

# Candidacy Exam

## Content Planning in Generation

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# The Problem: Content Planning

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## Generation of multisentential text.

<code>breed(Fido, CockerSpaniel)</code>	<code>loves(John, dog)</code>
<code>owner(Fido, John)</code>	<code>is-a(Fido, dog)</code>
<code>located(John, NYC)</code>	<code>loves(John, Fido)</code>
<code>aunt(John, Marie)</code>	<code>located(Marie, Paris)</code>
<code>is-a(NYC, city)</code>	<code>is-a(Paris, city)</code>

*Tell me about Fido.*

## Compare:

*Fido is a dog. Marie lives in Paris. Fido is a CockerSpaniel. New York is a city ...*

*Fido is a CockerSpaniel dog, owned by John. John loves Fido because he loves dogs. He lives in the city of New York ...*

- Given certain information, **structure** a **subset** of it.

# The Problem: Content Planning

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- The Tasks

- **Content Selection**: choosing the right bits of information to include in the final output.
- **Content Structuring**: organizing the data in some sensible way.

- The Goals

- Coherence (Structuring)
- Conciseness (Both)
- Appropriateness (Selection)

# The Papers

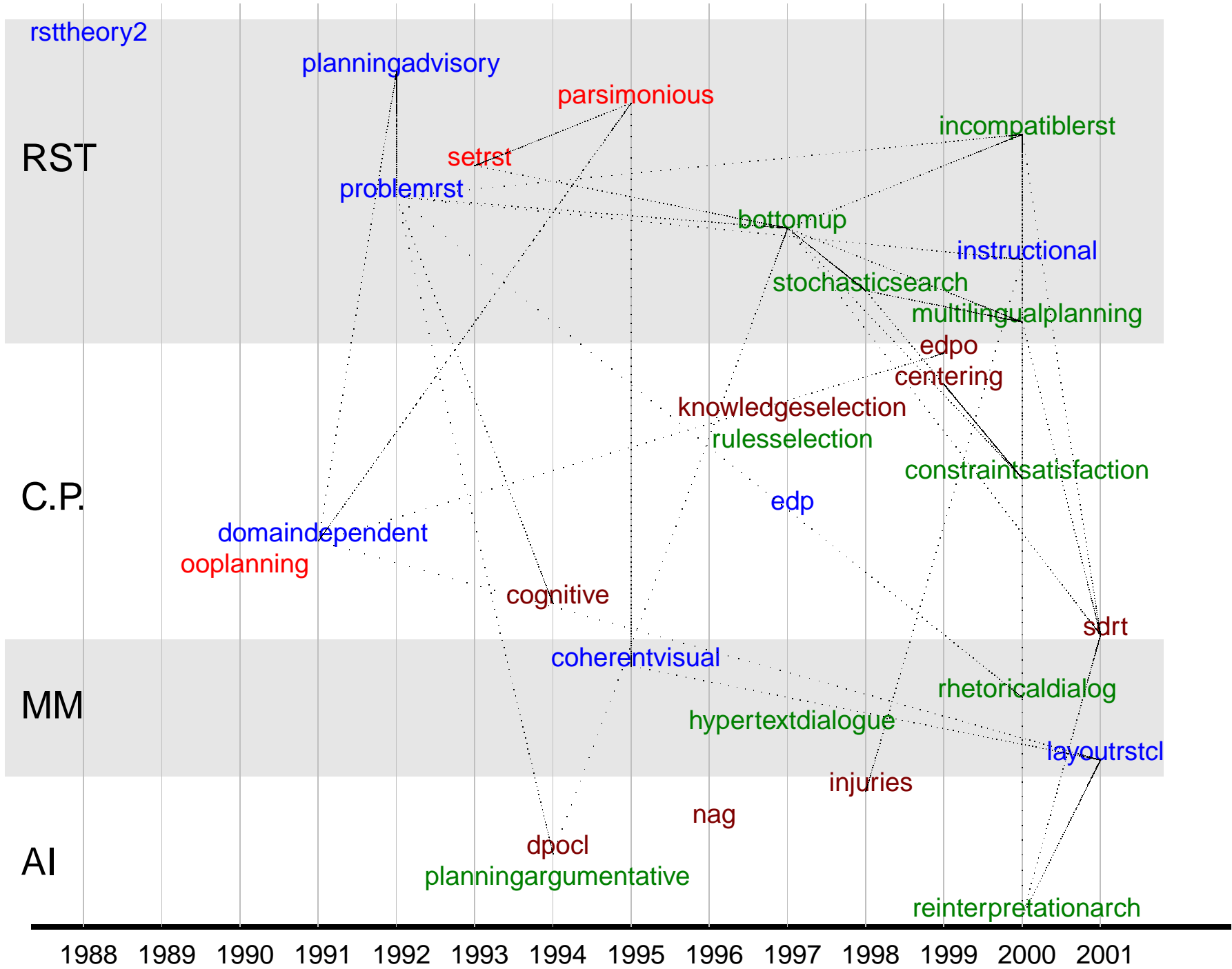
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This candidacy exam covers 29 papers:

**Milestones** in the search for a solution to the content planning problem.

**Prestigious** highly cited papers published in well-established journals.

**Innovative** remarkably new approaches to the problem.



# Issues

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My perspectives to analyze the papers:

- *Input*
- *Output*
- *Algorithm*
- *Relations*
- *Intentions*
- *Domain*
- *Communication Knowledge*
- *Surface*
- *Multimedia*
- *Centering*
- *Tree Structure*

# Input

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## What should the **input** to a Content Planner be?

- Should RST-relations be part of it?

**Yes** (Marcu, '97), (Mellish *et al.*, '98). *Looks limited to problems lacking any real use of the communicative power of the rhetorical structure.*

**No** done by most content planners (Young and Moore, '94) and architectures (Cahill *et al.*, '00), they find the relations while structuring the document. *It let you find relations that hold as a result of the structure (**presentational** relations).*

- Should it include the whole Knowledge Base or just some part?

**Total Access** *This happens mainly with generation-specific KB.*

**Partial Access** For example, the idea of *views* (Lester and Porter, '97). *This allows a generation more detached from the KB.*

# Output

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## What should the **output** of a Content Planner be?

- Should it be a *tree*, a *sequence*, or an *equational system*?

**Tree** Most content planners use trees as output, (Cahill *et al.*, '00).

**Sequence** More restricted than trees, for several applications they may be enough (Huang, '94), (Mellish *et al.*, '98). *I find them very appealing. Further stages can do local revision, if needed.*

**Equational System** More expressive than trees (Danlos *et al.*, '01). *Seem to solve some of the problems involved in trees.*

- Should include textual levels (paragraphs, etc.)?

**Yes** The content planner has the high level perspective to do so.

**No** Text structure may be incompatible with rhetoric (Bouayad-Agha *et al.*, '00) and a new task should be spanned. *The problem may actually be in the definition of what rhetoric structure is.*



# Algorithm

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What should the **process** inside a Content Planner be?

- Should it be actually a *planning* process?

Yes (Moore and Paris, '92) a well-motivated example of a complex planning process. Also (Huang, '94), (Ansari and Hirst, '98), (Kosseim and Lapalme, '00). *Full planning is the “real thing” although expensive and require modeling a full rainbow of issues.*

No Other alternatives are macro-expansion (Lester and Porter, '97), rule systems (Reiter *et al.*, '97) as pointed out in (Rambow, '99). *Simpler architectures are always appealing.*

- With which operators?

Rhetorical

Intentional

Pragmatical

Relations

Intentions

Domain Communication Language

# Algorithm

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- Should it be top-down or bottom-up?

**Top-Down** Speed and ease of understanding motivates building top-down planners (Young and Moore, '94).

**Bottom-Up** (Marcu, '97) sees the whole process as a linking among facts by means of input-given RST-relations. *Interesting perspective, although it is too shallow to be enough far-reaching.*

**Hybrid** (Huang, '94) combines a top-down (planned) approach with a bottom-up opportunistic perspective based on centering. *The top-down module has too high priority to be a real hybrid.*

- Other approaches

- (Mellish *et al.*, '98) stochastic search (e.g., genetic algorithms).
- (Power, '00) constraint satisfaction.
- (Knott *et al.*, '97) defeasible rules.

# Relations

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The existence of rhetorical relations holding between spans of text is an agreed fact.

- What are the sizes of those spans?
  - (Mann and Thompson, '88), (Stent, '00)
  - .
- What are the relations themselves? How many?
  - (Knott and Dale, '93), (Hovy and Maier, '95).
- Is there a fixed amount?
  - Yes** (Rambow, '99), (Knott and Dale, '93).
  - No** (Mann and Thompson, '88), (Hovy and Maier, '95).

# Intentions

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The beliefs of the **H** and the intentions of the **S** are important to generate well-motivated discourse.

- How they can be represented?

– (Moore and Paris, '92).

- Should we model *degrees* of belief?

**Yes** (Zukerman *et al.*, '96), (Walker and Rambow, '94), (Rambow, '99).

**No** (Moore and Paris, '92), (Young and Moore, '94).

# Domain Communication Knowledge (DCK)

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Some discourses are completely shaped by its use and environment.

- The concept of DCK and its necessity is introduced in (Kittredge *et al.*, '91).
- (Rambow, '99) proposes an integrated approach to deal with DCK and other issues.
- How is this knowledge *represented*?
  - implicit In most of the cases.
  - explicit (Huang, '94) (Proof Communicative Acts). (Lester and Porter, '97) (Schemas).
- It is distinguished from *domain* knowledge?

# Surface

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The planner decisions may relate to lower level issues than the mere rhetorical tree.

- Where should the *connectives* (e.g., cue phrases) defined?
- Should the particularities in the realization of given phrases (act./pass., to-inf/gerund) be synchronized with rhetorical decisions?
- (Kosseim and Lapalme, '00) does a very detailed analysis of the issues relating election of syntactical forms given a communicative context.
- (Rambow, '99) provides a framework to allow the content planner synthesize decisions at different levels of abstractions, as it may see fit.
- (Bouayad-Agha *et al.*, '00) analyses possible incompatibilities between the text structure (paragraphs, etc.) and the rhetorical structure.

# Multimedia/Multilingual/Dialog/Layout

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## Planning different type of contents.

- How compatible are textual and non-textual materials from the planning perspective?
- How does layout affect the communicative process?
- How different languages affect the structuring of the message?
  
- (Dale *et al.*, '97), hyperlinks; (Kamps *et al.*, '01), layout; (Stent, '00), dialog; (Marcu *et al.*, '00), multilingual; (Power, '00), (Bouayad-Agha *et al.*, '00), text structure; (André and Rist, '95), multimedia.

# Centering

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The local focus is an agreed ingredient in the coherence of texts.

The relation between centering theory and content planning are brought explicit in (Kibble and Power, '99).

- How explicit should centering be represented and dealt with?
- For understanding, centering is local issue, is that the case for generation?
- (Mellish *et al.*, '98) uses some idea of local focus for scoring possible candidates during the genetic search.
- (Huang, '94) uses centering to drive its bottom-up planner. *But this considers it a local behaviour*



# Tree Structure

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There is some agreement that the output of a Content Planner should be a tree.

However, so many incompatibility results may suggest it may not be the case. What other options do we have?

- (Mann and Thompson, '88) makes a strong argument for the rhetorical structure to be a tree in *most of the texts*. However their JOINT relation seems to be an *ad hoc* way to complete tree.
- (Danlos *et al.*, '01) provides a good discussion on the other direction, i.e., that a tree is not enough.
- Incompatibility results: (Marcu *et al.*, '00), multilingual; (Bouayad-Agha *et al.*, '00), text structure; (Mellish *et al.*, '98), cross-over.
- (Ansari and Hirst, '98), (Rambow, '99), (Lester and Porter, '97), (Marcu, '97), (Kittredge *et al.*, '91).

# Conclusion

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Normally a content planner has to integrate the following, contrasting issues:

- DCK
- Intentional
- Rhetoric
- Semantic

Each particular planner explores some directions according to the particularities of their problem at hand.

As (Rambow, '99) points out, a general framework for dealing with the problem will require powerful, aggregated operators.

Given such operators, an appealing way to combine them is to think them as adding constraints to the search space in a constraint satisfaction setting. (As sketched in (Power, '00).)

