Q)** = The situation described in P causes the expectation of X but it leads to the unexpected situation described in Q. (concession)
  Although **the cheese was rather strong,**$_{\mathbf{(P)}}$ *I liked it.*$_{(Q)}$

[1] A$<$B means A causes B

Back to CCR – 4 Dimensions

CCR's assumption:
All relations can be described by decomposing them according to 4 dimensions.

4 basic dimensions:

1. **Polarity**: positive or negative (is P or Q negated '¬'?)
2. **Basic operation**: causal or additive (& or →?)
3. **Source of coherence**: objective or subjective
4. **Order of segments**: basic or non-basic (P → Q or Q ← P?

CCR – Polarity

Distinguishes between **positive** and **negative** (or adversative) relations

- Positive: the propositions P and Q are linked directly, without a negation of one of these propositions (e.g., P & Q, P $\rightarrow$ Q) *and, because*
  - *John likes apples* and **Mary does too.**
  - *John likes apples* because **they're sweet.**
- Negative: Q is a negation to an expectation raised by P (the expectation can be causally or additively linked to P)
  - *John likes apples* but **Mary likes pears.**
  - Although **John likes apples,** *he doesn't usually eat them.*

CCR Polarity – Exercise: annotate some relations

Annotate the polarity of the following relations using the handout.

1. *The student sometimes placed his jeans in the freezer overnight* because **ice-cold temperatures prevent dirty smells.**
2. *The beer was brewed with a chocolate extract.* **It** also **contains peppermint.**
3. *Experts say such long hours for flight attendants are dangerous.* For instance, **tired attendants might not react quickly enough during an emergency.**
4. *My mom ate bags of M&Ms while she was pregnant with me* so **chocolate is in my blood.**
5. Rather than keep the loss a secret from the outside world, *Michelle blabs about it to a sandwich man* while **ordering lunch over the phone.**
6. *They've been assured that the police doesn't have anything to do with the population count.* Still, **a lot of people are afraid of counteractions.**

CCR – Basic operation

Distinguishes between **causal** and **additive** relations.

- Causal: an implication relation (P $\rightarrow$ Q) can be deduced *because, although*
  - *John likes apples* because **they're sweet.**
  - Although **John likes fruits,** *he doesn't usually eat them.*
- Subtype: Conditional: cause has not yet been realized (if P $\rightarrow$ Q) *if, unless*
  - If **John likes apples, Mary does too.**
- Additive: segments connected by a logical conjunction (P&Q) *and, whereas*
  - *John likes apples* and **Mary does too.**
  - *John likes apples* but **Mary likes pears.**
- Subtype: Temporal: segments are ordered in time (P & then Q) *before, after*
  - *John washed the apple* before **he ate it.**

CCR Basic operation – Exercise: annotate some relations

Annotate the basic operation of the following relations using the handout.

1. *The student sometimes placed his jeans in the freezer overnight* because **ice-cold temperatures prevent dirty smells.**
2. *The beer was brewed with a chocolate extract.* **It** also **contains peppermint.**
3. *Experts say such long hours for flight attendants are dangerous.* For instance, **tired attendants might not react quickly enough during an emergency.**
4. *My mom ate bags of M&Ms while she was pregnant with me* so **chocolate is in my blood.**
5. Rather than keep the loss a secret from the outside world, *Michelle blabs about it to a sandwich man* while **ordering lunch over the phone.**
6. *They've been assured that the police doesn't have anything to do with the population count.* Still, **a lot of people are afraid of counteractions.**

CCR – Source of Coherence

Distinguishes between **objective** and **subjective** relations.

- Objective: segments report events occuring in the real world *denn, parce que*
  - *Mary was in a hurry* because **she was late for class.**
  - *The streets are wet* because **it rained.**

  (Temporal relations are always objective, because they represent events that happened in the real world)

- Subjective: segments present speaker's claim, argument, conclusion *weil, car*
  - *Mary must have been in a hurry* because **she was running.**
  - *The neighbours are not at home* because **the lights are out.**

  SoC often does not apply to relation labels of other frameworks because other frameworks do not consistently make this distinction

CCR Source of Coherence – Exercise: annotate some relations

Annotate the source of coherence of the following relations using the handout.

1. *The student sometimes placed his jeans in the freezer overnight* because **ice-cold temperatures prevent dirty smells.**
2. *The beer was brewed with a chocolate extract.* **It** also **contains peppermint.**
3. *Experts say such long hours for flight attendants are dangerous.* For instance, **tired attendants might not react quickly enough during an emergency.**
4. *My mom ate bags of M&Ms while she was pregnant with me* so **chocolate is in my blood.**
5. Rather than keep the loss a secret from the outside world, *Michelle blabs about it to a sandwich man* while **ordering lunch over the phone.**
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CCR – (Surface) order of the segments

Distinguishes between **basic order** and **non-basic order** relations.

- Basic: S1 is cause / argument / condition / first event (P $\rightarrow$ Q, P & then Q)
  therefore, so, and then
  - *Mary was in a hurry* so **she ran.**
  - After *she finished classes, Mary went to the supermarket.*
- Non-basic: S1 is consequence / claim / second event (Q $\leftarrow$ P, P after Q)
  because, but first
  - *Mary was in a hurry* because **she was late for class.**
  - *Mary went to the supermarket* after **she finished classes.**
- Not applicable: S1 and S2 are symmetrically equivalent (Q & P) *and, while*
  - *Mary was in a hurry* and **Jane was too.**
  - *Mary ran to the bus* while **she was on the phone.**

Order often does not apply to relations because other frameworks make different order distinctions (e.g., RST's nuclearity)

CCR Order – Exercise: annotate some examples

Annotate the order of the following relations using the handout.

1. *The student sometimes placed his jeans in the freezer overnight* because **ice-cold temperatures prevent dirty smells.**
2. *The beer was brewed with a chocolate extract.* **It** also **contains peppermint.**
3. *Experts say such long hours for flight attendants are dangerous.* For instance, **tired attendants might not react quickly enough during an emergency.**
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CCR – The corpus

- No large corpus with CCR annotations available
  but there are smaller projects
- Disco-SPICE (Rehbein, Scholman & Demberg, 2016):
  - 41.000 words (English)
  - Subset of spoken texts from SPICE-Ireland corpus
  - Contains both CCR and PDTB 3.0 annotations
- DiscAn corpus: Dutch; written (newspapers and novels), spoken, chat

CCR as a tool for mapping relations

Advantage of using CCR as (starting point for) Unifying Dimensions:
Values for dimensions show similarities and differences between relations

What are the PDTB / RST labels for these relations?

1. *John likes apples* and **Mary does too.**

2. *John likes apples* but **Mary doesn't like them.**

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   → PDTB Conjunction, RST Comparison

2. *John likes apples* but **Mary doesn't like them.**
   → PDTB Opposition, RST Contrast

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What are the decomposed values for these relations?

1. *John likes apples* and **Mary does too.**
   → PDTB Conjunction, RST Comparison `positive, additive`

2. *John likes apples* but **Mary doesn't like them.**
   → PDTB Opposition, RST Contrast `negative, additive`

Values show that both relations are additive but differ in polarity

CCR as a tool for mapping relations

Values for dimensions show similarities and differences between relations.
But 4 dimensions lead to somewhat coarse-grained classification...

What are the PDTB / RST labels for the second relation?

1. *John likes apples* and **Mary does too.**
   → PDTB Conjunction, RST Comparison

2. *John likes fruits.* **He especially likes apples.**

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1. *John likes apples* and **Mary does too.**
   → PDTB Conjunction, RST Comparison

2. *John likes fruits.* **He especially likes apples.**
   → PDTB Specific., RST Elab.-Gen.-Specific

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   → PDTB Specific., RST Elab.-Gen.-Specific `positive, additive`

→ We need additional features in order to be as fine-grained as other frameworks and not lose any information
Joint work with Ted Sanders, Jet Hoek, Sandrine Zufferey, and Jacqueline Evers-Vermeul

Unifying Dimensions – additional features

How were additional features identified?

- PDTB, RST and SDRT as starting point
- Bottom-up approach: distinguish features that are already present in these frameworks
- Create a feature when at least two of these frameworks make the distinction
  - i.e., PDTB's Specification is similar to RST's General-specific,
  - but PDTB's Opposition vs. Juxtaposition distinction is not made in RST or SDRT

UniDim – additional features for additives

Further distinctions within the class of additives:

Temporality

- Relations for which the segments are ordered in time
- Distinguishes the following relations:

1. *I took a photo of Powder Tower* while **we were on the tour.**
   → PDTB Synchronous `pos, add, +temp, NA order`

2. *We met at Powder Tower* before **we visited the Castle.**
   → PDTB Precedence `pos, add, +temp, basic`

3. *We visited the Castle* after **we saw Powder Tower.**
   → PDTB Succession `pos, add, +temp, nonbasic`

4. While in Prague, *I tried Trdelnik* and **I saw the Prague Castle.**
   → PDTB Conjunction `pos, add, −temp, NA order`

UniDim – additional features for additives

List

- Relations for which the segments make up a list
- Distinguishes the following relations:
  1. We saw some beautiful buildings on the guided tour *we saw the Powder Tower,* and **we visited the Prague Castle.**
     → PDTB List `pos, add, +list`
  2. While in Prague, *I tried Trdelnik* and **I saw the Prague Castle.**
     → PDTB Conjunction `pos, add, −list`

UniDim – additional features for additives

Specificity

- Relations that are characterized by the specificity of one segment relative to the other segment
- Distinguishes the following relations:

1. *I ate some nice food in Prague.* For example, **I tried Trdelnik.**
   → PDTB Instantiation `pos, add, +specificity`

2. *I ate something wonderful in Prague.* More specifically, **it was a pastry called Trdelnik.**
   → PDTB Specification `pos, add, +specificity`

3. *I ate some nice pastries in Prague.* **All food in Prague is actually good.**
   → PDTB Generalization `pos, add, +specificity`

4. While in Prague, *I tried Trdelnik* and **I saw the Prague Castle.**
   → PDTB Conjunction `pos, add, −specific`

UniDim – additional features for additives

Alternatives

- Relations for which the segments present alternatives
- Distinguishes the following relations:

1. When in Prague, *you should visit the Castle* or **go to Charles Bridge.**
   → PDTB Alt.Conjunctive `pos, add, +alternative`

2. When in Prague, *you have to go hard* or **go home.**
   → PDTB Alt.Disjunctive `neg, add, +alternative`

3. When in Prague, *you shouldn't visit the Castle.* Instead, **go to Charles Bridge.**
   → PDTB Alt.Chosen alternative `neg, add, +alternative`

4. When in Prague, *you shouldn't visit the Castle.* Except **if you're interested in old buildings.**
   → PDTB Exception `neg, add, −alternative`

UniDim – additional features for causals

Conditionality

- Relations for which the cause has not yet been realized
- Distinguishes the following relations:
  1. If **you're in Prague,** *you must visit the Prague Castle.*
     → PDTB Condition `pos, caus, +cond, obj`
  2. If **you're a fan of sweets,** *Prague has a lot of pastries.*
     → PDTB Pragmatic condition `pos, caus, +cond, subj`
  3. *I visited the Prague Castle* because *it was recommended to me.*
     → PDTB Reason `pos, caus, −cond, obj`

UniDim – additional features for causals

Goal-orientedness

- Relations for which one of the segments concerns an intentional action by an agent
- Distinguishes the following relations:
  1. *We met at the venue* **to start our walking tour.**
     → RST Purpose `pos, caus, +goal oriented`
  2. *It's important to learn more about new cultures.* **Traveling allows you to do so.**
     → RST Enablement `pos, caus, +goal oriented`
  3. *I learned a lot about Prague* **by joining the walking tour.**
     → RST Means `pos, caus, +goal oriented`
  4. *I visited the Prague Castle* because *it was recommended to me.*
     → PDTB Cause `pos, caus, −goal oriented`

Unifying Dimensions

In sum, the following Unifying Dimensions have been proposed as a tool for the mapping:

- Polarity
- Basic operation
  - Temporality (additives)
  - Specificity (additives)
  - List (additives)
  - Alternatives (additives)
  - Conditionality (causals)
  - Goal-orientedness (causals)
- Source of coherence
- Order

Every PDTB, RST and SDRT label has been decomposed using the dimensions. The analysis is based on the labels' definition in the manual.

Unifying Dimensions – Practice decomposing

For every label on the handout, study the description we provided and decompose the label into values for dimensions accordingly.

- Polarity (pos, neg, underspecified)
- Basic operation (caus, add, und)
  - Temporality (additives) (+temp, −temp, und)
  - Specificity (additives) (+spec, −spec, und)
  - List (additives) (+list, −list, und)
  - Alternatives (additives) (+alt, −alt, und)
  - Conditionality (causals) (+cond, −cond, und)
  - Goal-orientedness (causals) (+goal, −goal, und)
- Source of coherence (obj, subj, und)
- Order (basic, nonbasic, NA, und)

Unifying Dimensions – Practice decomposing

- Contingency.Cause.Reason
- Contingency.Cause.Result
- Expansion.Restatement.Generalization

- Explanation-argumentative
- Means
- Comparison

Unifying Dimensions – Practice decomposing

- Contingency.Cause.Reason
  - `positive, causal, underspecified, underspecified`
- Contingency.Cause.Result
- Expansion.Restatement.Generalization
- Explanation-argumentative
- Means
- Comparison

Unifying Dimensions – Practice decomposing

- Contingency.Cause.Reason
  - `positive, causal, underspecified, underspecified`
- Contingency.Cause.Result
  - `positive, causal, underspecified, underspecified`
- Expansion.Restatement.Generalization

- Explanation-argumentative

- Means

- Comparison

Unifying Dimensions – Practice decomposing

- Contingency.Cause.Reason
  - `positive, causal, underspecified, underspecified`
- Contingency.Cause.Result
  - `positive, causal, underspecified, underspecified`
- Expansion.Restatement.Generalization
  - `positive, underspecified, underspecified, underspecified, +specificity`
- Explanation-argumentative
- Means
- Comparison

Unifying Dimensions – Practice decomposing

- Contingency.Cause.Reason
  - `positive, causal, underspecified, underspecified`
- Contingency.Cause.Result
  - `positive, causal, underspecified, underspecified`
- Expansion.Restatement.Generalization
  - `positive, underspecified, underspecified, underspecified, +specificity`
- Explanation-argumentative
  - `positive, causal, objective, underspecified`
- Means
- Comparison

Unifying Dimensions – Practice decomposing

- Contingency.Cause.Reason
  - `positive, causal, underspecified, underspecified`
- Contingency.Cause.Result
  - `positive, causal, underspecified, underspecified`
- Expansion.Restatement.Generalization
  - `positive, underspecified, underspecified, underspecified, +specificity`

- Explanation-argumentative
  - `positive, causal, objective, underspecified`
- Means
  - `positive, causal, objective, underspecified, +goal oriented`
- Comparison

Unifying Dimensions – Practice decomposing

- Contingency.Cause.Reason
  - `positive, causal, underspecified, underspecified`
- Contingency.Cause.Result
  - `positive, causal, underspecified, underspecified`
- Expansion.Restatement.Generalization
  - `positive, underspecified, underspecified, underspecified, +specificity`

- Explanation-argumentative
  - `positive, causal, objective, underspecified`
- Means
  - `positive, causal, objective, underspecified, +goal oriented`
- Comparison
  - `positive, additive, underspecified, NA`

Unifying Dimensions – Decomposing the order

- PDTB/RST make a different type of order distinction in their labels
- Labels such as REASON remain underspecified for order, because the class comprises relations with different surface structures:
  1. *Max dressed up* <u>because</u> **he had a date.**
     PDTB REASON `pos, caus, obj, nonbasic`
  2. <u>Because</u> **he had a date,** *Max dressed up.*
     PDTB REASON `pos, caus, obj, basic`

  → The order of the segments is different, but they receive the same label

- But REASON and RESULT are currently decomposed into the same values, compare 2 to 3:
  3. *Max had a date* <u>so</u> **he dressed up.**
     PDTB RESULT `pos, caus, obj, basic`

  → The main–subordinate clause order is different, but they are decomposed into the same values

Unifying Dimensions – Decomposing the order

- Ideally, the unifying dimensions approach should be able to represent all types of order:
  - CCR's order, which depends on the surface structure of the segments
  - PDTB's distinction by type of connective
    (because / as / since vs. therefore / so / thus)
  - PDTB's Arg1-Arg2 order, which depends on the placement of the connective
    or
    RST's nuclearity order, which depends on the central information to the text

- Current solution: use information on Arg1-Arg2 or nucleus/satellite order to decompose relation at hand
- But is this satisfactory?
- Another solution could be to add another dimension for the other types of order

Unifying Dimensions – Decomposing the order

	Relation	PDTB label	CCR order	PDTB order	Nucl.
1	I visited my mother before I went shopping.	Prec	Basic	A1–A2	N–S
2	Before I went shopping, I visited my mother.	Prec	Nonb	A2–A1	S–N
3	After I visited my mother, I went shopping.	Succ	Basic	A2–A1	S–N
4	I went shopping after I visited my mother.	Succ	Nonb	A1–A2	N–S

1. CCR and the Unifying Dimensions proposal

2. Mapping in practice
   - PDTB & CCR
   - PDTB & RST

Mapping in practice

- So far, we've talked about:
  - Why frameworks and corpora aren't interoperable in their current state
  - What kinds of research questions we can answer if corpora were interoperable
  - Different ways in which we can achieve a mapping between frameworks, with the "one-to-decomposing features" being the most favourable way
  - We proposed a set of Unifying Dimensions, taking CCR as the starting point

- But so far we have talked about theoretical considerations based on definitions of relation labels... does this hold up for real data?

Mapping in practice – How to validate

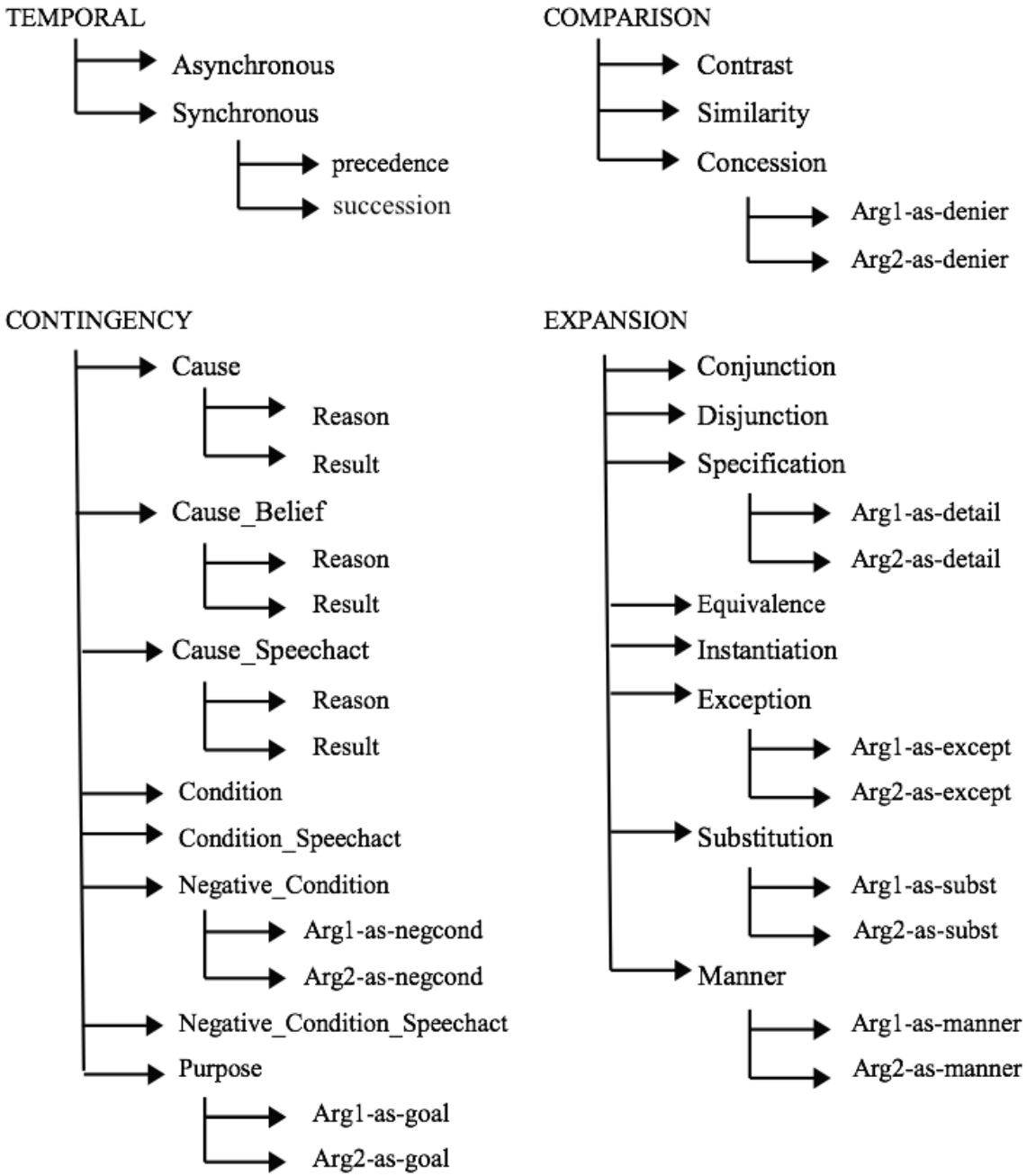
- First, investigate how framework-specific procedures can influence the resulting annotations, and validate whether the decomposition of relation labels is correct
  - i.e., for label RESULT, is the decomposition [`positive, causal`] correct?
  - Need relations that are annotated using the framework and the dimensions
    → Rehbein et al. (2016): PDTB & CCR
- Next, validate whether the decomposition can be used to translate labels from one framework to another
  - i.e., for PDTB label RESULT does the decomposition translate to RST label RESULT?
  - Need relations that are annotated using multiple frameworks
    → Demberg et al. (in prep.): validation for PDTB & RST
- We discuss each one in turn

Mapping in practice – PDTB & CCR

Disco-SPICE corpus

- 2445 discourse relations (41K words)
- Spoken discourse from the SPICE corpus (Broadcast and Telephone genres)
- All relations were segmented first, then annotated
- Two frameworks: PDTB 3.0 and CCR

Mapping in practice – PDTB 3.0



Mapping in practice – PDTB & CCR

- Annotations could be mapped onto each other easily because segments were the same
- Annotators agreed with each other (PDTB vs CCR agreement) for 70% of all relations

- Results are displayed in a heat map:
  - Table with PDTB labels in rows; CCR values in columns
  - Numbers represent percentage agreement wrt. PDTB relations
  - Colors represent the amount of agreement (darker color = higher agreement)
  - Bold, underlined numbers represent predicted mapping

Mapping in practice – PDTB & CCR

	Polarity	pos	pos	pos	pos	pos	pos	pos	pos	pos	neg	neg	neg	neg	pos	pos	
	Basic op.	temp	temp	temp	caus	caus	caus	caus	cond	cond	caus	caus	add	add	add	add	
	S. of coh.	obj	obj	obj	obj	obj	subj	subj	obj	subj	obj	subj	obj	subj	obj	subj	
	Order	na	forw	back	forw	back	forw	back	undsp	undsp	undsp	undsp	na	na	na	na	count
Temp.	Synchronous	**68**	13	4	0	0	0	0	0	0	0	0	0	2	8	5	53
	Asynchronous	3	**67**	**9**	3	0	1	2	1	0	0	0	3	2	6	3	105
Cont.	Cause	0	2	0	**17**	**12**	**25**	**36**	1	0	0	0	0	1	3	3	300
	Cause_belief	0	0	0	5	5	**40**	**32**	0	0	0	0	0	0	9	9	22
	Cause_speechact	0	0	0	0	0	**53**	**47**	0	0	0	0	0	0	0	0	15
	Condition	3	1	1	0	0	0	1	**30**	**58**	0	0	0	0	1	5	77
	Condition_speechact	0	0	0	0	0	0	0	0	**93**	0	0	0	0	0	7	14
Comp.	Concession	0	2	0	0	0	4	0	0	2	**10**	**25**	20	32	2	3	56
	Contrast	0	1	0	0	1	0	1	0	0	2	10	**33**	**43**	2	3	206
Exp.	Disjunction	0	0	0	0	0	0	0	0	0	0	0	**25**	**55**	0	20	20
	Substitution	0	0	0	0	0	0	0	0	0	7	0	**22**	**64**	7	0	14
	Conjunction	1	16	1	2	0	6	2	0	0	0	0	4	6	**31**	**31**	538
	Equivalence	0	0	0	0	2	4	32	0	0	0		4	2	**14**	**42**	45
	Instantiation	0	0	2	0	0	0	24	0	2	0	0	3	3	**16**	**50**	38
	Specification	0	0	1	1	6	6	23	0	1	0	1	3	4	**24**	**30**	143

Overall:

- Good amount of agreement on decomposition
- Some disagreement due to typical annotator error/difference in interpretation
- But there are some patterns in disagreement...

Mapping in practice – PDTB & CCR

	Polarity	pos	pos	pos	pos	pos	pos	pos	pos	pos	neg	neg	neg	neg	pos	pos	
	Basic op.	temp	temp	temp	caus	caus	caus	caus	cond	cond	caus	caus	add	add	add	add	
	S. of coh.	obj	obj	obj	obj	obj	subj	subj	obj	subj	obj	subj	obj	subj	obj	subj	
	Order	na	forw	back	forw	back	forw	back	undsp	undsp	undsp	undsp	na	na	na	na	count
Temp.	Synchronous	**68**	13	4	0	0	0	0	0	0	0	0	0	2	8	5	53
	Asynchronous	3	**67**	**9**	3	0	1	2	1	0	0	0	3	2	6	3	105
Cont.	Cause	0	2	0	**17**	**12**	**25**	**36**	1	0	0	0	0	1	3	3	300
	Cause_belief	0	0	0	5	5	**40**	**32**	0	0	0	0	0	0	9	9	22
	Cause_speechact	0	0	0	0	0	**53**	**47**	0	0	0	0	0	0	0	0	15
	Condition	3	1	1	0	0	0	1	**30**	**58**	0	0	0	0	1	5	77
	Condition_speechact	0	0	0	0	0	0	0	0	**93**	0	0	0	0	0	7	14
Comp.	Concession	0	2	0	0	0	4	0	0	2	**10**	**25**	20	32	2	3	56
	Contrast	0	1	0	0	1	0	1	0	0	2	10	**33**	**43**	2	3	206
Exp.	Disjunction	0	0	0	0	0	0	0	0	0	0	0	**25**	**55**	0	20	20
	Substitution	0	0	0	0	0	0	0	0	0	7	0	**22**	**64**	7	0	14
	Conjunction	1	16	1	2	0	6	2	0	0	0	0	4	6	**31**	**31**	538
	Equivalence	0	0	0	0	2	4	32	0	0	0		4	2	**14**	**42**	45
	Instantiation	0	0	2	0	0	0	24	0	2	0	0	3	3	**16**	**50**	38
	Specification	0	0	1	1	6	6	23	0	1	0	1	3	4	**24**	**30**	143

PDTB's additive labels EQUIVALENCE, INSTANTIATION and SPECIFICATION annotated as `subjective causal` in CCR

- CCR is sensitive to argumentative function of these relations; PDTB annotates the ideational function

Mapping in practice – PDTB & CCR

	Polarity	pos	pos	pos	pos	pos	pos	pos	pos	pos	neg	neg	neg	neg	pos	pos	
	Basic op.	temp	temp	temp	caus	caus	caus	caus	cond	cond	caus	caus	add	add	add	add	
	S. of coh.	obj	obj	obj	obj	obj	subj	subj	obj	subj	obj	subj	obj	subj	obj	subj	
	Order	na	forw	back	forw	back	forw	back	undsp	undsp	undsp	undsp	na	na	na	na	count
Temp.	Synchronous	**68**	13	4	0	0	0	0	0	0	0	0	0	2	8	5	53
	Asynchronous	3	**67**	**9**	3	0	1	2	1	0	0	0	3	2	6	3	105
Cont.	Cause	0	2	0	**17**	**12**	**25**	**36**	1	0	0	0	0	1	3	3	300
	Cause_belief	0	0	0	5	5	**40**	**32**	0	0	0	0	0	0	9	9	22
	Cause_speechact	0	0	0	0	0	**53**	**47**	0	0	0	0	0	0	0	0	15
	Condition	3	1	1	0	0	0	1	**30**	**58**	0	0	0	0	1	5	77
	Condition_speechact	0	0	0	0	0	0	0	0	**93**	0	0	0	0	0	7	14
Comp.	Concession	0	2	0	0	0	4	0	0	2	**10**	**25**	20	32	2	3	56
	Contrast	0	1	0	0	1	0	1	0	0	2	10	**33**	**43**	2	3	206
Exp.	Disjunction	0	0	0	0	0	0	0	0	0	0	0	**25**	**55**	0	20	20
	Substitution	0	0	0	0	0	0	0	0	0	7	0	**22**	**64**	7	0	14
	Conjunction	1	16	1	2	0	6	2	0	0	0	0	4	6	**31**	**31**	538
	Equivalence	0	0	0	0	2	4	32	0	0	0		4	2	**14**	**42**	45
	Instantiation	0	0	2	0	0	0	24	0	2	0	0	3	3	**16**	**50**	38
	Specification	0	0	1	1	6	6	23	0	1	0	1	3	4	**24**	**30**	143

Disagreement on CONCESSION versus CONTRAST

- PDTB's CONCESSION: "expectation"
- CCR's `negative causal`: "denied causality"
  → CCR is a bit stricter

Mapping in practice – PDTB & CCR

	Polarity	pos	pos	pos	pos	pos	pos	pos	pos	pos	neg	neg	neg	neg	pos	pos	
	Basic op.	temp	temp	temp	caus	caus	caus	caus	cond	cond	caus	caus	add	add	add	add	
	S. of coh.	obj	obj	obj	obj	obj	subj	subj	obj	subj	obj	subj	obj	subj	obj	subj	
	Order	na	forw	back	forw	back	forw	back	undsp	undsp	undsp	undsp	na	na	na	na	count
Temp.	Synchronous	**68**	13	4	0	0	0	0	0	0	0	0	0	2	8	5	53
	Asynchronous	3	**67**	**9**	3	0	1	2	1	0	0	0	3	2	6	3	105
Cont.	Cause	0	2	0	**17**	**12**	**25**	**36**	1	0	0	0	0	1	3	3	300
	Cause_belief	0	0	0	5	5	**40**	**32**	0	0	0	0	0	0	9	9	22
	Cause_speechact	0	0	0	0	0	**53**	**47**	0	0	0	0	0	0	0	0	15
	Condition	3	1	1	0	0	0	1	**30**	**58**	0	0	0	0	1	5	77
	Condition_speechact	0	0	0	0	0	0	0	0	**93**	0	0	0	0	0	7	14
Comp.	Concession	0	2	0	0	0	4	0	0	2	**10**	**25**	20	32	2	3	56
	Contrast	0	1	0	0	1	0	1	0	0	2	10	**33**	**43**	2	3	206
Exp.	Disjunction	0	0	0	0	0	0	0	0	0	0	0	**25**	**55**	0	20	20
	Substitution	0	0	0	0	0	0	0	0	0	7	0	**22**	**64**	7	0	14
	Conjunction	1	16	1	2	0	6	2	0	0	0	0	4	6	**31**	**31**	538
	Equivalence	0	0	0	0	2	4	32	0	0	0		4	2	**14**	**42**	45
	Instantiation	0	0	2	0	0	0	24	0	2	0	0	3	3	**16**	**50**	38
	Specification	0	0	1	1	6	6	23	0	1	0	1	3	4	**24**	**30**	143

Additive PDTB labels sometimes annotated as `negative additive` labels in CCR

- CCR: connective insertions test to distinguish all relations marked by *but*, annotated as `negative`
- PDTB: some instances with *but* can be positive

Mapping in practice – PDTB & CCR

Conclusion on PDTB-CCR study:

- Hypothesized mapping based on annotation schemes is consistent with annotation of actual data
- Challenges related to:
  - Differences in focus of annotation (argumentative versus illustrative function)
  - Differences in definitions for some pairs of relations (CONCESSION – CONTRAST)
  - Differences in operationalizations (connective insertion test for *but*, *because*)
- Conditions slightly easier than in reality:
  - Annotators trained together
  - Relations had the same segments for both frameworks

(Joint work with Ines Rehbein.
Full article: Rehbein, Scholman & Demberg (2016), LREC)

1. CCR and the Unifying Dimensions proposal

2. Mapping in practice
   - PDTB & CCR
   - PDTB & RST

Mapping in practice – PDTB & RST

Goal: validate whether the decomposition can be used to translate labels from one framework to another

- We need relations that are annotated using multiple frameworks:
- 385 Wall Street Journal texts are annotated by PDTB and RST annotators
- Relevant issues/topics for today:
  - For every PDTB relation, find the closest corresponding RST relation (segmentation issues)
  - Look at one-to-one mapping (direct PDTB – RST mapping)
  - Look at mapping for explicit and implicit relations separately
  - Look at the mapping per dimension

Mapping in practice – PDTB & RST

Find the closest corresponding relations (segmentation issues).
Steps for achieving this:

1. Project annotations onto one another
2. Match PDTB's Arg1 and Arg2 with RST's leafs
3. Find RST relation that best corresponds to PDTB relation
4. Calculate statistics over mapping

Not as easy as it sounds due to differences in arguments/leafs...

Mapping in practice – PDTB & RST

Segmentation in PDTB:

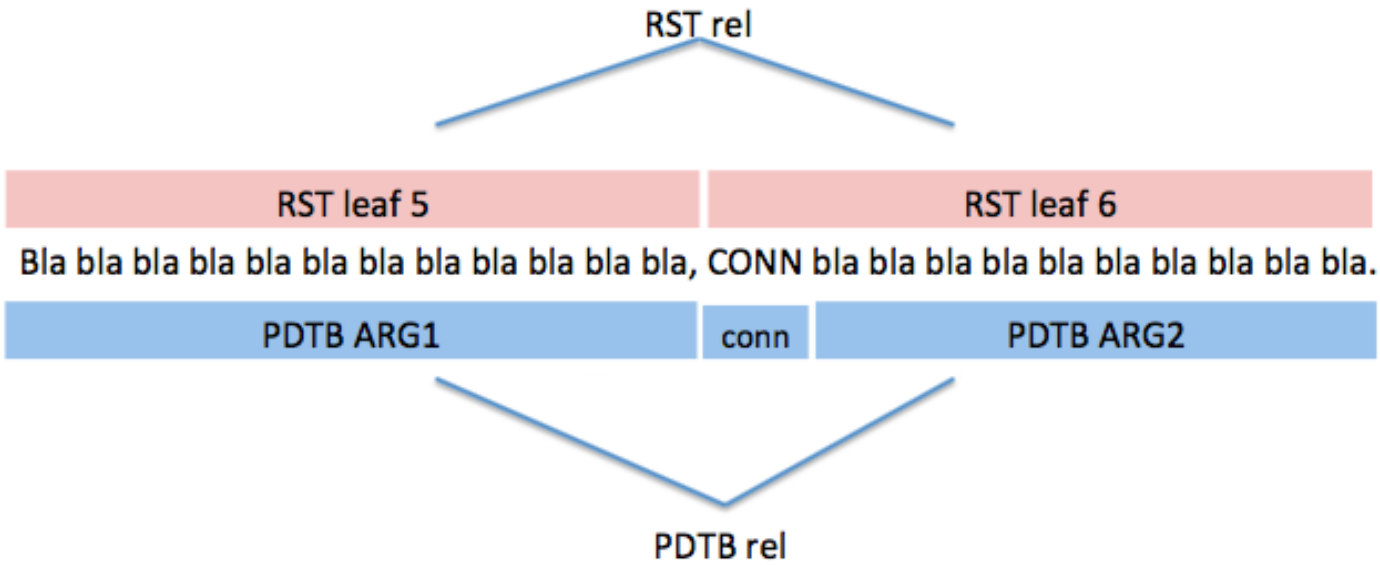
- Minimality principle: take the smallest possible arguments

Segmentation in RST:

- Tree structure: start with the smallest leafs, then build them up

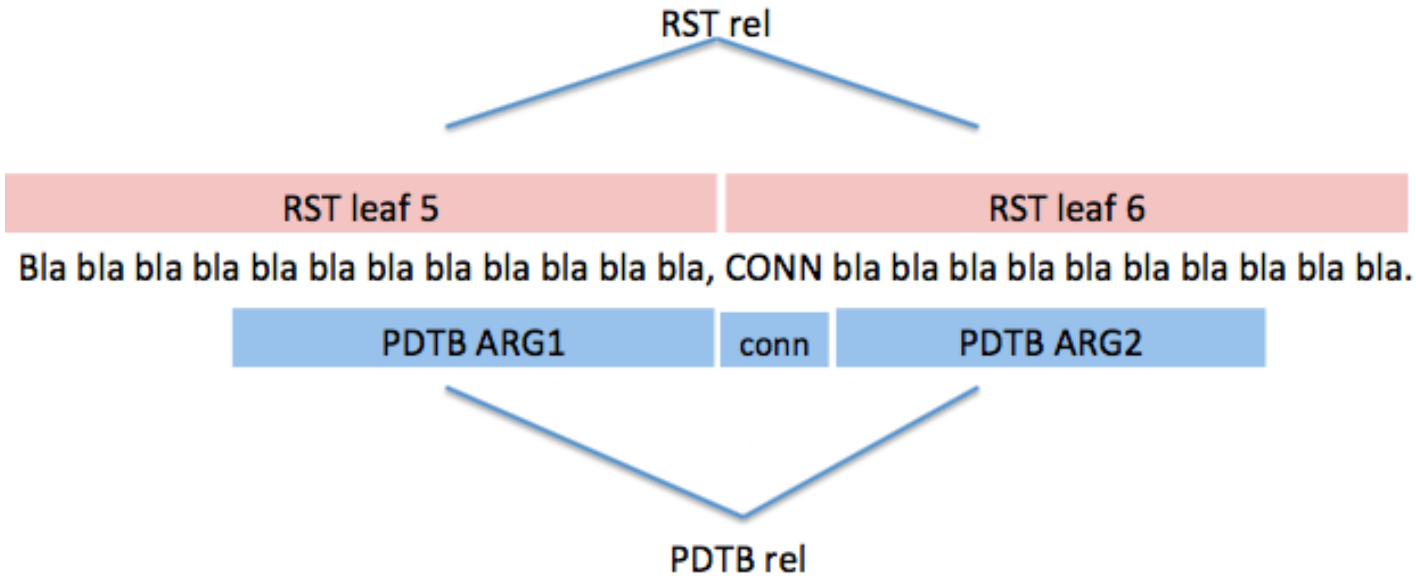
Mapping in practice – PDTB & RST

Argument span matching: easy case
Args and leafs correspond perfectly



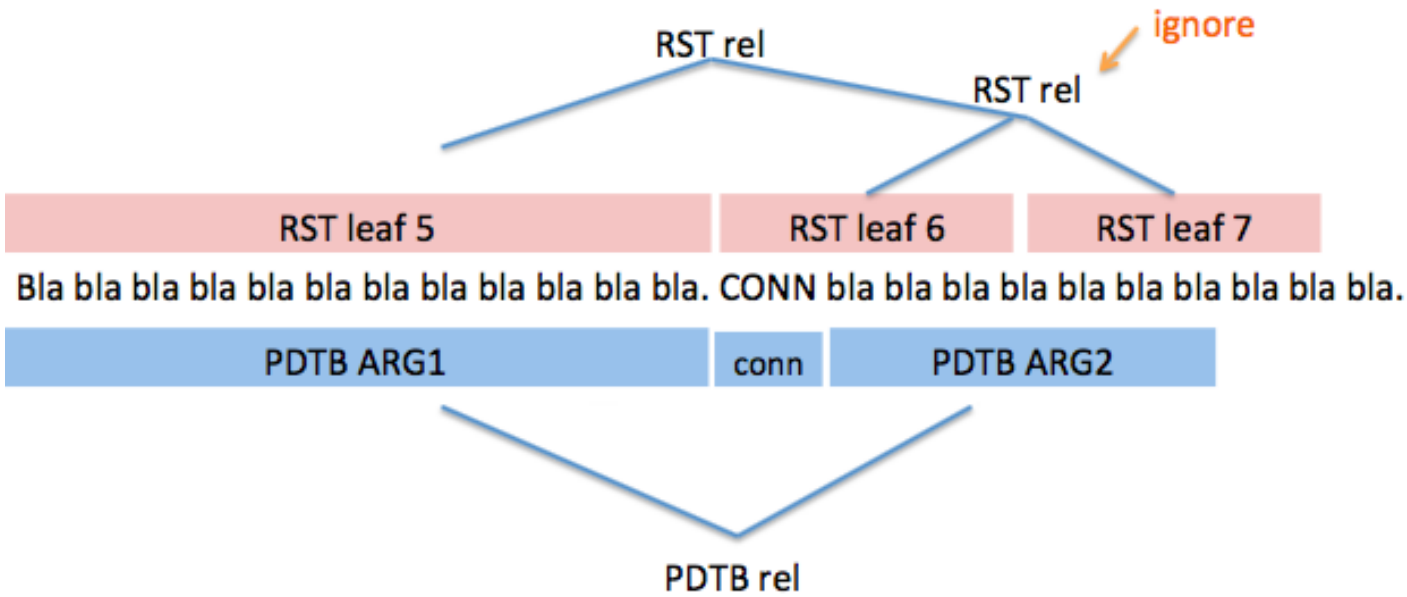
Mapping in practice – PDTB & RST

Argument span matching: small difference in arguments
PDTB annotated minimal span, RST slightly bigger



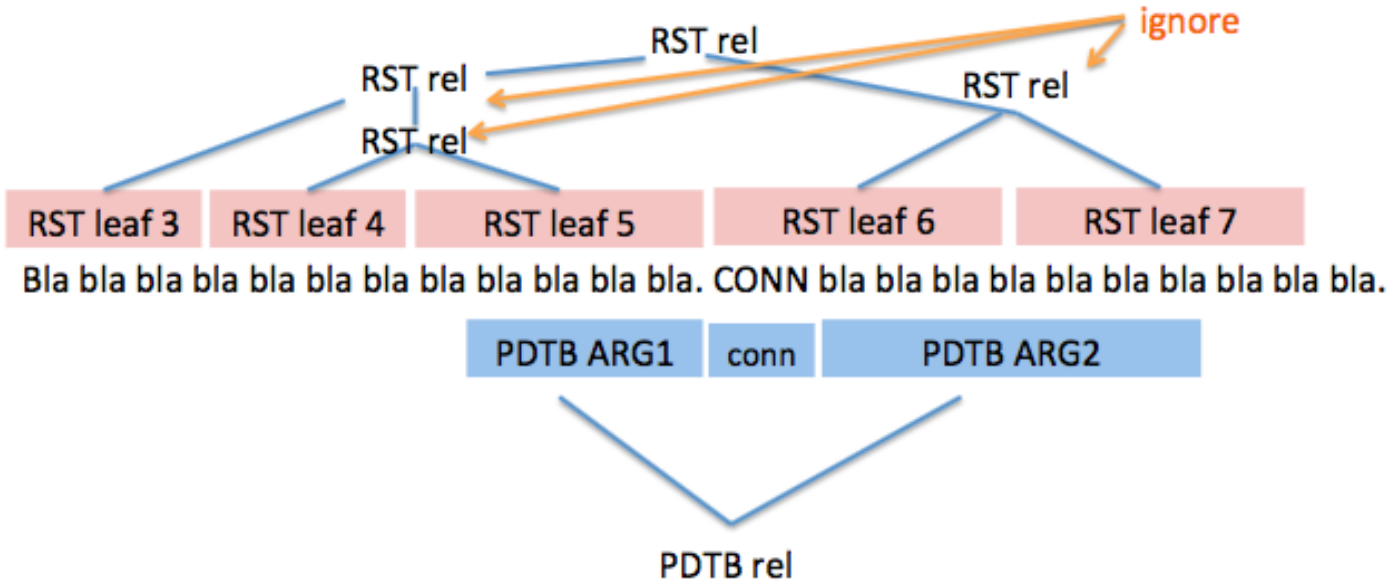
Mapping in practice – PDTB & RST

Argument span matching: intervening relation
Extra relation in RST's tree structure, not relevant though



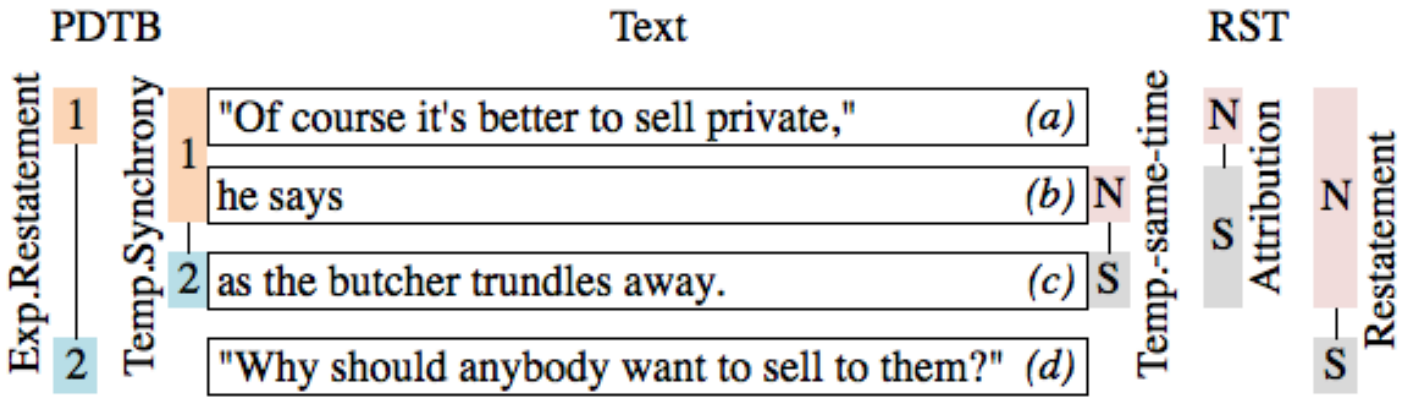
Mapping in practice – PDTB & RST

Argument span matching: no corresponding Arg1 due to tree structure
RST leaf 5 is enclosed in intervening relations. Find relation where the args first combine into a RST relation (top RST rel)



Mapping in practice – PDTB & RST

Real example:



- Temporal relation: PDTB (a-b) - (c); RST (b) - (c)
  $\rightarrow$ close enough match
- Attribution: no relation in PDTB, so no match
- Restatement: PDTB (a) - (d); RST (a-c) - (d)
  $\rightarrow$ different segments, but same nucleus

Mapping in practice – PDTB & RST

Conclusions on segmentation:

- In total, 75% of PDTB relations were mapped successfully (5022 rels)
- 53% of these 5022 rels are directly corresponding relations
- For remaining 47%, RST tree is more complex than the PDTB relation
- For the 25% that didn't map, we can't be sure if the corresponding arguments belong to the same relation

Now we can move on to the mapping of the labels...
First, we look at a one-to-one mapping, to see whether the labels correspond to each other (and evaluate the functionality of a one-to-one mapping)

Mapping in practice – PDTB & RST

		Temporal		
PDTB	RST	Temp.-same-time	Sequence	Temp.-after
Temporal	Synchronous	74	2	0
	Asynchronous	1	59	93
Contingency	Cause	1	1	0
	Condition	1	0	0
Comparison	Contrast	5	4	4
	Concession	0	0	0
Expansion	Conjunction	17	34	4
	Restatement	0	0	0
	Instantiation	0	0	0
	List	0	0	0
	Alternative	0	0	0
Raw count RST		78	82	54

- Mapping of PDTB Lvl2 and RST relation labels, only labels where n $>$ 50
- Numbers are % agreement from RST perspective
- Color matches amount of agreement
- We see that annotators of the two frameworks agree on temporal relations

Mapping in practice – PDTB & RST

		Temporal			Backgr.	
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance
Temporal	Synchronous	**74**	2	0	**0**	**37**
	Asynchronous	1	**59**	**93**	**14**	**30**
Contingency	Cause	1	1	0	21	11
	Condition	1	0	0	0	5
Comparison	Contrast	5	4	4	21	5
	Concession	0	0	0	3	1
Expansion	Conjunction	17	34	4	**32**	**9**
	Restatement	0	0	0	6	2
	Instantiation	0	0	0	3	0
	List	0	0	0	0	0
	Alternative	0	0	0	0	0
Raw count RST		78	82	54	63	277

- RST class Background can be temporal or additive; CIRCUMSTANCE matches PDTB's annotation reasonably well

Mapping in practice – PDTB & RST

		Temporal			Backgr.		Cause		Explanation			Cond
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition
Temporal	Synchronous	**74**	2	0	**0**	**37**	5	5	0	5	0	4
	Asynchronous	1	**59**	**93**	**14**	**30**	11	11	0	1	5	9
Contingency	Cause	1	1	0	21	11	**59**	**45**	**15**	**0**	**91**	0
	Condition	1	0	0	0	5	0	0	0	0	0	**79**
Comparison	Contrast	5	4	4	21	5	5	7	3	15	1	1
	Concession	0	0	0	3	1	0	1	0	1	0	0
Expansion	Conjunction	17	34	4	**32**	**9**	15	25	15	13	0	1
	Restatement	0	0	0	6	2	5	3	34	38	2	0
	Instantiation	0	0	0	3	0	0	1	32	25	0	0
	List	0	0	0	0	0	2	1	0	1	0	0
	Alternative	0	0	0	0	0	0	0	2	1	1	6
Raw count RST		78	82	54	63	277	66	142	95	149	97	154

- Bad correspondence for causal classes: majority of RST's causal labels CONSEQUENCE, EVIDENCE and EXPL.-ARGUMENT. map onto PDTB's additive labels RESTATEMENT and INSTANTIATION

Mapping in practice – PDTB & RST

		Temporal			Backgr.		Cause		Explanation			Cond	Contrast		
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition	Contrast	Concession	Antithesis
Temporal	Synchronous	**74**	2	0	**0**	**37**	5	5	0	5	0	4	1	3	1
	Asynchronous	1	**59**	**93**	**14**	**30**	11	11	0	1	5	9	1	2	1
Contingency	Cause	1	1	0	21	11	**59**	**45**	**15**	**0**	**91**	0	1	0	0
	Condition	1	0	0	0	5	0	0	0	0	0	**79**	0	4	0
Comparison	Contrast	5	4	4	21	5	5	7	3	15	1	1	**75**	60	**74**
	Concession	0	0	0	3	1	0	1	0	1	0	0	10	**28**	**15**
Expansion	Conjunction	17	34	4	**32**	**9**	15	25	15	13	0	1	8	3	6
	Restatement	0	0	0	6	2	5	3	34	38	2	0	0	0	0
	Instantiation	0	0	0	3	0	0	1	32	25	0	0	0	0	0
	List	0	0	0	0	0	2	1	0	1	0	0	1	0	0
	Alternative	0	0	0	0	0	0	0	2	1	1	6	3	0	2
Raw count RST		78	82	54	63	277	66	142	95	149	97	154	257	173	249

- Not a great correspondence for Concessions: RST CONCESSION often annotated as PDTB CONTRAST

Mapping in practice – PDTB & RST

		Temporal			Backgr.		Cause		Explanation			Cond	Contrast			Comp.	Elaboration			Joint	
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition	Contrast	Concession	Antithesis	Comparison	Elab.-additional	Elab.-general-spec.	Example	List	Raw count PDTB
Temporal	Synchronous	**74**	2	0	**0**	**37**	5	5	0	5	0	4	1	3	1	2	1	0	1	1	154
	Asynchronous	1	**59**	**93**	**14**	**30**	11	11	0	1	5	9	1	2	1	1	4	1	1	2	294
Contingency	Cause	1	1	0	21	11	**59**	**45**	**15**	**0**	**91**	0	1	0	0	1	20	13	0	4	475
	Condition	1	0	0	0	5	0	0	0	0	0	**79**	0	4	0	1	0	0	0	0	145
Comparison	Contrast	5	4	4	21	5	5	7	3	15	1	1	**75**	60	**74**	60	11	1	2	0	713
	Concession	0	0	0	3	1	0	1	0	1	0	0	10	**28**	**15**	2	2	0	1	0	143
Expansion	Conjunction	17	34	4	**32**	**9**	15	25	15	13	0	1	8	3	6	**28**	**37**	15	7	70	1014
	Restatement	0	0	0	6	2	5	3	34	38	2	0	0	0	0	0	18	**49**	16	3	354
	Instantiation	0	0	0	3	0	0	1	32	25	0	0	0	0	0	0	4	20	**72**	1	228
	List	0	0	0	0	0	2	1	0	1	0	0	1	0	0	2	1	0	0	**19**	138
	Alternative	0	0	0	0	0	0	0	2	1	1	6	3	0	2	1	1	1	0	0	46
Raw count RST		78	82	54	63	277	66	142	95	149	97	154	257	173	249	83	930	87	129	617	3704

- Not a great correspondence for additive labels; e.g., RST Comparison annotated as PDTB Contrast, RST List annotated as PDTB Conjunction; RST Elab.-additional annotated as all kinds of other labels in PDTB

Mapping in practice – PDTB & RST

- Agreement on labels in one-to-one mapping: 49%
- Some patterns can be recognised in the data:
  - RST assigns ELAB.-ADDITIONAL to relations that PDTB assigns more specific labels to
  - RST assigns causal labels EVIDENCE and EXPLANATION-ARGUM. to relations that PDTB assigns additive labels RESTATEMENT and INSTANTIATION to
  - Lots of confusion between CONTRAST and CONCESSION
- Disagreements often occur for more "ambiguous" relations, i.e., relations that are not marked explicitly by a connective:
  - Agreement on explicit relations: 61%
  - Agreement on implicit relations: 38%
- So let's look at distributions of annotations for explicit and implicit relations separately

Mapping in practice – PDTB & RST, explicits

		Temporal			Backgr.	
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance
Temporal	Synchronous	79	4	0	0	43
	Asynchronous	1	53	94	25	33
Contingency	Cause	1	0	0	8	8
	Condition	1	0	0	0	6
Comparison	Contrast	5	2	2	25	3
	Concession	0	0	0	17	2
Expansion	Conjunction	11	42	4	25	5
	Restatement	0	0	0	0	0
	Instantiation	0	0	0	0	0
	List	0	0	0	0	0
	Alternative	0	0	0	0	0
Raw count RST		73	53	51	12	237

- Temporal RST SEQUENCE interpreted in PDTB as CONJUNCTION; connectives = *then*, *and*
- Temporal/additive RST BACKGROUND interpreted in PDTB as CONTRAST/CONCESSION; connectives = *but*, *and*

Mapping in practice – PDTB & RST, explicits

		Temporal			Backgr.		Cause		Explanation			Cond
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition
Temporal	Synchronous	**79**	4	0	**0**	**43**	8	6	0	13	0	4
	Asynchronous	1	**53**	**94**	**25**	**33**	13	12	0	0	6	9
Contingency	Cause	1	0	0	8	8	**60**	**47**	**22**	**67**	**91**	0
	Condition	1	0	0	0	6	0	0	0	0	0	**79**
Comparison	Contrast	5	2	2	25	3	5	4	11	13	0	1
	Concession	0	0	0	17	2	0	0	0	4	0	0
Expansion	Conjunction	11	42	4	**25**	**5**	15	29	22	4	1	1
	Restatement	0	0	0	0	0	0	0	33	0	0	0
	Instantiation	0	0	0	0	0	0	0	11	0	0	0
	List	0	0	0	0	0	0	1	0	0	0	0
	Alternative	0	0	0	0	0	0	0	0	0	1	6
Raw count RST		73	53	51	12	237	40	78	9	55	70	154

- RST CONSEQUENCE interpreted in PDTB as additive CONJUNCTIVE; connectives = *because*, *and*
- RST EVIDENCE interpreted in PDTB as multiple additives; connectives = *in fact*, *indeed*

Mapping in practice – PDTB & RST, explicits

		Temporal			Backgr.		Cause		Explanation			Cond	Contrast		
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition	Contrast	Concession	Antithesis
Temporal	Synchronous	**79**	4	0	**0**	**43**	8	6	0	13	0	4	1	3	1
	Asynchronous	1	**53**	**94**	**25**	**33**	13	12	0	0	6	9	1	2	1
Contingency	Cause	1	0	0	8	8	**60**	**47**	**22**	**67**	**91**	0	0	0	0
	Condition	1	0	0	0	6	0	0	0	0	0	**79**	0	4	0
Comparison	Contrast	5	2	2	25	3	5	4	11	13	0	1	**75**	59	**75**
	Concession	0	0	0	17	2	0	0	0	4	0	0	11	**29**	**16**
Expansion	Conjunction	11	42	4	**25**	**5**	15	29	22	4	1	1	9	2	4
	Restatement	0	0	0	0	0	0	0	33	0	0	0	0	0	0
	Instantiation	0	0	0	0	0	0	0	11	0	0	0	0	0	0
	List	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Alternative	0	0	0	0	0	0	0	0	0	1	6	2	0	2
Raw count RST		73	53	51	12	237	40	78	9	55	70	154	204	168	225

- RST CONCESSION still confused with PDTB CONTRAST; connectives = *but*, *though*

Mapping in practice – PDTB & RST, explicits

		Temporal			Backgr.		Cause		Explanation			Cond	Contrast			Comp.	Elaboration			Joint	
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition	Contrast	Concession	Antithesis	Comparison	Elab.-additional	Elab.-general-spec.	Example	List	Raw count PDTB
Temporal	Synchronous	**79**	4	0	**0**	**43**	8	6	0	13	0	4	1	3	1	2	3	0	3	1	201
	Asynchronous	1	**53**	**94**	**25**	**33**	13	12	0	0	6	9	1	2	1	2	3	14	0	1	211
Contingency	Cause	1	0	0	8	8	**60**	**47**	**22**	**67**	**91**	0	0	0	0	0	1	0	0	0	189
	Condition	1	0	0	0	6	0	0	0	0	0	**79**	0	4	0	2	0	0	0	0	146
Comparison	Contrast	5	2	2	25	3	5	4	11	13	0	1	**75**	59	**75**	63	16	14	3	5	528
	Concession	0	0	0	17	2	0	0	0	4	0	0	11	**29**	**16**	5	5	0	3	0	130
Expansion	Conjunction	11	42	4	**25**	**5**	15	29	22	4	1	1	9	2	4	**22**	**65**	29	9	80	555
	Restatement	0	0	0	0	0	0	0	33	0	0	0	0	0	0	0	3	**29**	0	0	12
	Instantiation	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	2	0	**82**	0	32
	List	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	**12**	50
	Alternative	0	0	0	0	0	0	0	0	0	1	6	2	0	2	2	2	14	0	0	24
Raw count RST		73	53	51	12	237	40	78	9	55	70	154	204	168	225	41	188	7	34	379	2005

- RST COMPARISON annotated as PDTB CONTRAST; connectives = *but*, *while*
- RST ELAB.-ADDITIONAL annotated as all kinds of other labels in PDTB; connectives = *also*, *and*, *but*
- RST LIST annotated as PDTB CONJUNCTION; connectives = *and*, *also*

Mapping in practice – PDTB & RST, implicits

		Temporal			Backgr.	
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance
Temporal	Synchronous	**0**	0	0	**0**	**0**
	Asynchronous	0	**67**	**67**	**12**	**3**
Contingency	Cause	0	4	0	24	28
	Condition	0	0	0	0	0
Comparison	Contrast	0	8	33	20	22
	Concession	0	0	0	0	0
Expansion	Conjunction	100	21	0	**33**	**31**
	Restatement	0	0	0	8	17
	Instantiation	0	0	0	4	0
	List	0	0	0	0	0
	Alternative	0	0	0	0	0
Raw count RST		5	24	3	51	36

- Hardly any implicit RST TEMP-SAME-TIME interpreted in PDTB as CONJUNCTION
- Implicit RST TEMPORAL-AFTER interpreted in PDTB as CONTRAST

Mapping in practice – PDTB & RST, implicits

		Temporal			Backgr.		Cause		Explanation			Cond
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition
Temporal	Synchronous	**0**	0	0	**0**	**0**	0	3	0	0	0	0
	Asynchronous	0	**67**	**67**	**12**	**3**	5	10	0	1	4	0
Contingency	Cause	0	4	0	24	28	**55**	**41**	**14**	**46**	**71**	0
	Condition	0	0	0	0	0	0	0	0	0	0	**0**
Comparison	Contrast	0	8	33	20	22	5	12	2	6	4	0
	Concession	0	0	0	0	0	0	0	0	0	0	0
Expansion	Conjunction	100	21	0	**33**	**31**	18	21	14	7	11	0
	Restatement	0	0	0	8	17	14	7	34	23	7	0
	Instantiation	0	0	0	4	0	0	3	34	15	4	0
	List	0	0	0	0	0	5	2	0	0	0	0
	Alternative	0	0	0	0	0	0	0	2	1	0	0
Raw count RST		5	24	3	51	36	22	58	86	241	28	0

- Causal implicit relations in RST interpreted as additive relations in PDTB

Mapping in practice – PDTB & RST, implicits

		Temporal			Backgr.		Cause		Explanation			Cond	Contrast		
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition	Contrast	Concession	Antithesis
Temporal	Synchronous	**0**	0	0	**0**	**0**	0	3	0	0	0	0	0	0	0
	Asynchronous	0	**67**	**67**	**12**	**3**	5	10	0	1	4	0	2	0	0
Contingency	Cause	0	4	0	24	28	**55**	**41**	**14**	**46**	**71**	0	4	33	0
	Condition	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0
Comparison	Contrast	0	8	33	20	22	5	12	2	6	4	0	**73**	44	**67**
	Concession	0	0	0	0	0	0	0	0	0	0	0	6	**0**	**0**
Expansion	Conjunction	100	21	0	**33**	**31**	18	21	14	7	11	0	4	11	21
	Restatement	0	0	0	8	17	14	7	34	23	7	0	0	11	0
	Instantiation	0	0	0	4	0	0	3	34	15	4	0	0	0	4
	List	0	0	0	0	0	5	2	0	0	0	0	4	0	0
	Alternative	0	0	0	0	0	0	0	2	1	0	0	8	0	8
Raw count RST		5	24	3	51	36	22	58	86	241	28	0	52	9	24

Disagreement on polarity for RST negative implicit relations:

- Concessions in RST annotated as positive Causes in PDTB
- Antithesis in RST annotated as positive Conjunction in PDTB

Mapping in practice – PDTB & RST, implicits

		Temporal			Backgr.		Cause		Explanation			Cond	Contrast			Comp	Elaboration			Joint	
PDTB	RST	Temp.-same-time	Sequence	Temp.-after	Background	Circumstance	Result	Consequence	Evidence	Explanation-argum.	Reason	Condition	Contrast	Concession	Antithesis	Comparison	Elab.-additional	Elab.-general-spec.	Example	List	Raw count PDTB
Temporal	Synchronous	**0**	0	0	**0**	**0**	0	3	0	0	0	0	0	0	0	3	1	0	0	0	9
	Asynchronous	0	**67**	**67**	**12**	**3**	5	10	0	1	4	0	2	0	0	0	4	0	1	2	72
Contingency	Cause	0	4	0	24	28	**55**	**41**	**14**	**46**	**71**	0	4	33	0	3	24	14	10	8	427
	Condition	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0
Comparison	Contrast	0	8	33	20	22	5	12	2	6	4	0	**73**	44	**67**	58	10	0	2	11	233
	Concession	0	0	0	0	0	0	0	0	0	0	0	6	**0**	**0**	0	1	0	0	0	11
Expansion	Conjunction	100	21	0	**33**	**31**	18	21	14	7	11	0	4	11	21	**33**	**30**	14	6	43	461
	Restatement	0	0	0	8	17	14	7	34	23	7	0	0	11	0	0	22	**51**	19	5	337
	Instantiation	0	0	0	4	0	0	3	34	15	4	0	0	0	4	0	5	21	**62**	2	195
	List	0	0	0	0	0	5	2	0	0	0	0	4	0	0	5	1	0	0	**26**	87
	Alternative	0	0	0	0	0	0	0	2	1	0	0	8	0	8	0	1	0	0	1	22
Raw count RST		5	24	3	51	36	22	58	86	241	28	0	52	9	24	40	715	80	103	277	1849

- Lots of disagreements on RST additive implicit relations

Mapping in practice – PDTB & RST

Conclusions one-to-one mapping:

- More agreement on explicit than on implicit relations
- Many items receive different annotations depending on the framework
- Independent of any mapping procedure, there are differences in how annotation decisions are being made.

Let's look at the mapping per dimension.
This will give us a perspective on the question which features of discourse relations are hard to agree on.

Mapping in practice – PDTB & RST

Polarity:

		RST					
		Positive		Negative		Underspec.	
PDTB	Positive	**64**	(2916)	2	(71)	11	(475)
	Negative	8	(372)	**14**	(636)	1	(50)
	Underspec.	0	(4)	0	(2)	0	(3)

Table: Percentage of agreement (and nr of instances) in PDTB-RST mapping for polarity.

- More than 90% of annotations were consistent with each other in terms of polarity (including underspecified annotations)
- 2/3 of disagreements were implicit relations
- As shown by one-to-one mapping, many disagreements on RST List, Comparison, Explanation-argum., as well as PDTB Conjunction

Mapping in practice – PDTB & RST

Basic operation:

	RST									
PDTB	Causal		Cond.		Add.		Temp.		Undsp	
Causal	**12**	(524)	0	(3)	7	(319)	0	(4)		(145)
Cond.	0	(7)	**3**	(140)	0	(5)	0	(1)	1	(23)
Add.	10	(428)	1	(29)	**43**	(1950)	1	(49)	8	(361)
Temp.	1	(53)	1	(24)	2	(82)	**4**	(197)	4	(182)
Undsp	0	(1)		–	0	(1)		–	0	(1)

Table: Percentage of agreement (and nr of instances) in PDTB-RST mapping for basic operation

- 62% of annotations were consistent with each other in terms of basic operation, additional 16% was underspecified
- Most of disagreements from implicit relations
- Often disagreement on causal/additive nature of relations:
  - Implicit PDTB causal relations annotated as RST ELAB.-ADDITIONAL
  - RST CIRCUMSTANCE marked by *as* often annotated as PDTB causal
  - Many disagreements between CONTRASTS and CONCESSIONS

Mapping in practice – PDTB & RST

Source of Coherence:

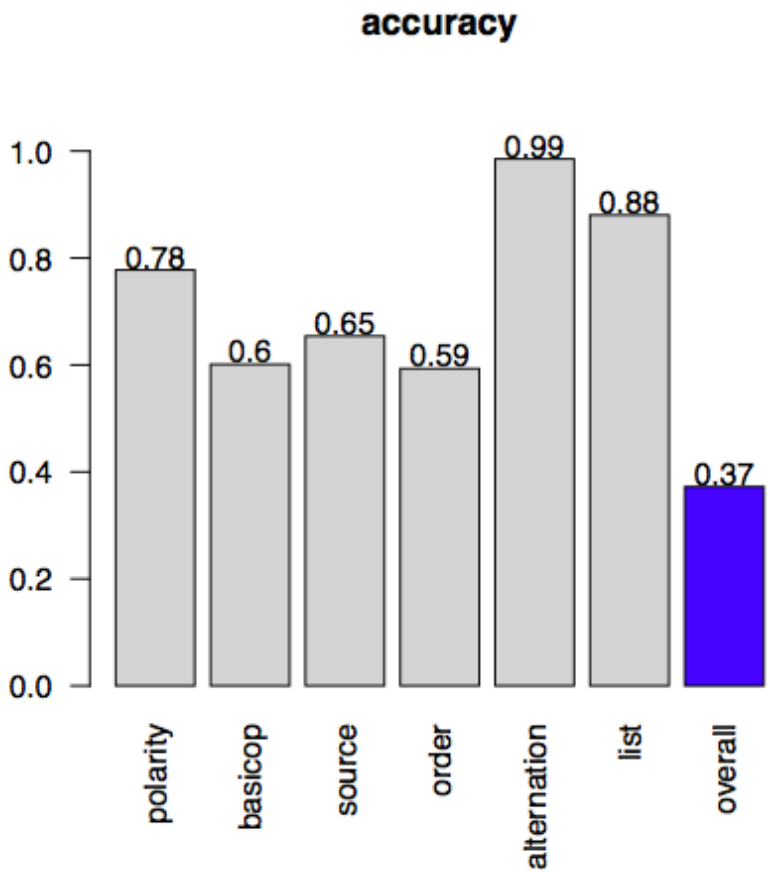
		RST					
		Ojective		Subjective		Underspec.	
PDTB	Objective	**18**	(792)	1	(44)	10	(440)
	Subjective	0	(13)	**0**	(3)	1	(36)
	Underspec.	16	(715)	6	(258)	49	(2228)

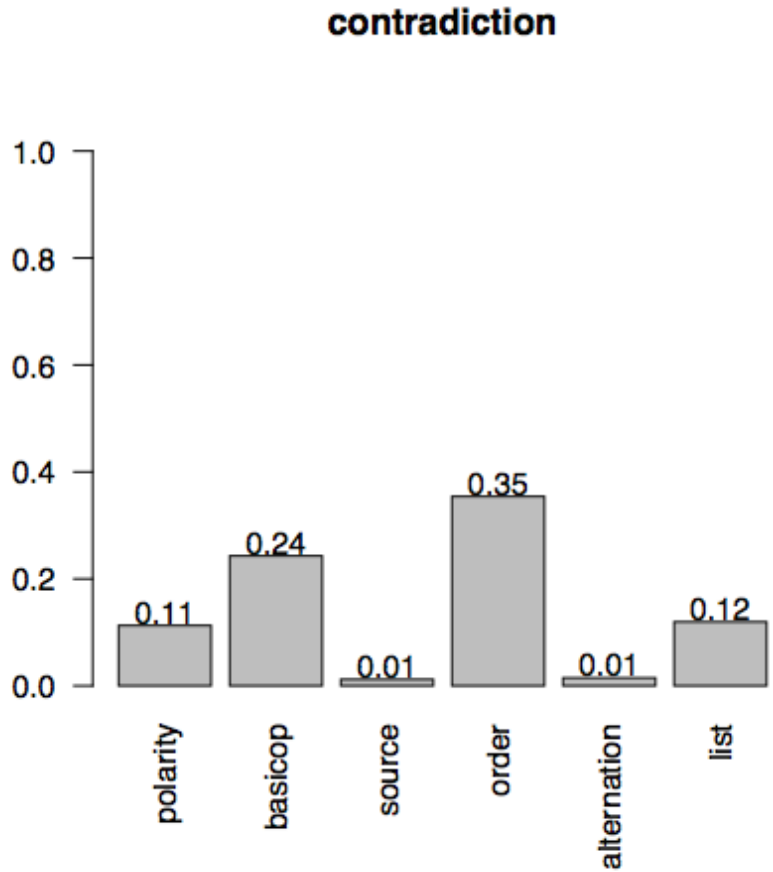
Table: Percentage of agreement (and nr of instances) in PDTB-RST mapping for source of coherence.

- 80% of relations were underspecified in either/both frameworks
- Very few relations were labeled subjective, so little agreement on this value
- Due to number of underspecified relations, SoC cannot be mapped properly

Mapping in practice – PDTB & RST

How often do dimensions match/contradict:





- CCR's Order is difficult to map
- Many contradictions in basic operation: causal/additive

Mapping in practice – PDTB & RST

Mapping revealed important issues:

- One-to-decomposing features mapping is better than one-to-one mapping
- Frameworks' operationalizations influence the resulting annotations
- This in turn influences the mapping's accuracy
- Certain relations might need to be reanalyzed (e.g., RST's Comparison, Circumstance)
- Dimensions Source of coherence and Order were not very informative, because the other frameworks do not make these distinctions very often
- (But other frameworks do make the SoC distinction; e.g., PDTB 3.0, Crible et al, etc.)

(Joint work with Fatemeh Torabi Asr)

Conclusion

- The unifying dimensions have proven to be a suitable tool to map relations between frameworks
- Granularity differences between frameworks cannot be overcome (i.e., a mapping cannot add information that is not present in currently annotated resources)
- But the dimensions makes explicit to users which aspects of a relation are conflated, and which additional distinctions are made
- Coarse-grained labels lead to underspecification in the mapping
- As a result, the translation sometimes suggests multiple candidate corresponding labels
- But this number is still restricted