

## "MUMBLE" A Flexible System for Unquage Production

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MUMBLE is a general purpose subsystem intended as the final output segment of the natural language interface of an expert system. As described in [1], it takes plans expressed in nearly any conceptual representation and realizes them as English texts, integrating the different parts of the plan linguistically as well as taking full responsibility for the grammaticality of the output and its coherency as a discourse.

MUMBLE has been under development since 1975, having undergone four major overhauls, and is being used at MIT, BBN, and UMass. It is available from the author in a common dialect of macLisp and lispmachine lisp, with a translation to franz lisp underway and one to interlisp in planning. The kernel of MUMBLE consists of roughly 400 functions in eleven files, and as interpreted code occupies roughly 150k words of memory on a PDP/10. Runtimes are a function of the complexity of the input plans, but fall around .6 to 2 seconds per word of output text (again running interpreted).

Input plans for MUMBLE are invariably composed from the same data structures that the expert program uses itself to represent what it wants to talk about. They are interpreted for production by a "dictionary" that one writes for each new expert program. This dictionary associates expressions from the expert with English phrases (or phrase schemas if the expression takes arguments); should more than one phrase be possible, one either includes a set of discriminating tests or makes use of the system supplied routine for managing synonyms. Example dictionaries are available for five different domains and their internal representations.

MUMBLE supplies an extensive vocabulary of linguistic relations and operations in terms of which to write the needed English phrases, and at runtime maintains a thoroughly annotated abstract description of the linguistic structure already built from those elements of the plan that have been realized so far. This structure will automatically constrain the realization of the rest of the elements to insure their grammaticality with respect to what has gone before; it also provides a context-sensitive reference for any heuristics one may write (or adapt from

those already included) to govern decisions such as the proper length of sentences, how to express contrasts, or how elaborate a description to use for some object.

The paragraph below is an example of MUMBLE'S output, starting from the given list of assertions. (The task is to readout the contents of a semantic net describing a grammar.)

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((aubconcept pp phrase) (has role pp pobj) (has role pp prep) (has-role pp inierp) (has-role pp ppobj) (restriction pobj np) (restriction prep prep) (restriction interp relation) (restriction ppobj pp) (aubconcept ofpersonpp pp) (aubconcept insubjectpp pp) (aubconcept locationpp pp) (aubconcept aboutsubjectpp pp))
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*Pp is the subconcept of phrase. It has the roles: pobj, prep, interp, and ppobj. Pobj must be an np, prep a prep, interp a relation, and ppobj a pp. Pp's subconcepts are ofpersonpp, insubjectpp, locationpp and aboutsubjectpp.*

MUMBLE'S existing grammar knows how to apply rhetorical rules for discourse focus, pronominalization, ellipsis, and the merging of propositions via adjunction, relative clauses, reduced conjunctions, or appositives. It also can plan syntactic adjustments for various thematic transformations, complex adverbials and verb groups, and all kinds of WH-movement. More importantly perhaps, MUMBLE provides a framework in which interested researchers can develop their own analyses of the rules of language use, relieved of the need to simultaneously develop rules and control structure for all of the mundane but necessary language phenomena that go into production.

### References

- [1] McDonald, D.D. (1980) Language Production as a Process of Decision-making Under Constraints, Ph.D Dissertation, MIT. (To be published as Technical Report from the MIT Artificial Intelligence Laboratory).