

## Editor's introduction

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### 1. A personal memoir: Margaret Masterman (1910–1986)

Margaret Masterman was ahead of her time by some twenty years: many of her beliefs and proposals for language processing by computer have now become part of the common stock of ideas in the artificial intelligence (AI) and machine translation (MT) fields. She was never able to lay adequate claim to them because they were unacceptable when she published them, and so when they were written up later by her students or independently 'discovered' by others, there was no trace back to her, especially in these fields where little or nothing over ten years old is ever reread. Part of the problem, though, lay in herself: she wrote too well, which is always suspicious in technological areas. Again, she was a pupil of Wittgenstein, and a proper, if eccentric, part of the whole Cambridge analytical movement in philosophy, which meant that it was always easier and more elegant to dissect someone else's ideas than to set out one's own in a clear way. She therefore found her own critical articles being reprinted (e.g. chapter 11, below) but not the work she really cared about: her theories of language structure and processing.

The core of her beliefs about language processing was that it must reflect the coherence of language, its redundancy as a signal. This idea was a partial inheritance from the old 'information theoretic' view of language: for her, it meant that processes analysing language must take into account its repetitive and redundant structures, and that a writer goes on saying the same thing again and again in different ways; only if the writer does that can the ambiguities be removed from the signal. This sometimes led her to overemphasise the real and explicit redundancy she would find in rhythmical and repetitive verse and claim, implausibly, that normal English was just like that if only we could see it right.

This led in later years to the key role she assigned to rhythm, stress, breath groupings and the boundaries they impose on text and the processes of understanding. To put it crudely, her claim was that languages are the way they are, at least in part, because they are produced by creatures that

breathe at fairly regular intervals. It will be obvious why such claims could not even be entertained while Chomsky's views were pre-eminent in language studies. But she could never give systematic surface criteria by which the breathgroups and stress patterns were to be identified by surface cues, or could be reduced to other criteria such as syntax or morphology, nor would she become involved in the actual physics of voice patterns.

Her views on the importance of semantics in language processing (which she continued to defend in the high years of Chomskyan syntax between 1951 and 1966) were much influenced by Richens' views on classification and description by means of a language of semantic primitives with its own syntax. These, along with associated claims about semantic pattern matching onto surface text, were developed in actual programs, from which it might be assumed that she was a straightforward believer in the existence of semantic primitives in some Katzian or Schankian sense. Nothing could be further from the truth: for she was far too much a Wittgensteinian sceptic about the ability of any limited sublanguage or logic to take on the role of the whole language. She always argued that semantic primitives would only make sense if there were empirical criteria for their discovery and a theory that allowed for the fact that they, too, would develop exactly the polysemy of any higher or natural language; and she always emphasised the functional role of primitives in, for example, resolving sense ambiguity and as an interlingua for MT.

She hoped that the escape from the problem of the origin of semantic primitives would lie in either empirical classification procedures operating on actual texts (in the way some now speak of deriving primitives by massive connectionist learning), or by having an adequate formal theory of the structure of thesauri, which she believed to make explicit certain underlying structures of the semantic relations in a natural language: a theory such that 'primitives' would emerge naturally as the organising classification of thesauri. For some years, she and colleagues explored lattice theory as the underlying formal structure of such thesauri.

Two other concerns that went through her intellectual life owe much to the period when Michael Halliday, as the University Lecturer in Chinese at Cambridge, was a colleague at CLRU. She got from him the idea that syntactic theory was fundamentally semantic or pragmatic, in either its categories and their fundamental definition, or in terms of the role of syntax as an organising principle for semantic information. She was the first AI researcher to be influenced by Halliday, long before Winograd and Mann. Again, she became preoccupied for a considerable period with the nature and function of Chinese ideograms, because she felt they clarified in an empirical way problems that Wittgenstein had wrestled with in his so-called picture-theory-of-truth. This led her to exaggerate

the generality of ideogrammatic principles and to seem to hold that English was really rather like Chinese if only seen correctly, with its meaning atoms, being highly ambiguous and virtually uninflected. It was a view that found little or no sympathy in the dominant linguistic or computational currents of the time.

Her main creation, one that endured for twenty years, was the Cambridge Language Research Unit, which grew out of an informal discussion group with a very heterogeneous membership interested in language from philosophical and computational points of view. Subsequently, the attempt to build language-processing programs that had a sound philosophical basis was a distinctive feature of the unit's work. This approach to language processing, and the specific form it took in the use of a thesaurus as the main vehicle for semantic operations, will probably come to be seen as the unit's major contributions to the field as a whole, and it was Margaret who was primarily responsible for them. Her vision of language processing and its possibilities was remarkable at a time when computers were very rudimentary: indeed, much of the CLRU's work had to be done on the predecessors of computers, namely Hollerith punched-card machines. Equally, Margaret's determination in establishing and maintaining the unit, with the enormous effort in fundraising that this involved, was very striking: the fact that it could continue for decades, and through periods when public support for such work was hard to come by, is a tribute to Margaret's persistence and charm. It is difficult for us now, in these days of artificial intelligence in the ordinary market-place, and very powerful personal computers, to realise how hard it was to get the financial resources needed for language-processing research, and the technical resources to do actual experiments.

Perhaps the best comment on Margaret's initiative in embarking on language-processing research, and specifically on machine-translation work, comes from a somewhat unexpected source. Machine translation, after an initial period of high hopes, and some large claims, was cast into outer darkness in 1966 by funding agencies who saw little return for their money. Reviewing twenty-five years of artificial-intelligence research in his presidential address to the American Association for Artificial Intelligence in 1985, Woody Bledsoe, one of the longstanding leaders of the field, though in areas quite outside language, said of those who attempted machine translation in the fifties and sixties: 'They may have failed, but they were right to try; we have learned so much from their attempts to do something so difficult'.

What MMB and CLRU were trying to do was far ahead of their time. Efforts were made to tackle fundamental problems with the computers of the day that had the capacity of a modern digital wristwatch. Despite every

kind of problem, the unit produced numerous publications on language and related subjects, including information retrieval and automatic classification. For over ten years the unit's presence was strongly felt in the field, always with an emphasis on basic semantic problems of language understanding. Margaret had no time for those who felt that all that needed doing was syntactic parsing, or that complete parsing was necessary before you did anything else. Now that the semantics of language are regarded as a basic part of its understanding by machine, the ideas of CLRU seem curiously modern.

Margaret's main contribution to the life of CLRU was in the continual intellectual stimulus she gave to its research, and through this to the larger natural language processing community: she had wide-ranging concerns, and lateral ideas, which led her, for example, to propose the thesaurus as a means of carrying out many distinct language-processing tasks, like indexing and translation. Margaret's emphasis on algorithms, and on testing them, was vital for the development of CLRU's work on language processing; but her ideas were notable, especially for those who worked with her, not just for their intellectual qualities, but for their sheer joyousness.

Her colleagues and students will remember her for her inspiration, rather than her written papers: she made questions of philosophy and language processing seem closely related and, above all, desperately important. On their joint solutions hung the solutions of a range of old and serious questions about life and the universe. In this, as so much else, she was a Wittgensteinian but, unlike him, she was optimistic and believed that, with the aid of the digital computer, they could be solved.

She could not only inspire and create, but terrify and destroy: she had something of the dual aspects of Shiva, an analogy she would have appreciated. Even in her seventies, and still funded by European Commission grants, her hair still black because a gypsy had told her forty years before that it would not go grey if she never washed it, she would rise, slowly and massively at the end of someone's lecture, bulky in her big, belted fisherman's pullover, to attack the speaker, who would be quaking if he had any idea what might be coming. The attack often began softly and slowly, dovelike and gentle, gathering speed and roughness as it went. As some readers may remember, there was no knowing where it would lead.

## 2. Themes in the work of Margaret Masterman

In this introductory chapter I shall seek to reintroduce and then focus the work of Margaret Masterman by enumerating and commenting briefly on a number of themes in her work. Some of these have been successful, in the sense of appearing, usually rediscovered, in some established place in the