# Definition of intelligence with linear orders for ontologies.

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**Abstract**

The definition of intelligence is a highly debated topic that has no clear agreed solution. We show that a definition of intelligence is not possible except when the goal is formally established. This result should be taken into consideration for constructing ontologies of intelligence.

In the simplest case, a definition of intelligence defines implicitly a map between systems and the set {intelligent, not intelligent}. More formal definitions quantify intelligence with tests that map systems to a set with a linear order, i.e. the real numbers, which enables to compare the systems against each other. There are examples in human psychology, e.g. IQ tests, and in artificial intelligence, e.g. fitness functions. However, these tests cannot account for the full capabilities of the systems. Hence, domain-specific tests measure the capabilities of the tested systems under a a variety of tasks to provide a multi-dimensional lattice-like measure of intelligence, which makes difficult to compare any 2 systems but for a single dimension. It is possible to map a lattice to a linear order to make the systems comparable, but then the measure becomes specific to this mapping. Another problem is that only systems able to take a specific test can be measured, e.g. a baby cannot complete an IQ test meant for adults. Also, a system A capable of outperforming another system B at specific goals will not automatically translate to A outperforming B at all goals belonging to some class. For example, a computer will easily beat any human at the game of chess, but this same program will fail if the game changes to shōgi. Both chess and shōgi belong to the class of strategy turn-based strategy games. When generalizing to the class of all goals, then humans become comparable to more systems, yet not necessarily outperform those systems. This is the case when we compare the capability of human intelligence to duplicate the data it carries against a biological cell performing the same task: all the cells in the human brain are clones of each other, but the data hold by that brain is unique. Therefore, it seems that no tests of intelligence cannot measure general intelligence because they are designed with specific systems and specific goals in mind.

We propose that the solution is to reconsider the question, rather than the answer, to the definition of intelligence. General definitions of intelligence are too ambiguous and confusing to receive a formal treatment, and formal definitions are too concrete to be applied to any system. Therefore, instead of asking ourselves, "How can we define intelligence?", we ask "What flaw is there to the definition of intelligence?", and the response is that any definition of intelligence requires a goal attached to it, because it is not possible to have a general and formal definition of intelligence as just shown. Therefore, an ontology of general intelligence is unconceivable, but ontologies of intelligence for specific goals are possible indeed.

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