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Foreword

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I feel honored by the dedication of the Special Issue of IJCCC to me. I should like to express my deep appreciation to the distinguished Co-Editors and my good friends, Professors Balas, Dzitac and Teodorescu, and to distinguished contributors, for honoring me. The subjects which are addressed in the Special Issue are on the frontiers of fuzzy logic.

The Foreword gives me an opportunity to share with the readers of the Journal my recent thoughts regarding a subject which I have been pondering about for many years - fuzzy logic and natural languages. The first step toward linking fuzzy logic and natural languages was my 1973 paper," Outline of a New Approach to the Analysis of Complex Systems and Decision Processes." Two key concepts were introduced in that paper. First, the concept of a linguistic variable - a variable which takes words as values; and second, the concept of a fuzzy if- then rule - a rule in which the antecedent and consequent involve linguistic variables. Today, close to forty years later, these concepts are widely used in most applications of fuzzy logic.

The second step was my 1978 paper, "PRUF - a Meaning Representation Language for Natural Languages." This paper laid the foundation for a series of papers in the eighties in which a fairly complete theory of fuzzy - logic-based semantics of natural languages was developed. My theory did not attract many followers either within the fuzzy logic community or within the linguistics and philosophy of languages communities. There is a reason. The fuzzy logic community is largely a community of engineers, computer scientists and mathematicians - a community which has always shied away from semantics of natural languages. Symmetrically, the linguistics and philosophy of languages communities have shied away from fuzzy logic.

In the early nineties, a thought that began to crystallize in my mind was that in most of the applications of fuzzy logic linguistic concepts play an important, if not very visible role. It is this thought that motivated the concept of Computing with Words (CW or CWW), introduced in my 1996 paper "Fuzzy Logic = Computing with Words." In essence, Computing with Words is a system of computation in which the objects of computation are words, phrases and propositions drawn from a natural language. The same can be said about Natural Language Processing (NLP.) In fact, CW and NLP have little in common and have altogether different agendas.

In large measure, CW is concerned with solution of computational problems which are stated in a natural language. Simple example. Given: Probably John is tall. What is the probability that John is short? What is the probability that John is very short? What is the probability that John is not very tall? A less simple example. Given: Usually Robert leaves office at about 5 pm. Typically it takes Robert about an hour to get home from work. What is the probability that Robert is home at 6:l5 pm.? What should be noted is that CW is the only system of computation which has the capability to deal with problems of this kind. The problem-solving capability of CW rests on two key ideas. First, employment of so-called restriction-based semantics (RS) for translation of a natural language into a mathematical language in which the concept of a

restriction plays a pivotal role; and second, employment of a calculus of restrictions - a calculus which is centered on the Extension Principle of fuzzy logic.

What is thought-provoking is that neither traditional mathematics nor standard probability theory has the capability to deal with computational problems which are stated in a natural language. Not having this capability, it is traditional to dismiss such problems as ill-posed. In this perspective, perhaps the most remarkable contribution of CW is that it opens the door to empowering of mathematics with a fascinating capability - the capability to construct mathematical solutions of computational problems which are stated in a natural language. The basic importance of this capability derives from the fact that much of human knowledge, and especially world knowledge, is described in natural language.

In conclusion, only recently did I begin to realize that the formalism of CW suggests a new and challenging direction in mathematics - mathematical solution of computational problems which are stated in a natural language. For mathematics, this is an unexplored territory.

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