LANGUAGE GENERATION:
THE LINGUISTICS COMPONENT

David 0. McDonald

MIT Artificial Intelligence Lab.

Cambridge, Mass. 02139

Speaking is the result of two processes: first, deciding what to say, and than, datarmining how that can ba said using a natural language, in this case English. The second is a linguistic process, which begins with intentional messages formed by the first process, adds audience and discourse information, and produces fluent, situationally appropriate English utterances as output. This note reports on a theory and program developed for that process, in particular, an English generation grammar, procedural lexicon, and translation process have been designed and implemented as the program MUMBLE, which has been tested by replicating several existing programs improving their capabilities. This work was initially presented In [1]. It has since been completed and is described in detail in [2]

CAPABILITIES:

Using MUMBLE has two principle benefits. 1) Programs which incorporate it are freed from concern with the details of English grammar, thus simplifying their processing by allowing them to use whatever internal representation is most comfortable while they determine the content of what they should say - their message. 2) It becomes possible to use the constructions of fluent English in a general, theoretically motivated fashion. For example, MUMBLE can select from the full range of nominal descriptions: from pronouns, through noun phrases with relative clauses, to nominalized clauses, depending on the program's intent and the current discourse context. MUMBLE can employ sophisticated methods in constructing major clause structures: topicalization, extraposition, tag-questions, appositives, etc.. Such methods are viewed as strategies for conveying particular intentions, such as degree of conviction or special emphasis, that go beyond the "standard" content of the clause. Redundant phrases are dealt with automatically, by ellipsis, or by the dropping of obvious function words. Strictly grammatical details are implemented automatically, such as the morphological distinctions between instances of the same relation in functionally different roles (e.g. modifier, principal relation, object of a predicate).

CHARACTERISTICS OF THE DESIGN:

Linguistically, language generation is seen as a process of translation from a message given in one representation - that of the speaking program - to the equivalent message represented in English. Messages *are* taken as consisting of a set of intentional features and annotated pointers to the program entities the message refers to: objects, predicates, machine states, etc. The features encode the effects that the message is intended to have on its audience. Several effects may be desired in the same message. For example, to "ask a question", "express an assumption", and "describe e relation from one element's point of view", ere combined in: *"the red block supports the green block, doesn't itr.* Much of of the linguistics component's skill consists of knowing how to simultaneously realize such sets of intentions as grammatical English utterances.

Possible message elements (or their categories) are entered in a lexicon - the interface with each main program. The bulk of each entry is a procedure for constructing its English description. Such procedures, called composers, can vary the descriptions they produce according to context in the message, linguistic restrictions derived from earlier decisions made during the translation, and the content of the discourse so far. This sensitivity is possible because the grammar - the possible constructions and syntactic configurations of the language - is designed as a collection of distinct entities/procedures which can be annotated by conditions on their use, and reasoned about directly. The obfuscating details of their eventual implementation in phrases are handled automatically. For example, because all composers *are* annotated with the sort of phrase they construct (e.g. adjective vs. verb phrase), planning can be done (e.g. of where an element can be positioned) without incurring the often unnecessary overhead of actually constructing the phrase.

A data driven control structure permits the grammar to produce the requisite translation directly, without superfluous construction, backup, or extensive buffering. First the message is examined and a skeleton syntactic plan of the target utterance constructed Then the plan is traversed and refined top-down and left to right, executing composers for locally describabte message elements embedded in the plan as they are reached. Active background processes, structured by the plan, perform all required grammatical operations (e.g. agreement, subordination, insertion of function words).

REFERENCES

[1] McDonald, D. (1975) *"A Preliminary Report on a Program for Generating Natural Language",* in the proceedings of I X A 1-4, Sept. 3-8, Tibilisi, USSR.

[2] McDonald, D. (1977) Linguistic Reasoning During Language Generation. Technical Report 404, MIT A.I. lab, Cambridge, Mess.