

How reasoning differs from computation.

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Abstract: Sieg has proposed axioms for computability whose models can be reduced to Turing machines. This lecture will investigate to what extent these axioms hold for reasoning. In particular we focus on the requirement that the configurations that a computing agent (whether human or machine) operates on must be 'immediately recognisable'. If one thinks of reasoning as derivation in a calculus, this requirement is satisfied; but even in contexts which are only slightly less formal, the requirement cannot be met. Our main example will be the Wason selection task, a propositional reasoning task in which in a typical (undergraduate) subject group only around 5% arrive at the answer dictated by classical logic. The instructions for this task (as well as other standard tasks in the psychology of reasoning, such as syllogisms) do not contain any 'immediately recognisable' configurations. The subject must try to find an interpretation of the task by making the various elements in the instructions cohere, in effect solving a difficult constraint satisfaction problem, which has no unique solution. The subject has given a complete interpretation of the task if she can formulate the problem posed in the task as a theorem to be proved. The complexity of such theorems can be quite high; e.g. for the propositional Wason selection task the theorem can be in Σ_3^1 . This sounds implausible, but we'll present experimental data confirming this point.

There are versions of the task which are easy for subjects (75% correct answers). In the psychological literature these data have been used to argue that logical form is not a determinant of reasoning, since tasks with same form elicit such vastly different success scores. It turns out, however, that the easy versions of the task are all first order, whereas the difficult versions are second order. We'll show that in the latter domain some further distinctions can be made; e.g. interpreting the reasoning problem as a planning problem lowers the complexity and improves the scores.