Intelligence as Portability in Problem-Solving

What is intelligence? Is it something that we measure when we conduct so-called IQ tests? Is it something that, no matter how it gets measured, is uniquely human? Does some form of the Turing test, an alleged indicator of the presence of machine intelligence, provide some help in answering the original question? Is there such a thing called 'emotional intelligence'? If so, how is it related to traditional, i.e. non-emotional, intelligence? Much disagreement surrounds these and other related questions. In this talk, I address the first and most central of these questions by focusing on two traits that, as I argue, are ubiquitous in behaviour that we intuitively deem as intelligent, namely success in problem-solving and portability. I argue for a specific articulation of these traits and conclude that a conception of intelligence with this articulation at its foundations makes some headway in understanding the phenomenon under study better.

Several conceptions of intelligence have been proposed over the years – see Sternberg and Detterman (1986) for examples. No specific conception seems to have been widely accepted, however, and, as a consequence, recent attempts have been less committal about the details of what intelligence means and more inclined to emphasise the non-triviality of associated projects like how to best measure intelligence. This is no more clearly evident than in the so-called 'mainstream science on intelligence' movement, whose public statement (signed by fifty-two researchers) defends the use of intelligence tests but falls short of specifying exactly what intelligence amounts to. Instead, the statement exhibits a reluctance to be drawn into any substantive details of what intelligence means. Intelligence, we are told, "is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience" (Gottfredson 1997: 13).

Although holding back in detail, this characterisation of intelligence contains the seeds for a more thoroughgoing approach to the question of intelligence. Take problem-solving. Gardner (1983) puts this trait at the centre of his conception of intelligence. And with good reason or so I will argue. Any set of circumstances that require the application of intelligent behaviour to bring about some desired result can be adequately be re-described in terms of a problem-solving activity. Take, for example, the abilities of planning, of abstract or of complex thinking, which in the aforementioned statement are listed as distinct from each other but also from problem-solving. Any instance of these abilities can be adequately re-described in terms of a problem-solving activity. Thus, planning a trip from A to B can be re-described as involving (i) the problem of how can one get to B given that they start from A and have certain resources at their disposal and (ii) a non-empty set of solutions that contains at least one feasible route from A to B and only makes use of the available resources. This method of re-description obviously generalises. In any given case we identify *the problem* as the question of how to proceed from a set of circumstances to a desired result and *a solution* as the behaviour that one can employ to achieve the desired result. To give more richness to our framework, we may also employ a notion of *resource-efficiency* that allows for at least a partial ordering of the efficiency of solutions for a given problem. With this articulation in mind, one can put forth various intelligence-related conjectures. For example, an agent X_1 is strictly more intelligent than an agent X_2 with respect to a type of problem p if X_1 always arrives at a more resource-efficient solution to a token of p than X_2.

Beyond the ability to solve problems there is also another trait that in my view is of paramount importance in characterising intelligent behaviour. I call this trait 'portability'. Roughly put, it is the ability to find one or more solutions to a wide range of problems. (Similar ideas have been floated in the literature on intelligence, e.g. Sternberg and Salter's (1982) idea of 'adaptive behaviour'). The greater the range, the more portable the ability. Part of the reason why, at the time of writing, artificial intelligence has limited success in passing something like the Turing test is the fact that its

various incarnations are good, and sometimes even better, at solving some but not all problems that human beings are able to solve. A truly portable problem-solving machine, or at least one that's as portable as a human being, would presumably pass the Turing test with flying colours. That's because one type of problem-solving case involves natural language question-and-answer games. The problem in this type of case is how to proceed from the given conversational context to formulate a human-like answer to the given question in the Turing test and a solution is the verbal answer that can be employed to achieve the desired deception. Once again, we can employ this articulation of the notion of portability to put forth various conjectures that are tied to intelligence. Modifying the conjecture cited above, we can, for example, say that a (biological or artificial) agent X_1 is strictly more intelligent than a (biological or artificial) agent X_2 if, and only if, for any type of problem p, X_1 always arrives at a more resource-efficient solution to a token of p than X_2.

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