SOME ISSUES IN GENERATION FROM A SEMANTIC REPRESENTATION

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ABSTRACT

This paper investigates certain problems in the production of text from a languaqe-free representation and proposes a model of generation to treat these problems. We deal with generation of connected text. We show that the generation of a connected text cannot be reduced to a simple combination of phrases expressing sub-parts of the representation, but must be based on patterns of discourse structure reflecting the whole representation.

0.   Introduction

In our generator, the semantic representations which constitute the inputs are based on the pragmatic knowledge with pertains to a given specific domain, in the style proposed by Schank and his colleagues (Schank 1982). The linguistic task domain investigated is that of terrorist crimes as reported in newspapers. Because the output of the generator is intended to be in the style of a newspaper, our generator is designed to produce well constructed texts, not the kind of texts produced while speaking. Our implemented program produces texts both in French and English.

First we will examine how to choose a term to express a RESULT , i.e., a new STATE which arises because of one (or several) prior ACTs (Schank and Riesbeck 1981). This will stand as an illustration of how to express a single concept. Then we will explore how to combine clauses to express the concepts involved in the semantic representation of a complete story. This raises the issue of segmenting a conceptual representation into sentences. Next we will present our generator which is based on patterns of discourse structure reflecting the whole representation.

1.   Choice of a term to express a concept

To generate a RESULT, one might start by generating independently the new state and its cause, and then connecting them by an explicit causal formulation, such as a clause introduced by because. With this method, a representation where the RESULT is DEAD and the ACT is an EXPLOSION would be generated as

The ICM President died yeAteAday in Paris because anaAchiAtA exploded a bomb In his house.

However, this text is far less satisfactory than one using the verb to bill and dropping because

A word written in capital letters is a mnemonic name for a semantic or pragmatic notion.

The ICM PAeAident WAS killed yeAteAday in Paris by anaAchiAtt who exploded a bomb in his houAe.

A verb such as to kill is particularly appropriate for expressing the result DEAD because it means roughly CAUSE TO DIE . Many verbs or verbal groups in French, as in English, have causal semantics similar to that of to kill in the sense that their subject causes a new state to occur for their object. This is the case for various verbs such as to penturb, to diAcourage, to cut, to cook, to pack and compounds such as to give a hangover, to put into verse, etc. Adopting the principle that it is better to express oneself as compactly as possible, the first attempt to generate a RESULT must be to look for a verbal expression with the appropriate causal semantics. Let us examine which factors must be taken into account to choose such an expression.

The context in which the RESULT occurs may be significant. As an illustration, consider the case of the result WOUNDED. This result can be expressed for example by to wound or by to injuAe. The choice between these two verbs depends upon the context, as shown in the following pair of sentences :

John shot and (wounded injured mary
A lightning bolt [*wounded + injured) Mary

The former one involving a crime, the latter one an accident.

The specific action which causes the RESULT may also be relevant in determining which term best expresses the RESULT. For example, in order to choose verbs such as to strangle

A young woman WOA STRANGLE thiA wo fining by a mentally-HI peAAon.

the generation process must be aware of the specific ACT which caused the death of the young woman.

Furthermore, the generation process must consider whether the ACTOR is specified or not. As an illustration, suppose that, when the ACTOR is specified, the generator produces :

AnaAchiAtA killed the. ICM PAeAident ...

for RESULT = DEAD on a TARGET which is not famous

Anarchists assassinated Pope Max 7 ...
for RESULT = DEAD on a TARGET which is famous

AnaAchiAtA blew up a police Atation ...
VeA anarchistes ont fait exploser un commissariat de police ...
for RESULT = DEMOLISHED and ACT = EXPLOSION

*However, this analysis remains controversial in the current literature.

Now, consider the same cases but for stories in which the ACTOR is not specified. One solution may be to keep the same verbal expression as when the ACTOR is specified, but to use it in another

construction, such as the passive construction without an agent. This is possible with *to kill, to assassinate* and *to blow up* but not with *faire exploser* which cannot be passivised :

The ICM President was killed ...
Pope Max 7 was assassinated ...
A police station was blown up ...
*Un commissariat de police a été fait exploser ...

Another possibility is to construct the verbal expression in the active form but where the subject is concerned with the cause of the ACT, such as a bomb. This is possible with *to kill* and *to blow up* but not with *to assassinate* or *faire exploser* which can be constructed only with a human subject :

A bomb killed the ICM President.
*A bomb assassinated Pope Max.
A bomb blew up a police station.
Une bombe a tué ... à un commissariat de police.

The formation of a passive form depends first upon the form of the verbal group involved and its syntactic construction. For example, in French, the passive requires, roughly, a simple verb constructed with *to* and it cannot, of course, be predicted from language representation. Furthermore, even when the verbal expression conforms to the conditions required for the passive, the formation of the passive depends not only upon the specific verbal group involved but also upon its complements. The following pairs, taken from (Gross 1979), illustrate this point :

Max inhabits Manhattan
*Manhattan is inhabited by Max

Rich politicians inhabit Manhattan
Manhattan is inhabited by rich politicians

The work done at the LADL by Gross and his colleagues** has shown that there is no syntactic "transformation" that can be applied blindly, i.e., without looking at which particular verb and complements are used. As a consequence, the generation process cannot employ a mechanical procedure such as : when the ACTOR is not specified, choose the same verbal expression as if the ACTOR were specified, and construct it in a passive form without an agent. Nor is there any way to predict whether a verb can take only a human subject. Therefore, the generation process must take into account whether the ACTOR is specified or not in choosing a term to express a RESULT.

The person or object involved in the RESULT may also determine the choice of a term to express

*As a consequence, a compound such as *faire exploser* cannot be passivised. When the ACTOR is not specified/ the verb exploser can be used : *Un commissariat de police a explosé.*

**See, among others, (Gross 1975), (Boons et al. 1976), (Giry-Schneider 1978), (Negroni-Peyre 1978) (Danlos 1981), (Meunier 1981), (Salkoff 1983).

the RESULT. Recall that the result DEAD in a terrorist crime context is usually expressed by *to aAba-&&£natz* if it concerns a famous target. Furthermore, the term for expressing a RESULT may also depend on the number of targets involved. As an illustration, consider the case of a terrorist crime involving two famous targets. If the results of the ACT for the two targets *are* identical, one may generate the result for each target as if it were alone, and then coordinate the phrases obtained :

Pope Max 7 and Idi Amin were [assassinated + wounded] yesterday in Paris.

But, for the case of one target DEAD and the other one WOUNDED, this method would yield

Pope Max 7 was assassinated yesterday in Paris and Idi Amin was wounded.

which is only appropriate for a story involving two different assassination attempts, for example, in two different places in Paris. Therefore, another formulation must be used, such as :

Pope Max 7 and Idi Amin were the targets of an assassination attempt yesterday in Paris : Pope Max 7 was killed and Idi Amin was wounded.

In conclusion, the factors relevant for choosing a term to express a RESULT, i.e., a STATE which concerns an OBJECT because of an ACT done by an ACTOR, are the particular STATE, OBJECT, ACT and ACTOR involved, in addition to the context in which this RESULT occurs. This situation is not peculiar to the choice of a term to express a RESULT. It seems likely that, for each kind of concept, all the semantic roles concerned with that concept may be factors in choosing the best term to express it.

2.   Segmentation into sentences

We have seen that the choice of a term to express a RESULT, and more generally any concept, requires us to look at numerous aspects of the semantic representation. This is also true for the problem of segmentation into sentences.

One factor affecting the generation of a PERSON-TERRORISM story is the feature arbitrary/non-arbitrary target. A non-arbitrary target is a person specifically aimed at, while an arbitrary one has not been individually chosen but represents a type of TARGET (e.g. British soldiers, policemen or right wing activists). When the TARGET is not arbitrary, it seems appropriate to produce a text such as :

Pope Max 7 was assassinated yesterday in Paris. A bomb exploded in his house.

where a sentence expressing the RESULT is simply followed by a sentence expressing the ACT. However, in cases where the victims are arbitrary, it seems more appropriate to use a form such as :

A bomb exploded in a police station in Paris yesterday killing 4 policemen.

in which the sentence expressing the RESULT occurs in the gerund form after the ACT sentence. But this kind of segmentation for the arbitrary target case does not always produce satisfactory texts. For example, if the ACT takes place in an ambush, the sentences produced by this method seem clumsy :

A bomb exploded under the car of 4 policemen killing them

The following kind of text reads better •

4 policemen were killed when a bomb exploded under their car.

Furthermore, special procedures must he used when there are very few details about the ACT. For example, if the only information given about the ACT is the fact that it took place in an ambush or that it was a shooting, the generation must then be something like :

4 policemen were killed in an ambush.
4 policemen were shot and killed.

where the ACT is combined with the RESULT in suitable formulations.

3.   Our generation process

Even the few examples mentioned here show that both phrase selection and sentence segmentation are affected by many semantic factors present in the representation. In generating causal sequences, we claim that the generation process cannot be a procedure made up of the three followino steps :

    i. Generate the ACT
    ii. Generate the RESULT
    iii. Combine the phrases obtained.

Such a procedure would suppose that the generation process can be based on local decisions, an assumption supported by (McDonald 1982) among others. But we have just shown that each of these operations requires many different tests about information scattered throughout the representation. Thus the Generation process cannot be based on a simple combination of purely local decisions about how to generate sub-parts of a semantic representation. It requires that the semantic representation be considered as a whole. Therefore our generator is based on associations between the semantic representations for specific classes of situations and templates of sentences expressing what occurs in those situations. For example, the representation of a story in which there is a non-arbitrary and non-famous TARGET killed in an explosion, is associated with the template :

TARGET (passive *(kill)*) TIME GEO *by* ACTOR *who explode* EXPLOSIVE LOCATION.

While stories for which there is no information about the ACT except that it is a SHOOTING are associated with templates such as :

TARGET (passive *(shoot and kill)*) TIME GEO.

These templates indicate the entire segmentation into sentences of large representation structures with the terms needed to express the main concepts included. They reflect a discourse structure appropriate for the domain of terrorist crimes as reported in newspapers. This accords with the assumption, supported by (McKeown 1982) for example, that people have preconceived ideas about the means with which a particular story can be expressed as well as about the ways in which these means can be integrated to form a (written) text. From these templates, the generator produces English text in a fairly straightforward fashion (Danlos 1983).

Our generation process does not operate by use of generation rules of a general nature. Of course, our claim is not that there exist no general principles of generation. For example, it is certain that one must not say something which has already been said or which is easily inferable from the previous phrases. Put, first, the application of such abstract principles varies from one case to another under conditions which elude all formalization in the present state of knowledge. Secondly, the generation of connected text must rely upon discourse structures. Such structures are domain and task dependent. For example, there is no common point between the discourse structures used by McKeown 1982 and ours. Let us add that our discourse structures would not be satisfactory, if they were to be used in a journal specialized in bomb explosions. Finally, a generation system must take into account the constraints presented by the words and their uses. These constraints cannot be predicted from a language-free representation. As an illustration, compare :

(1) *John assassinated Mary and spanked Peter*
(2) *John assassinated Mary and wounded Peter*

The clumsiness of (1) comes from a pragmatic fact, namely the difference of importance attached to an assassination and a spanking. It is possible to propose a general principle which forbids the coordination of concepts which differ too much in importance. Such a principle would enable us to avoid generating awkward sentences such as (1). But the clumsiness of (2) - being interpreted as a single crime with two targets - comes from the uses of the words *to assassinate* and *to wound*. Thus here the awkwardness cannot be predicted from a language-free representation. The generator must be given the patterns of sentences where these verbs occur, and the situations that correspond to the patterns.

Any generation from a conceptual representation must rely on associations between representations and "templates" of sentences. Such templates (whatever the form with which they arc presented) are clearly necessary, if only to indicate the construction of a verb, i.e., to relate the semantic roles (ACTOR, TARGET, etc.) to the complements of the verbs (subject, direct object, indirect object with its preposition). However, our use of templates gives far more information than those which are used only for the purpose of indicating the relation between the semantic roles and the syntactic complements (cf.(Goldman 1975) for example). This is justified by the fact that the generation process of a connected text cannot be reduced to a simple combination of phrases expressing sub-parts of the representation.

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