# Discourse generation from semantic network considering discourse structure relations

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## 1 Introduction

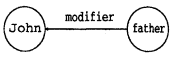
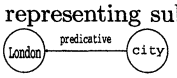
In the field of text generation, how to organise a set of messages to produce a well-structured text is an important issue. This is the problem of text structuring (Reiter and Dale, 2000). Discourse structure relations, which specify the relations between two discourse segments or groups of segments, is one of the key concepts of text structuring. Many papers discussed discourse structure and discourse generation (Hovy, 1993), (Mann, 1984), (Grosz et al., 1989), etc. The most influential theory is RST (Rhetorical Structure Theory) (Mann, 1984), which is applied to domain-dependent text generation system effectively. At present, researchers are exploring the method of building domain-independent text generation system.

Using Semantic Network as the internal Knowledge Representation, we built a domain-independent text generation system. The texts generated by this system reflect the features of general English text. Our research has two stages. At the first stage, we explored generation strategies on sentence-level and text-level, but we did not consider discourse structure (cue phrases, "but", "after", for example) (Deng et al., 2001). At the second stage, we investigate the problem of discourse generation. In this paper, we introduce the second stage of our research, that is, discourse generation. The rest of the paper is organized as follows: section 2 introduces semantic network of the English Generation System; section 3 introduces discourse generation; section 4 introduces future directions.

## 2 Semantic network

A semantic network of this study is a graph of the structure of meaning in which nodes represent concepts and links represent relations and abstractions(Lehmann, 1992).

In the English generation system, nodes are classified into two types according to the word classes: entity node (eg. noun) and event node (eg. verb, adjective, adverb); links are classified into three types according to the grammatical relations:

1. Type I includes modifier link and predicative link.
   (a) modifier link:
   the node modified is parent node, the other node is son node, eg, John's father.
   
   
   (b) predicative link:
   the node representing subject is son node, the other node is parent node, eg, London is a city. 
   

2. Type II represents the relation between entity node and event node. Event node is parent node, entity node is son node. Type II consists of 9 kinds of links, agent link, complement link, place link and so on (Deng et al., 2001).

3. Type III is event-event link which represents the relation between two discourse segments. It is classified into 14 kinds. We taxonomized the 14 kinds of discourse structure relations in four parallel classes according to the "strength" between two discourse segments. The ordering preferences of the four classes are: (apposition relations) $>$ (temporal relations) $>$ (cause/result and concession relations) $>$ (progression and contrast relations). In the English Generation System, we use a compare fuction to decide the generation order of event-event link.

   The 14 discourse relations are as follows:

   (a) Apposition relations
      i. apposition:
         eg, She has applied for a transfer, in other words, she is tired of her present job.
      ii. elaboration:
         eg, He is a local government administrator, that is to say, he is a Civil Servant.
      iii. summary:
         eg, He lost his watch and wallet, all in all, he had a bad day.
      iv. instance:
         eg, She has some assistance, for example, he has a secretary.
   (b) Temporal relations
      i. time before:
         eg, I start my meal before John arrives.
      ii. time after:
         eg, He felt better after he had a short nap.
      iii. same time:
         eg, When I read, I like to be alone.
   (c) Cause/result and concession relations
      i. cause-result:
         eg, The shops were closed, so I didn't get any milk.
      ii. result-cause:
         eg, I did it, because he told me to.
      iii. concession(+):
         eg, He is poor, but (he is) satisfied with his situation.
      iv. concession(-):
         eg, She won first prize, though none of us had expected it.
   (d) Progression and contrast relations
      i. progression:
         eg, Push the door hard, and it will open.
      ii. contrast:
         eg, My children enjoy jazz, while I prefer classical music.

   Figure 1(a) shows how to represent "I start my meal before John arrives." by semantic network.

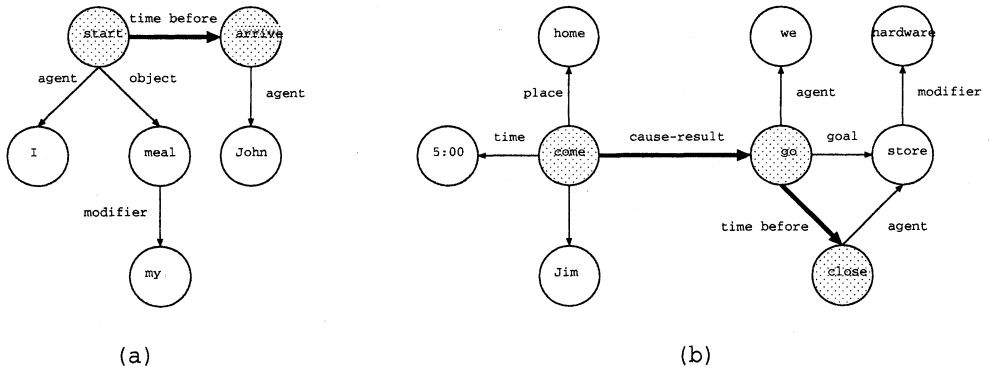



Figure 1: Example of discourse generation.

## 3 Discourse generation

"Coherence" is an important issue not only for text generation but for discourse generation. Coherence of discourse is enforced by the constraints of discourse structure relations (Hovy, 1993). Cue phrases, such as "but", "before", "in contrast", are used to signal discourse relations between two discourse segments. This section has two parts. In the first part, we introduce the basic method of discourse generation; in the second part, we investigate how to generate discourse coherently.

### 3.1 Discourse generation by means of discourse structure relations

In our research, one discourse segment is regarded to be one single sentence. We assume that a single sentence is a tree whose leaf nodes are words and whose root is an event node. Figure 1(a) shows that the discourse structure relation between "I start my meal" and "John arrives" is "time before", and it is described by an event-event link in semantic networks. We use Figure 1(a) to explain discourse generation algorithm.

1. Deciding generation order of the two discourse segments. The one containing parent node of the event-event link is generated first.

2. Generating the two discourse segments respectively. Generation result is: "I start my meal" and "John arrives".

3. Signaling the discourse relation by cue phrase. Generation result is: "I start my meal before John arrives".

### 3.2 Generating coherent discourse

Actually, the discourse relation shown by Figure 1(a) is the simplest one. Some discourses have more complex structures:

Example 3.2-1:
"Jim comes home by 5:00, so we go to the hardware store before it closes."

Figure 1(b) represents Example 3.2-1 by semantic networks. It is easy to see that event node "go" connects with two event-event links (cause-result link and time before link). At this time, the discourse generation algorithm is:

1. Comparing the event-event links connecting with event node "go" by compare function (which is introduced in Section 2). Generation order of event-event link is: time before link, cause-result link.
2. Generating discourse segment containing time before link. Generation result is "We go to hardware store before hardware store closes".
3. Generating discourse structure containing cause-result link. Generation result is "Jim comes home by 5:00, so we go to hardware store before hardware store closes."

Figure 2 shows another example whose generation result is: "John likes fruits, for example, John eats apple everyday. In contrast, Mary likes chocolate, that is to say, Mary likes sweets."

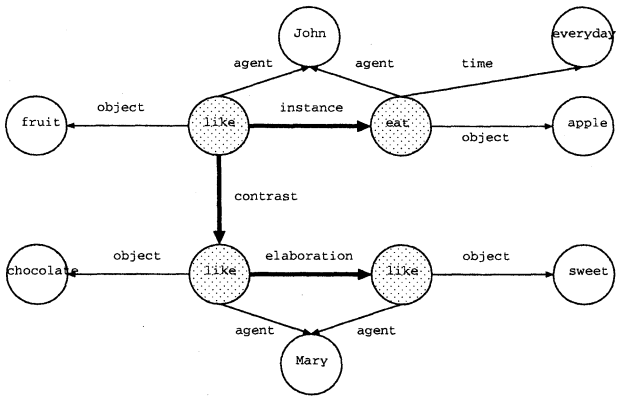



Figure 2: Example of discourse generation.

## 4 Future directions

This paper puts forward a new method of discourse generation, showing that it can be applied to domain-independent text generation system. Future work will concentrate on enhancing the overall quality (coherence, flexibility, and readability) of the generated texts. On the other hand, we will go on to explore some issues in sentence-level generation, paraphrase, aggregation and so on.

## References

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