TOWARD A FORMAL THEORY OF
HUMAN PLAUSIBLE REASONING

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The talk will describe our attempts to formulate a theory of human plausible reasoning based on analysis of people's answers to a large number of everyday questions (Collins 1978a, 1978b). The formalization generates a large number of plausible inference types from a small set of basic elements.

The basic elements in the theory include:

arguments	v_1, v_2, etc.
descriptors	a_1, a_2, etc.
references	c_1, c_2, etc.
terms	$a_1(v_1)$, $a_2(v_2)$, etc.
statements	$a_1(v_1) = c_1 : \gamma$
mutual dependencies between terms	$a_1(v_1) \xleftarrow{\alpha\beta} a_2(v_2)$
mutual dependencies between statements	$a_1(v_1) = c_1 \xleftrightarrow{\alpha\beta} a_2(v_2) = c_2$

Mutual dependencies are bidirectional reflecting people's functional knowledge, as between say the likelihood of a person having mumps and also having fever. In these expressions α, β, and γ are certainty parameters: γ reflects the degree to which a person thinks a statement is true, α reflects the degree of certainty about the right hand term in a mutual dependency given that the left hand term is true, and β the certainty in the reverse direction.

There are also four operators that occur in the rules of inference: generalization, specification, similarity, and dissimilarity (which is the negative operator in the system). These operators are designated by a "rel" in the rules of inference.

The inference rules in the system as developed so far include: descriptor transforms and reference transforms on both statements and mutual dependencies, and derivations from relations between arguments and from relations between terms in both statements and mutual dependencies. Attribution inferences, which are common in human reasoning, are an elaboration of these basic inference types. The system does not yet include the rules for induction of statements and mutual dependencies, nor the various meta-inferences in the theory (Collins, 1978b).

Given that "rel" can be realized in four different forms, this system generates 64 different one-step inferences, and a very large set of two-step inferences. Many common human inferences are two-step inferences in the system, as for example the functional analogy described in earlier papers (Collins et al., 1975; Collins, 1978a, 1978b). We will try to show how a variety of human protocols can be accounted for, given such a system of plausible reasoning.

References

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