NASSLLI @ USC 2022

Multiparty and Multi-floor dialogue structure

Lecture 1: Discourse Structure

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Outline for Today

- Introductions
- Basic Definitions: Types of Structure
- Outline of Course
- Overview of Discourse Structure

Basic Terms (1)
Participant settings

- Discourse
- Dialogue
- Multiparty Dialogue
- Multi-floor Dialogue

Basic Terms

- Discourse – coherent extended interaction (more than a single sentence)
- Dialogue
- Multiparty Dialogue
- Multi-floor Dialogue

Example Discourse

- It’s a nice day today
- Isn’t it?
- No rain in sight.
- And a pleasant temperature.
- But we are in a drought!
- I guess too many nice days is not so nice.

Basic Terms

- Discourse – coherent extended interaction (more than a single sentence)
- Dialogue – coherent interaction between multiple participants
- Multiparty Dialogue
- Multi-floor Dialogue

Example Dialogue

A It’s a nice day today

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Basic Terms

- Discourse – coherent extended interaction (more than a single sentence)
- Dialogue – coherent interaction between multiple participants
- Multiparty Dialogue – dialogue between more than two participants
- Multi-floor Dialogue

Example Multi-party Dialogue

A It’s a nice day today

B Is it?

A No rain in sight.

A And a pleasant temperature.

B But we are in a drought!

C I guess too many nice days is not so nice.

Basic Terms

- Discourse – coherent extended interaction (more than a single sentence)
- Dialogue – coherent interaction between multiple participants
- Multiparty Dialogue – dialogue between more than two participants
- Multi-floor Dialogue - interacting conversations with overlap between participants and content

Example Multi-floor Dialogue

Floor 1: Face to Face

A It's a nice day Today

B Is it?

A No rain in sight.

A And a pleasant temperature.

B But we are in a drought!

C I guess too many nice days is not so nice.

Floor 2: texting

A What's the temperature?

D 25 degrees

A Fahrenheit?

D No, Celsius.

A Thanks!

Terms

- Participant
- Participant Roles
  - Utterance (Speaker/Hearer, Reader/Writer, ICP/OCP)
  - Conversation (Active Participant, Side-participant)
  - Task (Director/Matcher, Giver/receiver, teacher/student)
- Conversation
- Floor

Basic Terms (2)

- Context –aspects outside the utterance itself that are important to interpret the meaning/function
- Dialogue State
- Discourse/Dialogue Structure

Basic Terms

- Context –aspects outside the utterance itself that are important to interpret the meaning/function
- Dialogue State – current configuration of context preserving (only) the aspects necessary for understanding subsequent utterances
- Discourse/Dialogue Structure

Basic Terms

- Context –aspects outside the utterance itself that are important to interpret the meaning/function
- Dialogue State – current configuration of context preserving (only) the aspects necessary for understanding subsequent utterances
- Discourse/Dialogue Structure – structural aspects of context, how new utterances combine with old to change dialogue state

Some Uses for Discourse Structure

- Carries some of the meaning, beyond meanings of individual units
- Used for future language interpretation – filling in underspecified values from relevant context
  - Pronouns
  - Ellipsis
  - Questions under discussion
- Used for automated language generation – creating interpretable, coherent, interesting, and compelling text
- Summarization (describe most important parts)

Aspects of utterance meaning

- Truth-conditions
  - Is an assertion true or false
- Function
  - How is an utterance used to impact participants
- State Update
  - How does an utterance change the dialogue state
- Relational
  - How is meaning created by performance of an utterance in the context of others

Linguistic Structure

- How units cluster with each other, in contrast to differences from other units/clusters
- How sub-units combine to form new higher-level units
- How units are related to each other
- How units impact the Dialogue State

Linguistic Levels

- Phone Phoneme
- Morpheme
- Word
- Phrase
- Clause
- Sentence
- Discourse

Organizing Principles for Discourse Structure

- Temporal sequencing
- Surface features (syntax, morphology, phonetics, prosody)
- Meaning
- Effect
- Purpose

Interactional Levels

- Discourse
  - Single speaker/writer
- Dialogue
  - At least two participants, alternating producer/receiver roles
- Multiparty Dialogue
  - More than two participants, more roles than producer/receiver
- Multi-floor dialogue
  - Multiple conversations, sharing at least one (but not all) participants and information flowing between them.

Example Discourse

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Example Dialogue

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Example Multi-party Dialogue

A It’s a nice day today

B Is it?

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B But we are in a drought!

C I guess too many nice days is not so nice.

Example Multi-floor Dialogue

Floor 1: Face to Face

A It's a nice day Today

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B But we are in a drought!

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Floor 2: texting

A What's the temperature?

D 25 degrees

A Fahrenheit?

D No, Celsius.

A Thanks!

Types of Structure: organizing methods

Linear Structure: Segmentation

- Find boundary points between units
- E.g., Sentences, utterances. Paragraphs
- Turn:

A It’s a nice day today. (Turn 1)

B Is it? (Turn 2)

A No rain in sight. (Turn 3)

A And a pleasant temperature. (Turn 3)

Relations

- E.g. question-answer
    1. A: Where are you going?
    2. B: Probably to the Student Union. (Answer to 1)
- Symmetric or asymmetric?
- Nuclearity?

State change (for unit)

- Example: Question Answer:
  - Question introduces Obligation (Traum & Allen ‘94) or puts Question Under Discussion (Ginzburg)
  - Answer resolves obligation

Discontinuous Units

- Example Question-Answer Relation
- 2 Interruption (multiple threads)
  - E.g. answer
    1. A: Where are you going?
    2. B: It's a nice day today.
    3. B: Probably to the Student Union.

Modelling Discontinuous Units

- Set membership
- Constraints on Accessible structures

Hierarchical Structure

- Units contain other units as constituents
  - E.g. answer
    1. A: Where are you going? (Unit 1)
    2. B: When? (Unit 2)
    3. A: For Lunch
    4. B: Oh, probably to the Student Union. (Unit 1)

Overview of Course

- Today: Introductions, terms and concepts, Intro to Discourse Structure
- Tomorrow: Dialogue structure. Additional complications from multiple language producers with separate mental states. What is new and what no longer applies?
- Wed: Multiparty dialogue. Beyond the dyad. How does this complicate aspects of dialogue state? What new phenomena are present? How to handle?
- Thursday: Multi-floor dialogue – multiple conversations, partly separate partly linked. Multi-communication,
- Friday: advanced issues with context in multi-floor dialogue

Overview of Course - Today

- Introductions,
- terms and concepts,
- Overview of Course
- Intro to Discourse Structure
  - RST
  - Grosz & Sidner's tripartite Theory
  - Hovy & Maier 92
  - ISO Dialogue relations

Overview of Course – Tomorrow
Aspects of Dialogue structure

- Participant Roles,
- Media Considerations,
- Turn-taking,
- Adjacency Pairs/IR Units,
- Initiative,
- Feedback and Repair,
- Grounding,
- Dialogue Games,
- Transaction Units,
- Thread management.

Overview of Course – Wednesday Multiparty dialogue

- Beyond the dyad
- How does this complicate aspects of dialogue state?
- What new phenomena are present?
- How to handle?
- How does this shed light on dialogue more generally?

Overview of Course – Thursday Multi-floor dialogue

- Multi-communicating
- Media and accessibility concerns
- Examples from everyday life and military missions
- Botlanguage setting, system and structure annotation scheme

Overview of Course – Friday
Multi-floor dialogue (continued)

- Role of non-linguistic context
  - Situations
  - Images
  - History
  - Visual accessibility
  - Plans
- Others?

Overview of Discourse Structure

Example Discourse

- It’s a nice day today
- Isn’t it?
- No rain in sight.
- And a pleasant temperature.
- But we are in a drought!
- I guess too many nice days is not so nice.

Scrambled Discourse

- But we are in a drought!
- Isn’t it?
- And a pleasant temperature.
- It’s a nice day today
- I guess too many nice days is not so nice.
- No rain in sight.

Example Discourse – anaphora, ellipsis, & cue words

- It's a nice day today
- Isn't it __?
- No rain in sight.
- And a pleasant temperature.
- But we are in a drought!
- I guess too many nice days is not so nice.

Scrambled Discourse

- But we are in a drought!
- Isn't it __?
- And a pleasant temperature.
- It's a nice day today
- I guess too many nice days is not so nice.
- No rain in sight.

Discourse Structure

- Discourse Elements
- Text
  - Basic units (clauses, utterances)
- Participants (fixed roles)
  - Speaker/writer
  - Hearer/reader

Discourse Levels

- Described events (Fabula, Diegetic)
- Speech time

Rhetorical Structure Theory (RST)

- Predominance of Nucleus/Satellite structural patterns
- Functional Basis of Hierarchy
- Communicative role of text structure

- Describe relations of clauses
  - Relating meanings of conjunctions
  - Grammar of clause combining

RST: Example Relations

1. The next music day is scheduled for July 21 (Saturday), noon-midnight.

2. I'll post more details later,

3. but this is a good time to reserve the place on your calendar.

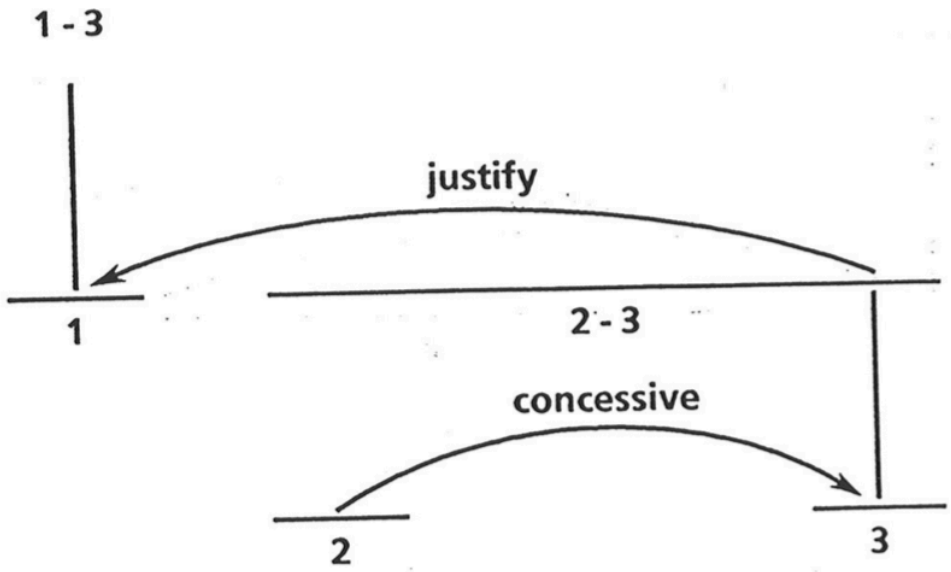


Figure 3: RST diagram of "Music Day" text

RST Extended Example

1. Farmington police had to help control traffic recently

2. when hundreds of people lined up to be among the first applying for jobs at the yet-to-open Marriott Hotel.

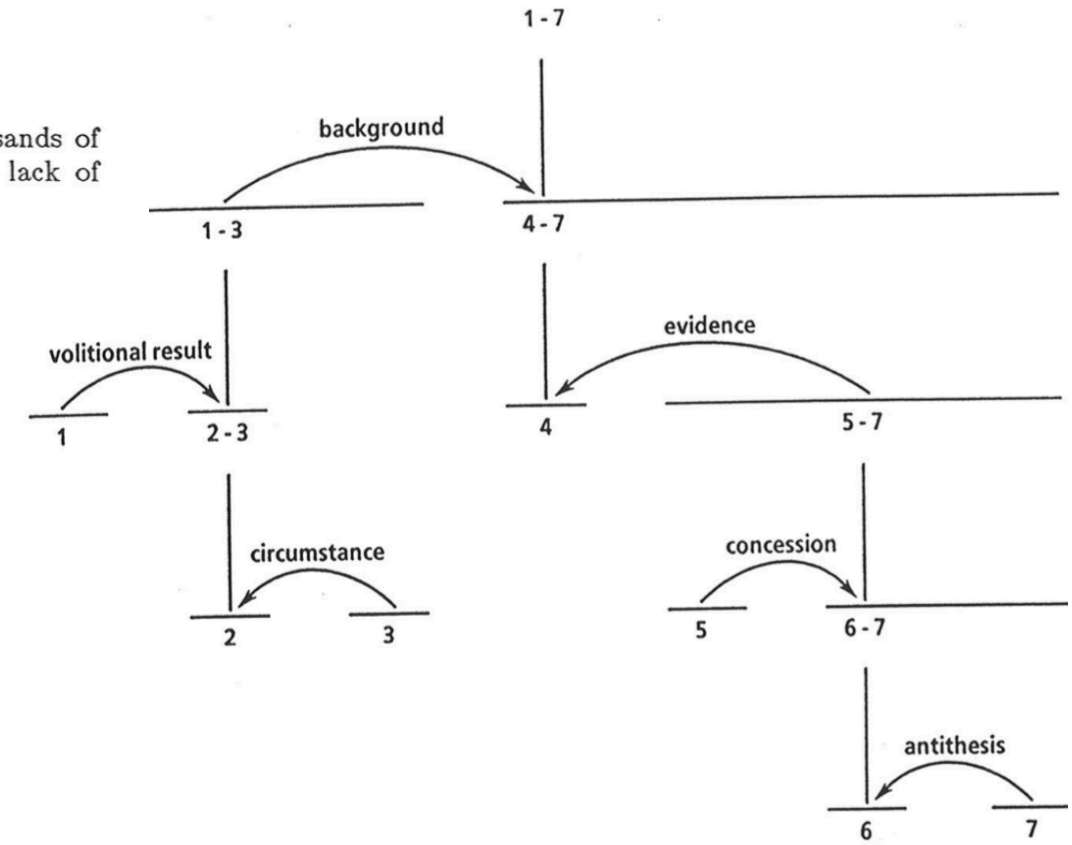
3. The hotel's help-wanted announcement - for 300 openings - was a rare opportunity for many unemployed.

4. The people waiting in line carried a message, a refutation, of claims that the jobless could be employed if only they showed enough moxie.

5. Every rule has exceptions,

6. but the tragic and too-common tableaux of hundreds or even thousands of people snake-lining up for any task with a paycheck illustrates a lack of jobs,

7. not laziness.



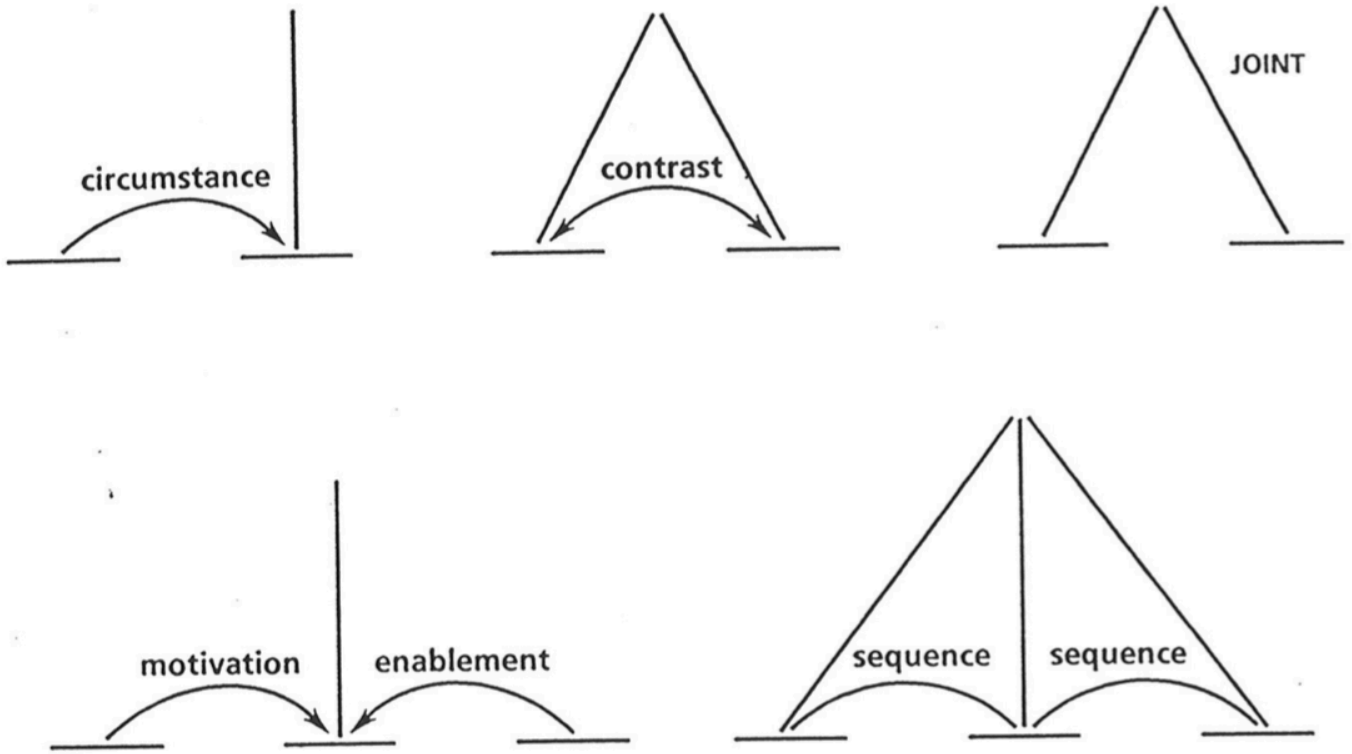
Elements of RST

- Relations
- Schemas
- Schema Applications
- Structures

Relations

- Constraints on Nucleus
- Constraints on Satellite
- Constraints on combination
- Effect

Schema types



Relations

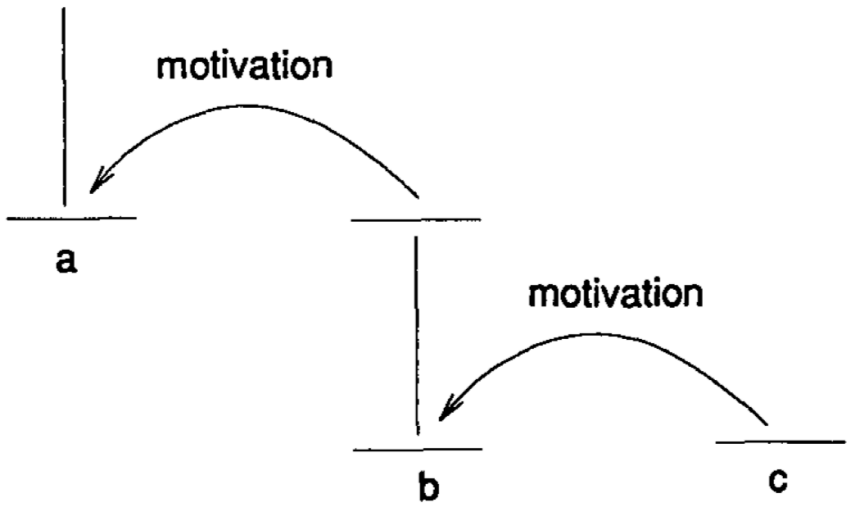
Table 1: Organization of the Relation Definitions

- Circumstance
- Solutionhood
- Elaboration
- Background
- Enablement and Motivation
  - Enablement
  - Motivation
- Evidence and Justify
  - Evidence
  - Justify
- Relations of Cause
  - Volitional Cause
  - Non-Volitional Cause
  - Volitional Result
  - Non-Volitional Result
  - Purpose
- Antithesis and Concession
  - Antithesis
  - Concession
- Condition and Otherwise
  - Condition
  - Otherwise
- Interpretation and Evaluation
  - Interpretation
  - Evaluation
- Restatement and Summary
  - Restatement
  - Summary
- Other Relations
  - Sequence
  - Contrast

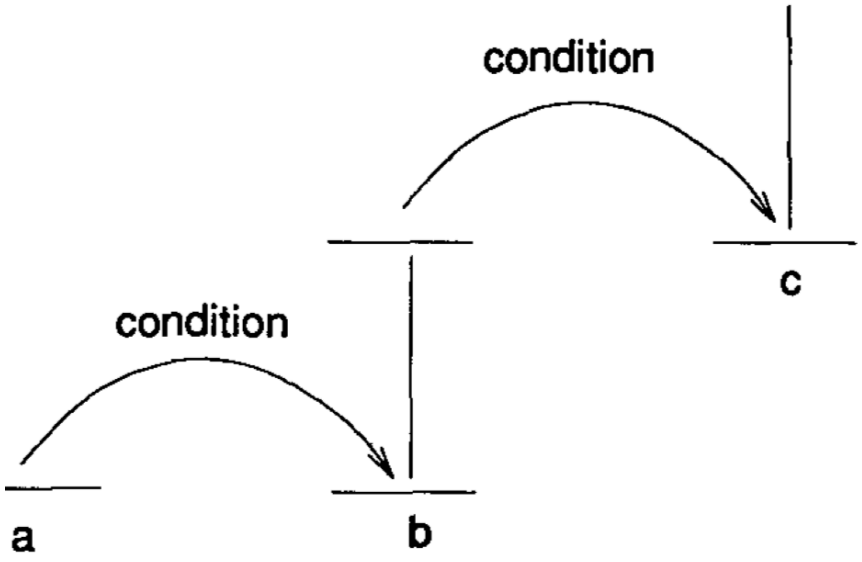
Moore and Pollack (1992): A problem for RST: Need for Multi-level discourse analysis

S: (a) Come home by 5:00. (b) Then we can go to the hardware store before it closes. (c) That way we can finish the bookshelves tonight.

Intentional Analysis



Information



Grosz & Sidner (1986)

- 3 Kinds of Structure
  - Linguistic structure
    - Discourse Segments
  - Intentional structure
    - Discourse Segment Purposes
  - Attentional state
    - Focus spaces

G&S: Linguistic Structure

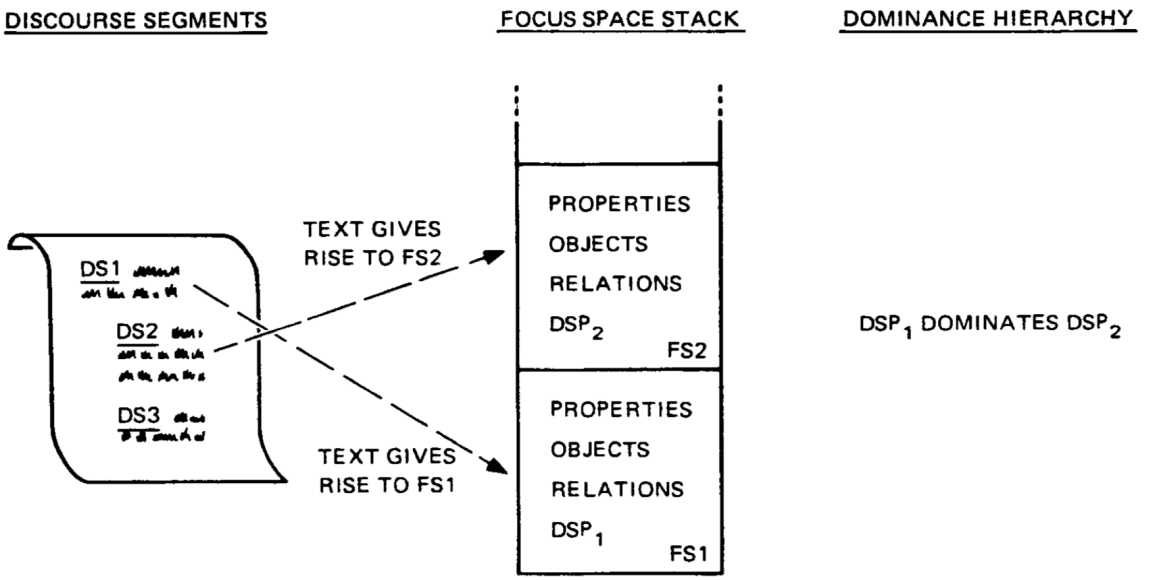
- Utterances as basic units
- Discourse Segments
- Hierarchical structure: segments can contain other segments and/or utterances
  - Surface reflection of relationships of intentional structure

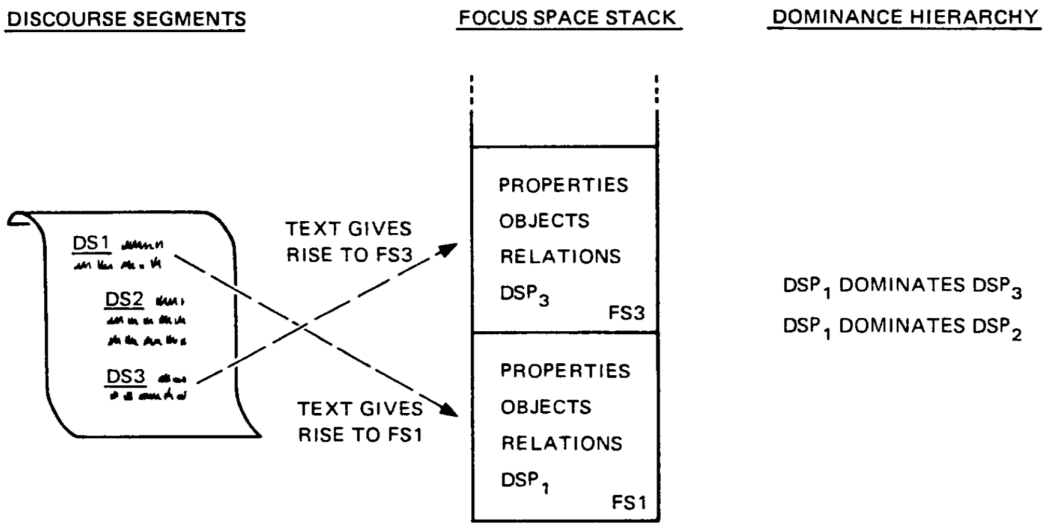
Intentional Structure

- Discourse Purpose
- Discourse Segment Purpose
- Relations:
  - Dominance
  - Satisfaction Precedence

G&S: Attentional State

- Set of Focus Spaces
- Stack data structure for accessibility
  - Relevant parts of intentional structure





G&S: Movie Essay Example

DS0

DS1
1. The "movies" are so attractive to the great American public,
2. especially to young people,
3. that it is time to take careful thought about their effect on mind and morals.

DS2
4. Ought any parent to permit his children to attend a moving picture show often or without being quite certain of the show he permits them to see?

DS3
5. No one can deny, of course, that great educational and ethical gains may be made through the movies
6. because of their astonishing vividness.

DS4
7. But the important fact to be determined is the total result of continuous and indiscriminate attendance on shows of this kind.
8. Can it be other than harmful?

DS5
9. In the first place the character of the plays is seldom of the best.
10. One has only to read the ever-present "movie" billboard to see how cheap, melodramatic and vulgar most of the photoplays are.

DS6
11. Even the best plays, moreover, are bound to be exciting and over-emotional.

DS7
12. Without spoken words, facial expression and gesture must carry the meaning:
13. but only strong emotion, or buffoonery can be represented through facial expression and gesture.
14. The more reasonable and quiet aspects of life are necessarily neglected.
15. How can our young people drink in through their eyes a continuous spectacle of intense and strained activity and feeling without harmful effects?
16. Parents and teachers will do well to guard the young against overindulgence in the taste for the "movie".

I0: (Intend ICP (Believe OCP PO))

where PO = the proposition that parents and teachers should guard the young from overindulgence in the movies.

I1: (Intend ICP (Believe OCP P1))

where P1 = the proposition that it is time to consider the effect of movies on mind and morals.

I2: (Intend ICP (Believe OCP P2))

where P2 = the proposition that young people cannot drink in through their eyes a continuous spectacle of intense and strained activity without harmful effects.

I3: (Intend ICP (Believe OCP P3))

where P3 = the proposition that it is undeniable that great educational and ethical gains may be made through the movies.

I4: (Intend ICP (Believe OCP P4))

where P4 = the proposition that although there are gains, the total result of continuous and indiscriminate attendance at movies is harmful.

I5: (Intend ICP (Believe OCP P5))

where P5 = the proposition that the content of movies (i.e., the character of the plays) is not the best.

I6: (Intend ICP (Believe OCP P6))

where P6 = the proposition that the stories (i.e., the plays) in movies are exciting and over-emotional.

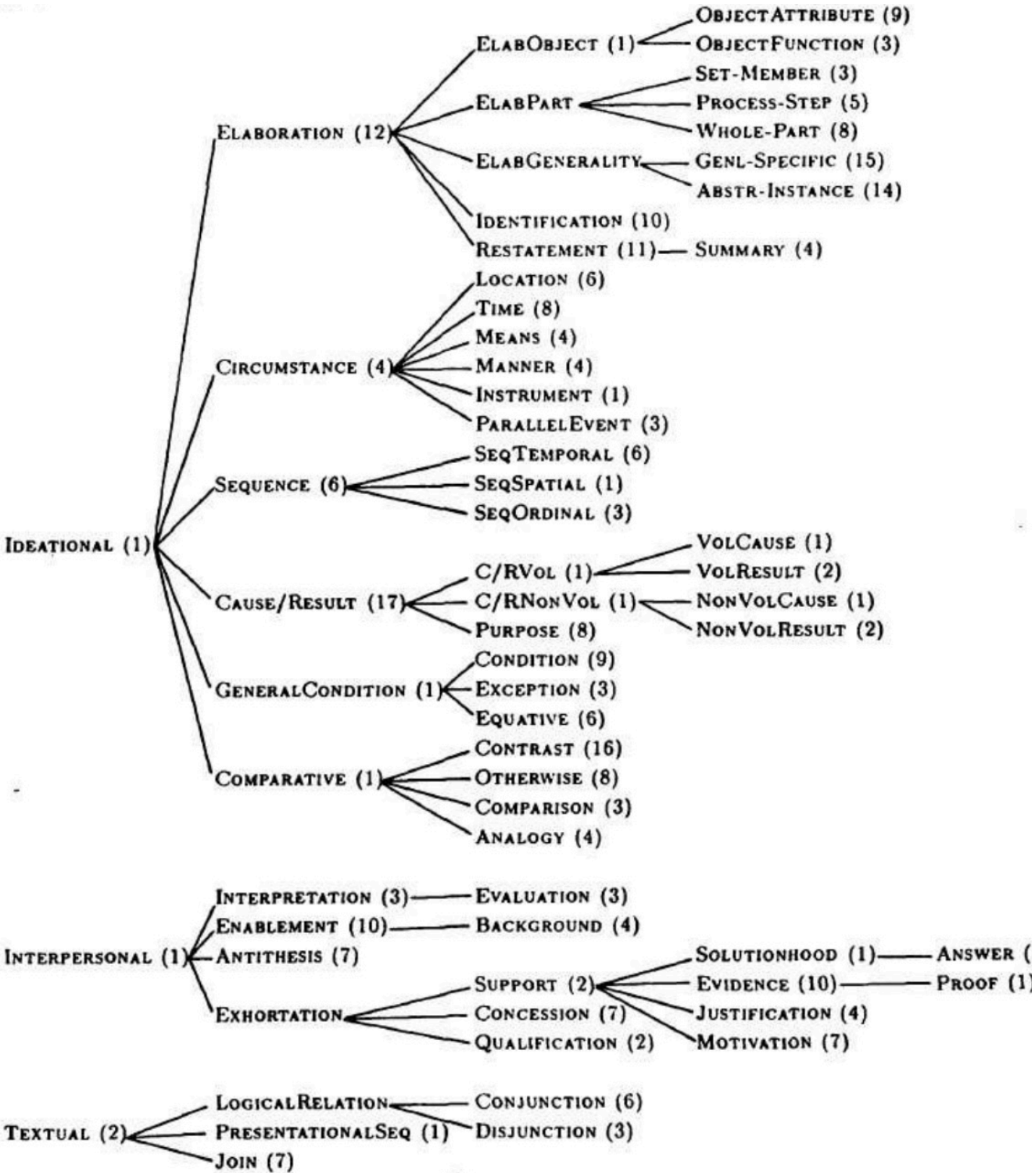
I7: (Intend ICP (Believe OCP P7))

where P7 = the proposition that movies portray strong emotion and buffoonery ... e neglecting the quiet and reasonable aspects of life.

I0 DOM I1
I0 DOM I2
I2 DOM I3
I2 DOM I4
I4 DOM I5
I4 DOM I6
I6 DOM I7

Hovy & Maier (94)

- Composite set of relations



ISO Discourse Relation Scheme

- A discourse relation is a relation expressed in discourse (written, spoken, or multimodal) between abstract objects, such as events, states, conditions, and dialogue acts.
- Discourse relations can be expressed explicitly in text/speech or can be implicit. The annotation of implicit relations may optionally include the specification of a connective that could express the inferred relation.
- A discourse relation takes two and only two arguments. Arguments can be shared by different relations.
- The meaning of discourse relations is described in informational terms.
- Pragmatic aspects of meaning involving beliefs and dialogue acts as arguments are represented as a property of arguments, rather than of discourse relations.
- Discourse relations are categorized as a flat set of relations.
- Annotations are at a low level; ISO DR-Core is agnostic towards the nature of the global structure of a text or dialogue.
- Asymmetrical relations are represented with relation-specific argument role labels.
- The relative importance of a relation's arguments with respect to the text as a whole is not represented as such.
- No apriori assumptions are made concerning constraints on syntactic form, syntactic complexity, or textual adjacency of expressions that may realize the arguments of a discourse relation.

ISO Discourse Relations

	ISO DRel	Symmetry	Relation and Argument-Role Definitions
1.	Cause	Asymmetric	Arg1 provides a reason for Arg2 to come about or occur.
2.	Condition	Asymmetric	Arg1 is an unrealized situation which, when realized, would lead to Arg2.
3.	Negative Condition	Asymmetric	Arg1 is an unrealized situation which, when not realized, would lead to Arg2.
4.	Purpose	Asymmetric	Arg1 enables Arg2.
5.	Manner	Asymmetric	Arg1 is a way in which Arg2 comes about or occurs.
6.	Concession	Asymmetric	An expected causal relation between Arg1 and Arg2, where Arg1 is expected to cause Arg2, is cancelled or denied by Arg2.
7.	Contrast	Symmetric	One or more differences between Arg1 and Arg2 are highlighted with respect to what each predicates as a whole or to some entities they mention.
8.	Exception	Asymmetric	Arg1 evokes a set of circumstances in which the described situation holds, while Arg2 indicates one or more instances where it doesn't.
9.	Similarity	Symmetric	One or more similarities between Arg1 and Arg2 are highlighted with respect to what each predicates as a whole or to some entities they mention.
10.	Substitution	Asymmetric	Arg1 and Arg2 are alternatives, with Arg2 being the favored or chosen alternative.
11.	Conjunction	Symmetric	Arg1 and Arg2 bear the same relation to some other situation evoked in the discourse. Their conjunction indicates that they are doing the same thing with respect to that situation, or are doing it together.
12.	Disjunction	Symmetric	Arg1 and Arg2 are alternatives, with either one or both holding.
13.	Exemplification	Asymmetric	Arg1 describes a set of situations; Arg2 is an element of that set.
14.	Elaboration	Asymmetric	Arg1 and Arg2 are the same situation, but Arg2 contains more detail.
15.	Restatement	Symmetric	Arg1 and Arg2 are the same situation, but described from different perspectives.
16.	Synchrony	Symmetric	Some degree of temporal overlap exists between Arg1 and Arg2. All forms of overlap are included.
17.	Asynchrony	Asymmetric	Arg1 temporally precedes Arg2.
18.	Expansion	Asymmetric	Arg2 provides further description about some entity or entities in Arg1, expanding the narrative forward of which Arg1 is a part, or expanding on the setting relevant for interpreting Arg1. The Arg1 and Arg2 situations are distinct.
19.	Functional dependence	Asymmetric	Arg2 is a dialogue act with a responsive communicative function; Arg1 is the dialogue act(s) that Arg2 responds to.
20.	Feedback dependence	Asymmetric	Arg2 is a feedback act that provides or elicits information about the understanding or evaluation by one of the dialogue participants of Arg1, a communicative event that occurred earlier in the discourse.

	Discourse relation	Argument role labels
1	Cause	Reason, Result
2	Concession	Expectation-raiser, Expectation-denier
3	Elaboration	Broad, Specific
4	Restatement	n.a.
5	Condition	Antecedent, Consequent
6	Negative Condition	Negated-Antecedent, Consequent
7	Contrast	n.a.
8	Similarity	n.a.
9	Expansion	Foreground, Entity-description
10	Purpose	Goal, Enablement
11	Manner	Means, Achievement
12	Exception	Regular, Exclusion
13	Substitution	Disfavoured-alternative, Favoured-alternative
14	Conjunction	n.a.
15	Disjunction	n.a.
16	Exemplification	Set, Instance
17	Synchrony	n.a.
18	Asynchrony	Before, After
19	Functional dependence	Antecedent-act, Dependent-act
20	Feedback dependence	Feedback-scope, Feedback-act

Table 2: Role labels for arguments of ISO DR-Core discourse relations

ISO Relations to other schemes (1)

ISO DR-Core	RST	RST Treebank
Cause	Vol. cause, Non-vol. cause, Vol. result, Non-vol. result, Evidence, Justify	Cause, Consequence, Result Evidence, Explanation-argumentation, Reason
Condition	Condition	Condition, Contingency, Hypothetical
Negative Condition	Otherwise	Otherwise
Purpose	Purpose	Purpose
Manner	–	Manner, Means
Concession	Concession	Concession, Antithesis, Preference
Contrast	Contrast	Comparison
Exception	–	–
Similarity	–	Analogy, Proportion
Substitution	Antithesis	–
Conjunction	Joint	List
Disjunction	Joint	Disjunction
Exemplification	Elaboration (set-member)	Elaboration set-member, Example
Elaboration	Elaboration (general-specific, whole-part, Elaboration (abstract-instance, process-step)	Conclusion, Elaboration-general-specific, Conclusion, Elaboration-general-specific, Elaboration-part-whole, Elaboration-process-step, summary
Restatement	Restatement	–
Synchrony	–	Temporal-same-time
Asynchrony	Sequence	Temporal-before, Temporal-after, Sequence, Inverted-sequence
Expansion	Elaboration (object-attribute)	Elaboration object-attribute, Elaboration additional

Table 3: Mapping between discourse relations in ISO DR-Core, RST, and RST Treebank

ISO Relations to other schemes (2)

ISO DR-Core	PDTB	Sanders et al/DiscAn
Cause	Reason, Result, Justification	Causal-Semantic-Basic-Positive Causal-Semantic-NonBasic-Positive Causal-Pragmatic-Basic-Positive Causal-Pragmatic-NonBasic-Positive
Condition	Hypothetical, General, UnrealPast, UnrealPresent, FactualPast, FactualPresent	Causal-Semantic-Basic-Positive Causal-Semantic-NonBasic-Positive Causal-Pragmatic-Basic-Positive Causal-Pragmatic-NonBasic-Positive
Negative Condition	Condition	–
Purpose	Result	Causal-Pragmatic-Basic-Positive Causal-Pragmatic-NonBasic-Positive
Manner	– –	AdditiveSemantic-Basic-Positive AdditiveSemantic-NonBasic-Positive
Concession	Expectation, Contra-Expectation	Causal-Semantic-Basic-Positive , Additive-Semantic-Negative
Contrast	Juxtaposition, Opposition	Additive-Semantic-Negative
Exception	Exception	Additive-Semantic-Negative
Similarity	Conjunction	Additive-Semantic-Positive
Substitution	Chosen Alternative	Additive-Semantic-Negative
Conjunction	Conjunction, List	Additive-Semantic-Positive
Disjunction	Disjunctive, Conjunctive	Additive-Semantic-Negative
Exemplification	Instantiation	Additive-Semantic-Positive
Elaboration	Generalization, Specification	Additive-Semantic-Positive
Restatement	Equivalence	–
Synchrony	Synchronous	–
Asynchrony	Precedence, Succession	–
Expansion	EntRel	Additive-Semantic-Positive

Some Other Important Approaches to Discourse Structure

- Hobbs ‘78, ’79, ‘90
- Polanyi ‘88 Linguistic Discourse Model
- Discourse Representation Theory (DRT)
- Segmented Discourse Representation Theory (SDRT)
- Penn Discourse Treebank (PDTB)

Issues

- One (primary) structure or many?
  - If many, independent or mutually constraining?
- How many and which relations?
- Nuclearity?
- Focus on hierarchical structure or relational structure?
- Text (Semantics), or participants/situation (pragmatics)
- Focus on semantic/pragmatic relation or explicit discourse marker
- How to evaluate?

Evaluation

- Inter-annotator reliability
- How to account for impact of other structures?
- Partial matches
  - Ratio of content grouped together
  - Boundaries matching
  - Hierarchical structure
- (Passonneau & Litman, 1997)

Annotation Exercise

1. Listen, lad. I built this kingdom up from nothing.
2. When I started here, all there was was swamp.
3. Other kings said I was daft to build a castle on a swamp,
4. but I built it all the same,
5. just to show 'em.
6. It sank into the swamp.
7. So, I built a second one.
8. That sank into the swamp.
9. So, I built a third one.
10. That burned down, fell over, then sank into the swamp,
11. but the fourth one... stayed up!
12. And that's what you're gonna get, lad: the strongest castle in these islands.

Next time

- Dialogue Structure
  - Multiple participants can change roles
  - Intentions of multiple participants
  - Interactional factors