Use Hans Rosling video from 2:30 to 10:00

<https://apps.dtic.mil/sti/pdfs/ADA625019.pdf>

At item [1], Rosling begins by highlighting the ignorance many of his students have regarding Demography and Demographic Economics. He emphasises the pressing need to communicate the data related to issues such as life expectancy, child health and economic inequality. He explains that the software being used in his presentation is designed to make the data easier to understand. This is an example of the preparation relation, as the audience is informed of the types of data to be discussed in the presentation. The audience are told what to expect and are informed of the information’s importance.

The contrast relation, items [2]-[3], summarises the most pronounced and statistically significant distinction between wealthy, developed societies and poorer, third world societies. In the developed world, people have smaller families and live longer lives, whilst in poorer societies, people die younger and have more children. [2] is treated as the nucleus and [3] is the satellite by virtue of [2] being mentioned first, though the distinction is immaterial in this context.

Items [5]-[8] are a sequence of facts as they directly follow one another, and each serve an identical literary purpose. These items are also satellites that constitute evidence for claim [4], which is the nucleus.

Similarly, [9] and [10] both include similar information, as they both provide explanations for the statistical changes alluded to in item [4] and evidenced in [5]-[8]. Items [9]-[11] constitute evaluations of item [4], as they assess the information contained in and related to the nucleus item [4]. These items are extrapolations Rosling made by comparing the data in the presentation with knowledge of historical events and government policy decisions which the demographic changes can be attributed to. Item [12] provides background, using Vietnam as an example to illustrate the fact highlighted in item [11].

**Rules for heuristic**

Highest priority will be given to the joint relation. There are no constraints on the joint relation, meaning the purpose of any join will be subjective, depending entirely upon its context and the intentions of the writer. The only assumption that can be made is that the author intends any joint text spans to be delivered together. The lack of constraints makes the joint relation unpredictable and it is therefore safer to prioritise Joints over other relations unless specifically directed to do the contrary.

An item which plays the role of a satellite in the preparation relation will be given the second highest priority. Preparation informs the expectations of the audience, guiding their interpretations and reactions to the content of the presentation. Thus, preparation satellites must be displayed before their corresponding nuclei. Additionally, preparation relations may provide content vital for preparing the audience for the presentation as a whole, giving them priority over most other relations.

The contrast relation is given the third-highest priority, as it can usually be assumed the speaker seeks to juxtapose contrasting items. Where direct juxtaposition is not desired or necessary, it is important that the audience not lose sight of the first contrasted element by the time the second is displayed.

A sequence will be given the fourth-highest priority. The purpose of a sequence relation is to specifically nominate a series of items which immediately succeed another item in the relation. As a result, it is unlikely that elements in a sequence relation will contain links to incomplete items until the sequence is complete.

The next priority bracket will be the background relation. For the purpose of this project, background precedes the evidence and evaluation relations, whilst the background satellite should precede its nucleus. It would be possible to provide both the background to and evidence for content prior to providing the content itself. However, it is possible the audience may fail to understand or acknowledge the importance of the background and evidence, without first hearing the underling claim. Thus, the ordering selected, for the purposes of this project, is considered to be a safer ordering choice.

Evidence precedes evaluation, as the evaluation may require an assessment of the available evidence, which will need to be made available before the assessment will make sense to the listener.

In cases where there are multiple elements in the same priority bracket, the tie is broken by selecting the item with the largest number of relations. This algorithm is not sufficiently advanced to perform a sentimental analysis of the text contained in each item. Thus, the simplest way to prioritise relations is to assume the items that link to a large number of other items are highly important and should be completed first.

**Defining Rhetorical Structure Theory**

Thomson and Mann (1987) define Rhetorical Structure Theory (RTS) as consisting of schemas which govern how text spans, blocks of text, can be built of other portions of text. These schemas serve as relations between each block of text and help to dictate the text’s meaning.

Many of these relations can be described as nucleus-satellite relations. This relation involves one clause, the satellite, providing information that complements that contained in the main clause, the nucleus.

A relation which involves a satellite clause dependant on a nucleus clause is known as a mononuclear relation. An example of a mononuclear relation is ‘I bought this laptop, because it has a good processor’ (Hoogervorst et al, 2016). Demonstrably, the latter clause cannot exist without the preceding clause and is therefore of inferior importance to it.

A parataxis or multinuclear relation includes two nuclei, both of equal importance to the overall meaning of the text block. Examples of these relations include the Contrast and Concession relations.

RST Relations can also be categorised by their purpose. Presentation relations exist to influence the feelings and attitudes of the readers about a particular subject. These include providing justifications or motivations for or a restatement of the sentiments expressed by the nucleus.

Subject Matter Relations differ from Presentation Relations in that their effect is solely to provide additional information to the reader (Wark & Nowina-Krowicki, 2015).

Each RST relation will enumerate four criteria. The relation must impose constraints on the nucleus, constraints on the satellite, constraints on the combination of nucleus and satellite and must achieve a desired effect on the reader.

|  |  |  |
| --- | --- | --- |
| **Name of Relation** | **Description** | **Example** |
| Solutionhood | Satellite text span poses a problem which the nucleus span addresses | What if you're having to clean floppy drive heads too often?  Ask for Syncom diskettes, with burnished Ectype coating and dust-absorbing jacket liners |
| Elaboration | Nucleus span is accompanied by additional information | As members of the University's staff, you are cordially invited to attend the 1983 Annual Staff Breakfast presented by President James Zumberge and the Staff Assembly.  The continental breakfast and get-together will be held in the Town and Gown Auditorium (on Main Campus) at 8:30 AM on Thursday 11/3. |
| Background | Satellite span provides information which adds to user’s understanding of the nucleus span | I am having my car repaired in Santa Monica (1522 Lincoln Blvd.) this Thursday 19th.  Would anyone be able to bring me to ISI from there in the morning or drop me back there by 5 pm please? |
| Contrast | The idea presented in the nucleus is distinguished from the idea presented in the satellite | I recently purchased a text which purported to be a guide to Pascal for engineers.  It totally ignored the subtleties of the language and made no bones about it |
| Concession | There is a potential contradiction between the nucleus and the satellite but they are intended to be compatible with each other | Your kind invitation to come and enjoy cooler climes, is so tempting, but I have been waiting for the outcome of medical diagnosis and the next 3 mon |
|  |  |  |

**Figure 1**: A list of Relations defined by Thomas and Mann (1987), including examples taken from the same article

**Applications of RST**

The use of RST in automated generation of text has been explored and its effectiveness has greatly varied depending on its application.

One example is the STOP software, which generates messages encouraging smokers to quit smoking (Reiter, Stripada & Williams, 2003). Readers undertake a questionnaire before being provided with a letter formulated to appeal to their own personal circumstances.

A weakness of this experiment was the inability to gather a large quantity of information from a survey. As participants cannot realistically be expected to spend large amounts of time completing the survey, there is a limited number of questions that can reasonably be asked. Important factors are noticeable absent from the survey.

For example, participants experiencing stress can be reminded of the link between tobacco and stress. However, other factors, such as participants turning to tobacco to deal with grief after the death of a loved one, are not accounted for.

It is worth noting that studies have also asserted that non-tailored letters were more effective at encouraging smokers to quit, in comparison to subjective tailored letters (Lennox et. al, 2001).

Another example of the application of RST is the SumTime-Mousam project, which is used to automate the formulation of weather reports (Reiter et al, 2005). The automation process consisted of three stages: Document Planning, Microplanning and Surface Realization.

Document Planning determines the lexical structure of the report. This structure includes the information the report will highlight, such as wind speeds, temperature and likely changes in weather data throughout a given time period.

Microplanning relates to how sentence structure, grammar and vocabulary should be used throughout the report. Microplanning involves lexicalisation, aggregation and referring expressions generation. Lexicalisation converts non-linguistic data (e.g.: statistics) into words. Aggregation relates to how the information should be divided throughout the blocks of text in the article and include factors such as sentence lengths and the number of sentences. Referring expressions generation involves determining how to refer to entities once they have been introduced. This could include the use of shorthand acronyms or pronouns.

Surface Realisation will create the weather report based on the decisions made in the Document Planning and Microplanning stages. This process requires domain communication knowledge to clarify the appropriate grammar rules and vocabulary for the relevant domain. The domain means the genre or topic at hand, in this case weather reporting (Kittredge et. al, 1991). Weather reporting is performed by humans using a sublanguage called ‘weatherese’ and must be simulated through AI in the same manner.

In the field of automated text generation, domain communication knowledge is particularly important when using relations with minimal restrictions and flexible applicability (https://journals.sagepub.com/doi/pdf/10.1177/1461445606064836). The least constrained relations are among the most difficult to manage through AI and include the joint relation, which connects two nuclei for a subject-dependant reason. It will be the domain and relevant sublanguage, in this case ‘weatherese’, which will inform the program which text blocks should be connected through a joint.

Another example of a practical use of RST is the Aspect-Based Sentiment Analysis (ABSA), which is used to analyse reviews of products and services. ABSA involves two stages: defining the important characteristics of the subject under review and determining which words in the text are describing those characteristics.

A major difficulty encountered throughout this process is posed by contrasting statements. An example, provided by <https://www.aclweb.org/anthology/I11-1038.pdf> is “Despite the pretty design, I would never recommend it because the sound quality is unacceptable”. This sentence contains a concession relation because the writer expresses a view that contrasts with their general sentiment without contradicting it. However, the overall sentiment expressed here, regarding the product being reviewed, is negative and must be registered as such by ABSA.

RST assists with this issue as greater weight can be attached to a nucleus when assessing the meaning of a sentence. The nucleus will typically convey the central meaning of a sentence, while less weight can be attached to a satellite, including a concession satellite.

<More info about RST>

<http://cgi.sfu.ca/~mtaboada/docs/publications/Hoogervorst_etal_ICWE_2016.pdf>

<Cite> splits clauses into Elementary Discourse Units (EDUs)

Words contained in a relation are typically more significant than ones that aren’t

Steps

Construct the discourse tree: Sets the context and determines which parser to be used; need to consider the inter-sentence relationships

Diagram

Description automatically generated

**References**

Hoogervorst, R, Essink, E, Jansen, W, Van den Helder, M, Schouten, K, Frasincar, F, Taboada, M 2016, *Aspect-Based Sentiment Analysis on the Web using Rhetorical Structure Theory*, Simon Fraser University, viewed 25th January 2021, <<http://cgi.sfu.ca/~mtaboada/docs/publications/Hoogervorst_etal_ICWE_2016.pdf> >.

# Lennox, A. S, Osman, L. M, Reiter, E, Robertson, R, Friend, J, McCann, I, Skatun, D, & Donnan, P. T 2001, ‘Cost effectiveness of computer tailored and non-tailored smoking cessation letters in general practice: Randomised controlled trial’, *British Medical Journal*, vol. 322, no. 7299, pp. 1396-1400, viewed 15th January 2021, <https://psycnet.apa.org/record/2001-07256-001>.

Reiter, E, Sripada, S, Hunter, J, Yu, J & Davy I 2005, ‘Choosing words in computer-generated weather forecasts’, *Artificial Intelligence*, vol. 167, no. 1-2. Pp. 137-169, viewed 15th January 2021, <http://www.sciencedirect.com/science/article/pii/S0004370205000998>.

Reiter, E, Sripada, S & Williams, S 2003, ‘Acquiring and Using Limited User Models in NLG’, *Proceedings of the 9th European Workshop on Natural Language Generation*, University of Aberdeen, pp. 87-94, viewed 25th January 2021, <http://oro.open.ac.uk/12455/1/enlg03.pdf>

Taboada, M & Mann, W 2006, 'Rhetorical Structure Theory: looking back and moving ahead', *Discourse Studies*, vol. 8, no. 3, pp. 423-449, viewed 15th January 2021, <https://journals.sagepub.com/doi/pdf/10.1177/1461445606061881>.

# Thompson, S & Mann, W 1987, 'Rhetorical Structure Theory: A Framework for the Analysis of Texts', *IPrA Papers in Pragmatics*, vol. 1, no. 1, pp. 79–102.

Wark, S & Nowina-Krowicki, M 2015, *Intelligent Multi-Media Presentation Using Rhetorical Structure Theory*, Australian Government, viewed 29th January 2021, <https://apps.dtic.mil/sti/pdfs/ADA625019.pdf>.